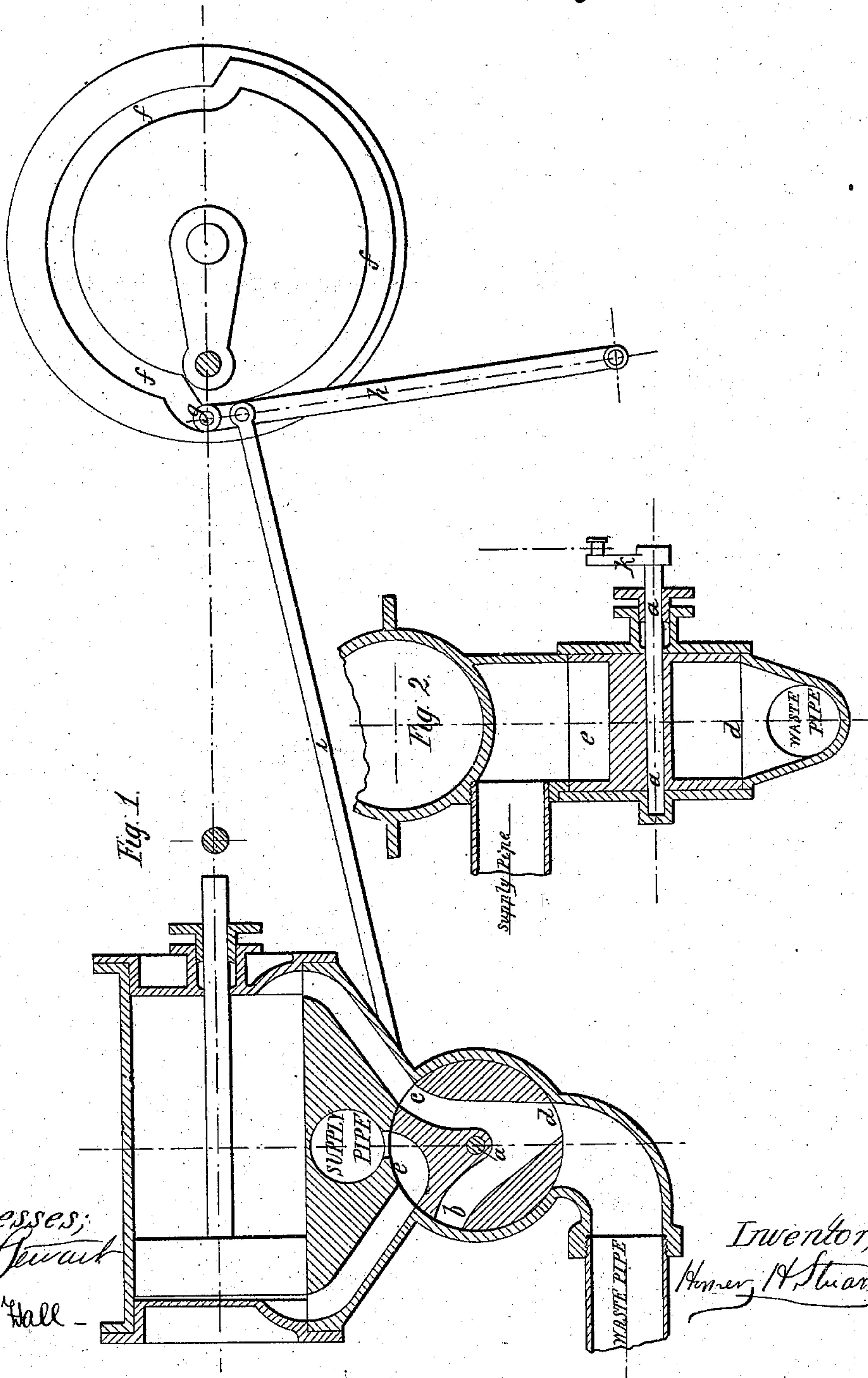


*H. H. Stuart,*  
*Hydraulic Engine.*

*N<sup>o</sup> 56,120.*

*Patented July 3, 1866.*



*Witnesses;*  
*Andrew Stewart*  
*Amable Hall -*

*Inventor;*  
*Henry H. Stuart*



# UNITED STATES PATENT OFFICE.

HOMER H. STUART, OF JAMAICA, NEW YORK.

## IMPROVEMENT IN HYDRAULIC ENGINES.

Specification forming part of Letters Patent No. 56,120, dated July 3, 1866.

*To all whom it may concern:*

Be it known that I, HOMER H. STUART, of Jamaica, in the county of Queens and State of New York, have invented certain new and useful Improvements in Hydraulic Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification, and to the letters of reference marked thereon.

My invention relates to that class of water-engines which are worked by the pressure of a column of water on a piston that reciprocates in a cylinder, and has the usual connections of a steam-engine with a crank for the purpose of obtaining a rotary motion.

In such an engine the chief considerations apply, first, to the introduction of the water into the cylinder in such a manner that its pressure or force will not be neutralized even when working at a high velocity; and, second, to the obtaining of a quick and efficient exhaust or disposition of the water that has been employed in making a stroke of the piston.

In steam-engines these considerations are of but little weight, for the reason that the elasticity of steam causes it to penetrate the most tortuous passages without material diminution of its pressure, and, in combination with its tenuity and lightness, enables it to act instantaneously with undiminished effect and with safety in response to the opening and closing of the valve. There is no shock or concussion in suddenly checking a current of steam, and it loses no time in preparing to proceed when the obstruction is removed. These remarks have been deemed desirable to enable the peculiar difficulties in dealing with water to be more readily distinguished.

As water is incompressible, and its elasticity is confined to a very narrow range, any attempt to check a current through a pipe, for instance, produces a shock throughout the whole length, and the part near the obstruction must not only withstand the concussion of the water in its immediate vicinity, but also the concussion incident to the whole mass of water pressing upon it; and, similarly, in again opening the pipe the want of elasticity prevents the first portion of the water acting with any effect until the inertia of the mass is

overcome, and the whole value of the water is not obtained until the entire column of water is again put in motion.

The disposition of the waste-water or the water after it has been used is open to some extent to the same difficulties. The elasticity of steam enables it to seek a vent without reference to gravity, and renders of secondary importance the desirability of keeping the exhaust-valve open until the completion of the stroke; but if water be not disposed of in accordance with gravity, it must be forced out of the cylinder by a portion of the working-power, and its incompressibility requires the exhaust-valve to be kept open to the last moment.

In accordance with these considerations it is the object of my invention to arrange the conduits to the piston in such a way that the flow of the water through the supply-pipe proceeds constantly and unchecked to either one side or the other, so that the pressure or force of the water shall be uniformly maintained at its highest rate, being simply diverted in an unbroken current to the alternate ends of the cylinder, and also to so provide for the disposition of the waste-water that it runs freely from the cylinder into a waste-pipe common to both ends, in order that the inertia of the water in the main waste-pipe draws upon the side of the cylinder being exhausted, and thus facilitates the escape of the water.

My invention therefore consists in the arrangement of a large and peculiar cylindrical valve below the working-cylinder, in which valve the passages for the exhaust are joined together, and that for the reception of the water is merely a recess cut into its face, and instead of using an eccentric or an ordinary cam for working the valve, I employ a cam-plate that would be otherwise of an unduly large size, so that the required changes in the position of the valve may be made only at the extreme ends of the stroke, where the piston has comparatively no motion.

To enable others skilled in the art to which it appertains to make and use my invention, I will proceed to describe its construction and operation with reference to the drawings.

Figure 1 is a sectional elevation of a hydraulic engine such as I have described, showing chiefly, however, only those parts that are



peculiar to my invention; and Fig. 2 is a transverse section of the cylinder and the valve.

The valve is a cylinder hung on a steel axis, *a*, and perforated by the exhaust-passages *b c*, that unite at *d* in an opening to the common waste-pipe. The recess *e*, for the reception and distribution of the water, is constantly in connection with the supply-pipe and either one end or the other of the cylinder. Its contents or capacity is so small that when the valve is shifted the water it contains is but a trifling obstruction to the flow of the current through the supply-pipe. To effect this arrangement of passages the valve shown in the drawings has the same diameter as the working-cylinder.

The cam is a circular disk on the crank-shaft with a groove, *f*, in which is fitted a roller, *g*, carried by a lever, *h*, that vibrates on its lower end, and is connected by the rod *i* to the lever *k* on the axle of the valve. The large size of the cam causes the roller and valve-levers to be operated during only a small portion of a revolution, amounting, in the proportion illustrated in the drawings, to something less than ten degrees, and causing the entire motion of the valve, even when it is wholly made before the termination of the stroke, to be accomplished in less than  $(\frac{1}{130})$  one one-hundred-and-thirtieth part of the stroke. If the cam were set so as to have the valve only half-open at the end of the stroke, this fraction would be reduced considerably more than one-half.

I am aware that cocks and cylindrical valves have been heretofore employed; but

the distinctive features of the valve and the method of operating it which I have described in connection with a hydraulic engine differ from those in the peculiar arrangement of the passages for the reception and disposition of the water by which the piston receives its full power and it is discharged from the cylinder after it has been used. The current of water in the supply-pipe proceeds unchecked by the valve, and with its full force uniformly upon the piston, which it would not do if it were stopped at the termination of each stroke and required time to again acquire motion to make another; and the large size of the valve permits the arrangement of the waste-water openings as large, if desirable, as the area of the working-cylinder itself. By this means, therefore, there is no destructive pounding by the concussion of the water suddenly arrested in the supply-pipe, and there is no time lost in beginning a stroke by waiting for the column of water to overcome its own inertia and again acquire a motion commensurate with its full power.

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

The valve with its passages, as shown, when operated by the eccentrically-grooved plate, in connection with the guide-pin and connecting-bar, substantially as described.

HOMER H. STUART.

Witnesses:

ANDREW STEWART,  
WM. KEMBLE HALL.