S. H. JOHNSON.

Apparatus for Crushing Stone.

No. 160,682 Patented March 9, 1875.

Fig: 3.

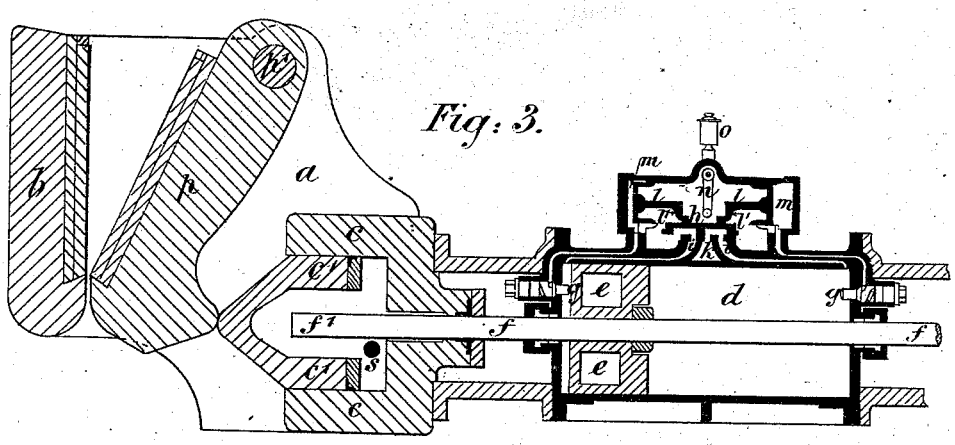


Fig: 1.

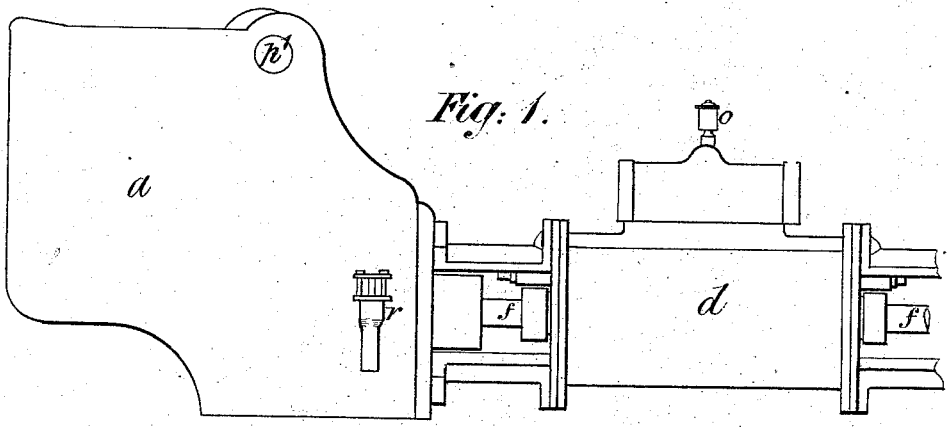
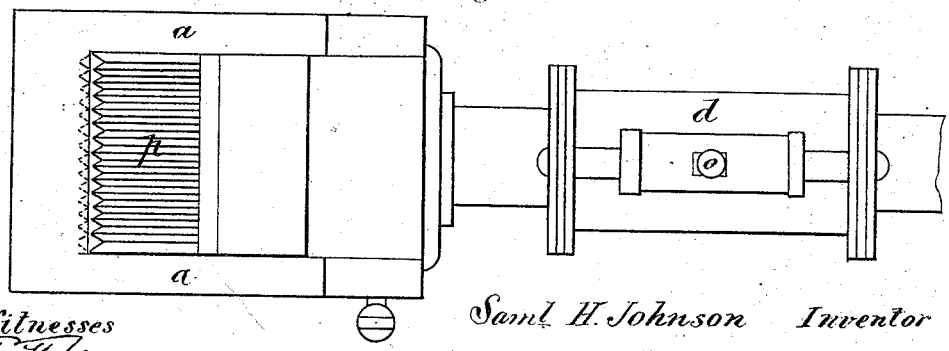


Fig: 2.



Witnesses
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UNITED STATES PATENT OFFICE.

SAMUEL HENRY JOHNSON, OF STRATFORD, ENGLAND.

IMPROVEMENT IN APPARATUS FOR CRUSHING STONE.

Specification forming part of Letters Patent No. **160,682**, dated March 9, 1875; application filed February 17, 1875.

To all whom it may concern:

Be it known that I, SAMUEL HENRY JOHNSON, F. C. S., of Lea Bank Works, Stratford, in the county of Essex, England, chemist, a subject of the Queen of Great Britain, have invented or discovered new and useful Improvements in Apparatus for Crushing or Breaking Stone and other substances; and I, the said SAMUEL HENRY JOHNSON, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof—that is to say—

This invention has for its object improvements in apparatus for breaking stone and other substances; and relates to the direct application of steam-power for operating the ram of a hydraulic cylinder to actuate the movable jaw of such apparatus, to which end I employ a direct-acting steam-cylinder, and the piston has a rod, which is continued to form a plunger. The plunger enters a hydraulic cylinder, in which a ram works, and the ram forces forward the movable jaw of the crushing-hopper. The return motion of the jaw may be obtained by means of a spring, or otherwise. The machine may be made double acting.

In order that my said invention may be most fully understood and readily carried into effect, I will proceed to describe the drawings hereunto annexed.

Figure 1 is an elevation of one-half of a double-acting machine constructed according to my invention. Fig. 2 is a plan, and Fig. 3 a longitudinal section, of the same.

a a is the main frame, together with which there is formed the fixed crushing-jaw *b* and the hydraulic cylinder *c*, which contains a ram, *c'*. The steam-cylinder *d* and the hydraulic cylinder *c* are connected end to end, but with sufficient space between them to allow free access to the packings. *e* is the steam-piston, and *f* the piston-rod, the portion *f'* of which works as a plunger in the hydraulic cylinder *c*. Thus there is a direct connection or attachment between the steam-piston and the plunger. This is an important feature in my invention. *g g* are tappet-valves in the cylinder ends, which are struck by the piston *e* when it arrives at the ends of its stroke, and the lifting of these valves *g* alternately causes the slide-valve *h* in the valve-chest to operate. This valve works over steam-ports *i i* and an exhaust-port, *k*, in the usual way. Lugs on the back of the valve *h* enter between the horns *l' l'* on the block *l*, the two ends of which form small pistons, which work in corresponding cylinders *m m* at the ends of the valve-chest.

The steam is always able to pass by narrow channels, or it may be by the imperfect fitting of the piston-block *l* from the central part of the valve-chest into the cylinders at its ends, so that when both the tappet-valves *g* are closed the block *l* is exposed to steam-pressure on both its ends, and the pressure being in equilibrium the block remains stationary; but when one of the tappet-valves *g* is opened, the pressure on the block *l* at that end is relieved, the steam finding free vent from behind it into the main cylinder *d*, and so to the condenser. The block *l* then moves, and in moving it ships the slide-valve *h*, and sets it in position to cause the return stroke of the piston. The action is similar at the two ends of the stroke. *n* is a lever for moving the slide-valve by hand. *o* is a lubricator.

I would remark that this method of working the slide-valve forms no part of my invention. I describe it only as a convenient arrangement, which I can employ in carrying out my invention. There are other known means of working valves, which also may be employed.

As the piston *e* approaches the hydraulic cylinder *c*, the plunger *f'*, displacing the water in the hydraulic cylinder, causes the ram *c'* to advance at a slow speed, and press forcibly against the back of the movable crushing-jaw *p*, which at its upper end hangs upon an axis, *p'*, carried by the frame *a*. The jaw *p* then crushes the material between it and the fixed jaw *b*.

When the piston *e* and plunger *c'* retire, the ram also recedes, and the crushed material falls from between the jaws as in other stone-crushers. The return of the ram may be aided by a spring.

r is a weighted valve, which allows water to escape from the cylinder *c* before the press-

ure becomes excessive, so that the steam-piston is always able to reach the end of its stroke. *s* is a suction-passage, connecting the cylinder *c* with a small water-tank. It is provided with a suction-valve, which opens and admits water during the return stroke whenever there has been any escape during the preceding effective stroke. The ram *c'* then reaching the back of the cylinder *c* before the plunger *f* ceases to retire, there is a suction which draws in a quantity of water equal to that which had before escaped.

In some cases I arrange the steam-piston *e* so that it can slide along its rod a short distance between stops. The piston then moves at the commencement of each stroke a little before the plunger, and then strikes a sudden blow, which is more effective than a dead pressure in breaking some materials.

In place of employing a steam-moved valve, the valve may be worked by an eccentric in the ordinary manner, such eccentric being on a crank-shaft actuated by a connecting-rod, which is jointed to a piston-rod passing out through the back cover of the steam-cylinder, or, it may be, to a cross-head on the main rod, connecting the steam-piston with the ram. On the same shaft a fly-wheel is mounted, to store the power whenever the full strain is not upon the jaws. With the same object a crank-shaft and fly-wheel may be applied in cases where a steam-moved valve is employed.

What I claim is—

The combination, substantially as hereinbefore set forth, of a steam-piston, a plunger directly connected therewith, a hydraulic cylinder in which the plunger works, a ram also working in said cylinder, and the movable jaw of a stone-breaker operated by the ram.

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Witnesses:

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