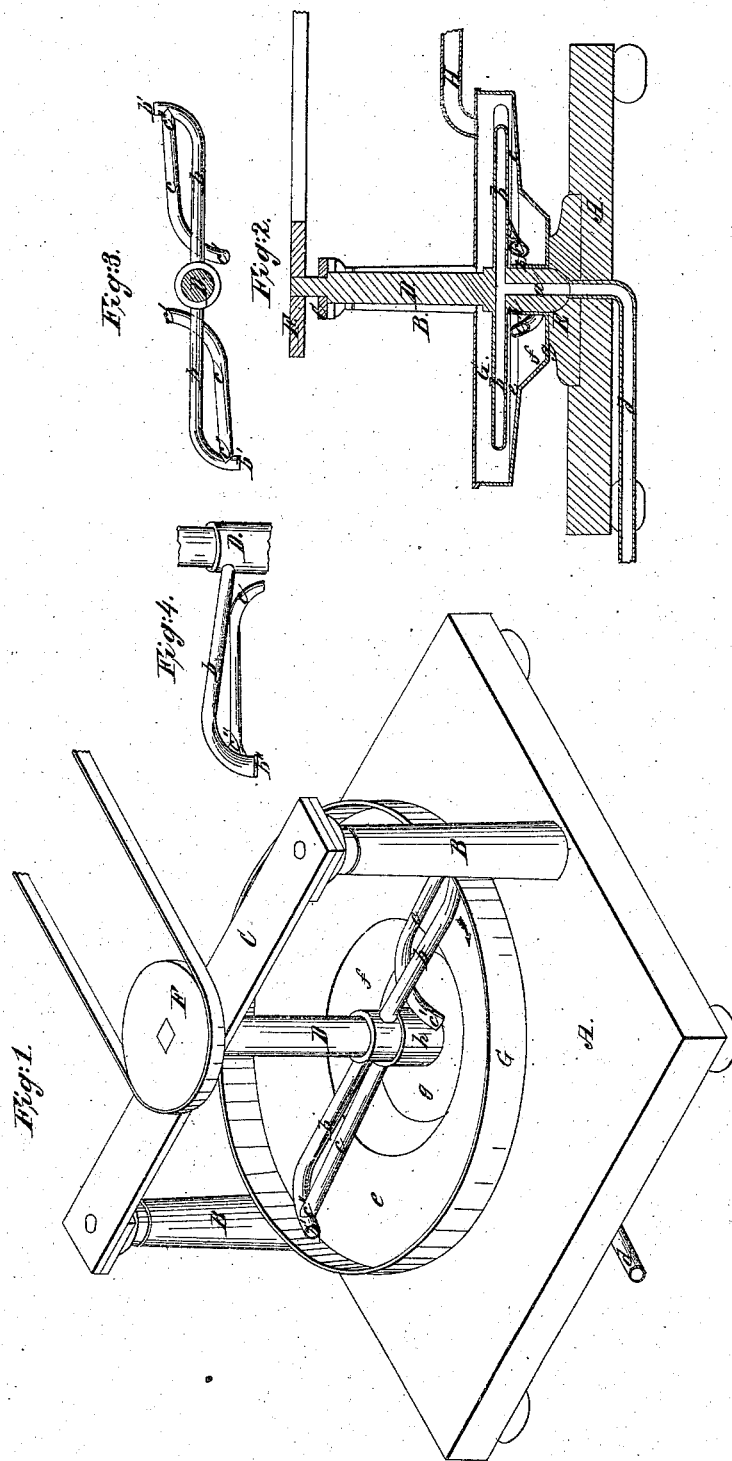


No. 3,943.

PATENTED MAR. 12, 1845.

J. BLACK.  
REACTING ROTARY STEAM ENGINE.



# UNITED STATES PATENT OFFICE.

JAMES BLACK, OF WILLIAMSPORT, PENNSYLVANIA.

## REACTING ROTARY STEAM-ENGINE.

Specification of Letters Patent No. 3,943, dated March 12, 1845.

*To all whom it may concern:*

Be it known that I, JAMES BLACK, of Williamsport, in the county of Lycoming and State of Pennsylvania, have invented  
5 a new and useful Improvement in the Manner of Constructing Rotary Steam-Engines, which I denominate the "Rotary Hydraulic Steam-Engine"; and I do hereby declare that the following is a full and  
10 exact description thereof.

My rotary steam engine is of that kind which is usually denominated as reaction-engines, as it is made to discharge the steam which is admitted into it from the ends of  
15 two or more arms the discharge-orifices at the outer ends of which are in the direction of a tangent to the circle in which they rotate, being in this respect similar to the well known Avery's rotary engine, and others,  
20 operating on the same general principle; I have, however, ascertained experimentally that the power of such an engine may be considerably increased by admitting water into the steam arms, just behind the point  
25 at which the discharge of steam takes place; such water entering said arms in the direction of the radii of the circle of rotation, and consequently at right angles, or nearly at right angles to the current of effluent  
30 steam. To effect this I place the axis of my rotary engine vertically and extend the arms for the passage of steam horizontally, curving them at their outer ends so that their steam issues shall stand in the direction  
35 above indicated. Steam is to be admitted into the revolving axis, at its lower end, and is to flow thence through the steam arms. The steam arms are to revolve within a circular case or drum, standing horizontally,  
40 and there is a depression toward the center part of this drum which is to constitute a reservoir of water, or other fluid, from which the current is to be supplied that is to pass into each of the steam arms, and  
45 into which it is to return after it has performed its office. To carry this water, or other fluid, to its destined point I use a second series of tubes the outer ends of which enter the steam arms as above stated,  
50 while their inner ends are bent down so as to dip into the above named reservoirs; the result of this arrangement is that each of these water tubes operates, when the steam arms are set in motion, as a centrifugal pump,  
55 raising a portion of water from the reser-

voir, and delivering it into its appropriate steam arm.

The arrangement of the respective parts, as I have essayed them, is shown in the accompanying drawings in which—

Figure 1, is a perspective view of the machine, and Fig. 2, a vertical section through its center. In the former of these figures the upper plate of the case or drum is omitted, for the purpose of showing the parts  
60 within it. Fig. 3, is a separate view of two compound arms.

A, is the basis upon which the machine rests.

B, B, are two columns supporting a cross  
70 head C, in which the upper end of the vertical shaft D, of the engine runs.

E, is the step of the lower end of the shaft D; this lower end and step are made to fit steam tight by being ground together.

b, b, are two steam arms that enter the shaft D, and receive their supply of steam through the tubular steam way a, d, that leads to a suitable boiler.

F, is a whirl by which the power of the  
80 engine may be communicated to any machinery that it is required to drive.

G, is the cylindrical case, or drum within which the arms revolve.

f, is the reservoir for water, oil, or other  
85 fluid; the bottom e, e, of the case, or drum should have an inclination toward the reservoir.

g is the bottom of the reservoir, and h a cylindrical rim rising from said bottom, and  
90 surrounding the lower end of the shaft D.

The hydraulic pipes that are to carry the fluid from the reservoir to the outer ends of the steam arms are shown at c, c; these tubes at their ends c', dip into the fluid contained  
95 in the reservoir f, and their ends c'', enter the steam arms b, b.

In Figs. 1, and 3, the steam arms are represented as having their discharge orifices b' circular; and although in this form there is  
100 considerable advantage derived from the employment of the hydraulic tubes, this is much increased by flattening the discharge orifices of the steam arms, and extending them in length, while their area may remain  
105 the same as when circular. This form of orifice is shown in Fig. 4, where b'' is one of the steam orifices formed in the manner which I prefer, after repeated trials.

H, Fig. 2, is a tube by which the dis- 110

charged steam may be carried off from the interior of the drum.

The effect of bringing the steam into contact with the water, (or other liquid used as a substitute therefor,) is to increase the reactive power of the discharge much above that which results from the emission of steam alone through the same orifice. The water thus used does not effect the condensation of the steam to any extent after the instrument has been a few minutes in operation, as it becomes rapidly heated, and until this takes place the full effect of the machine is not obtained; the same water flowing back into the reservoir, and being continuously used. The power expended in raising the water is very small, it being elevated to the height of a few inches only, while the advantage produced by it greatly transcends any loss from this cause.

Having thus fully described the manner in which I construct my improved rotary hydraulic steam engine, and shown the operation thereof, what I claim therein as new, and desire to secure by Letters Patent, is—  
The combining with each of the steam

arms a tube one end of which shall dip into a reservoir, like that marked *f*, which is to contain a portion of water or other fluid, which fluid, in its heated state, is to be carried into the steam tube, by the centrifugal action of the engine, and is to enter said steam tube, near the orifice for the emission of steam, and at right angles, or nearly so, to the course of the effluent steam; said water, or other fluid, being allowed to flow back into the reservoir, so that it may be continuously used, for the purpose, and in the manner, herein set forth.

I do not claim the introducing of a jet of cold water into the revolving arms for the purpose of condensing the steam, as was proposed in a rotary engine known as Sadler's; the water or other fluid used by me being, as hereinbefore stated, to be employed in its heated state, and for a purpose altogether different from that of condensation.

JAMES BLACK.

Witnesses:

THOS P. JONES,  
WM. BISHOP.