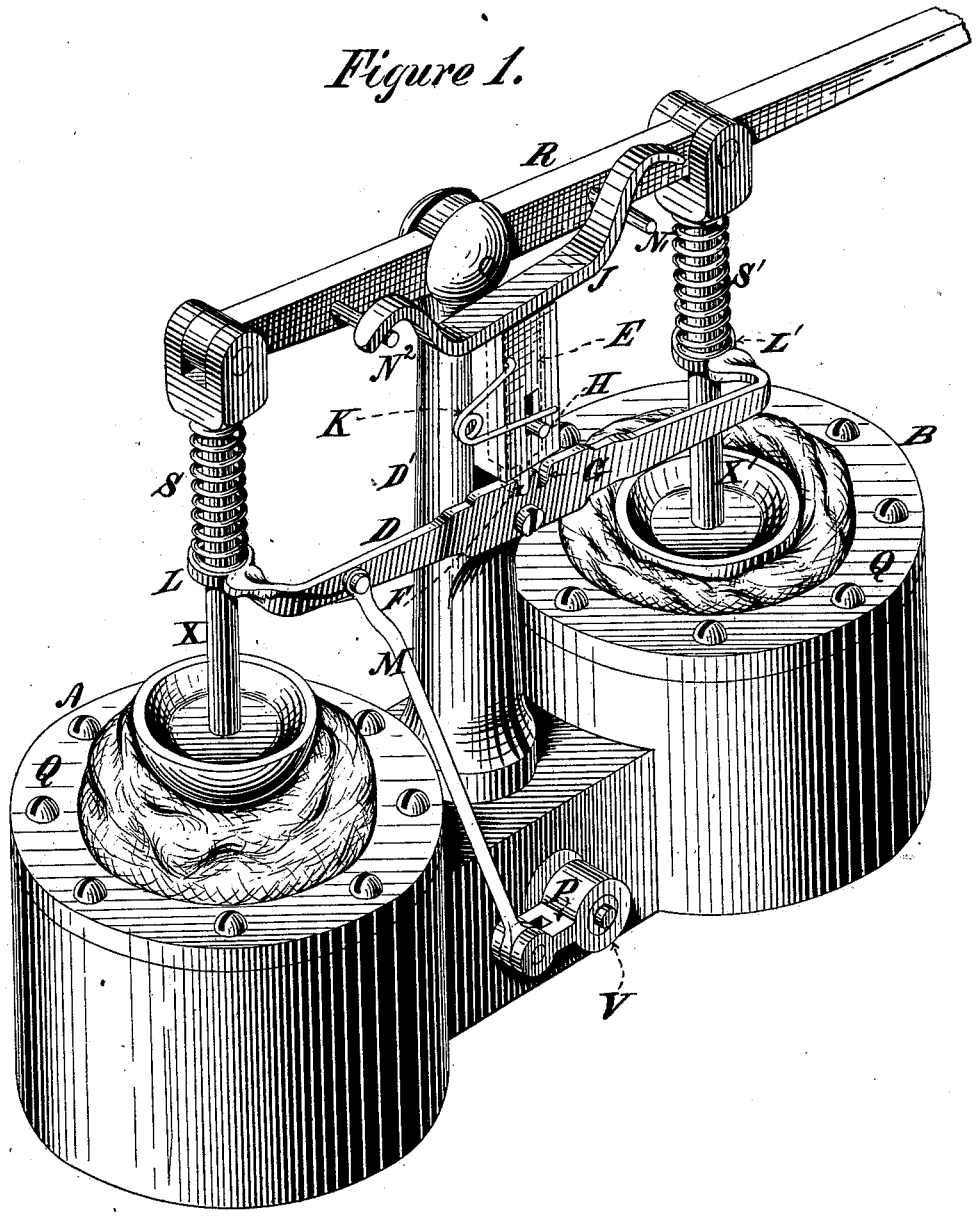
2 Sheets—Sheet 1.

# L. K. FULLER.
## Hydraulic-Engines.

**No. 213,745.** **Patented April 1, 1879.**

*Figure 1.*




Witnesses:
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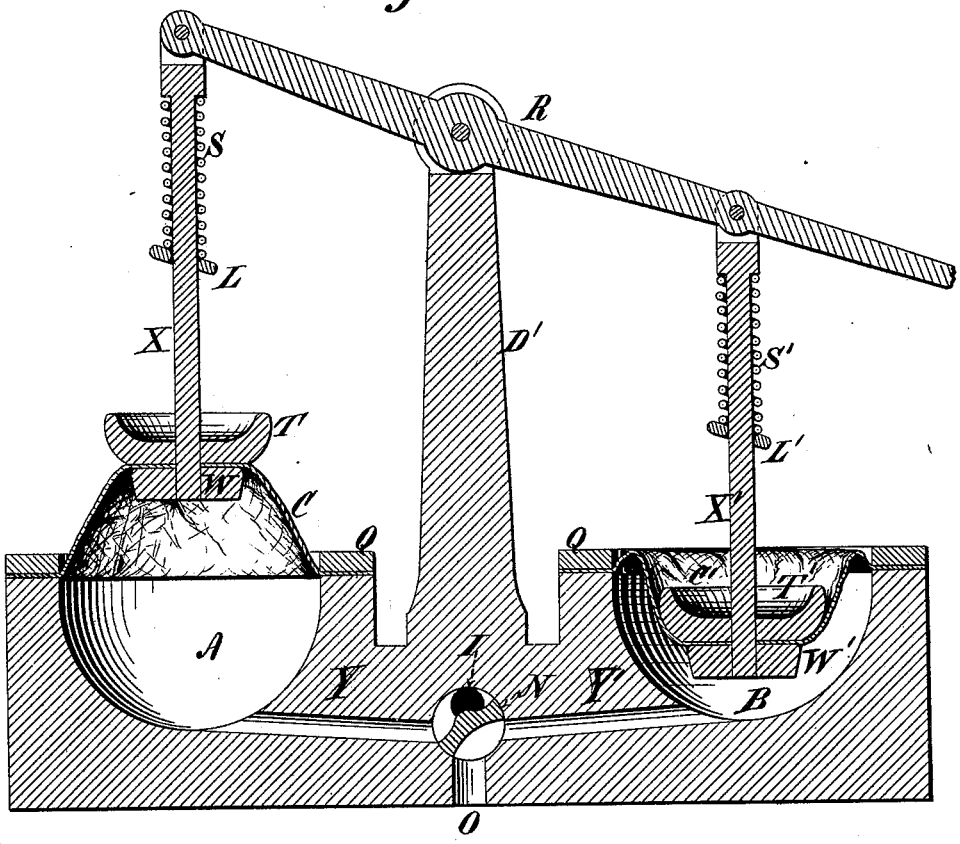
2 Sheets—Sheet 2.

# L. K. FULLER.
## Hydraulic-Engines.

**No. 213,745.** **Patented April 1, 1879.**

*Figure 2.*

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# UNITED STATES PATENT OFFICE.

LEVI K. FULLER, OF BRATTLEBOROUGH, VERMONT.

## IMPROVEMENT IN HYDRAULIC ENGINES.

Specification forming part of Letters Patent No. **213,745**, dated April 1, 1879; application filed December 19, 1878.

*To all whom it may concern:*

Be it known that I, LEVI K. FULLER, of the city of Brattleborough and State of Vermont, have invented a new and useful Improvement in Hydraulic Engines, of which the following is a full, true, and exact description, reference being had to the accompanying drawings.

The object of my invention is to produce a cheap, simple, and effective engine to be operated by the pressure of water, and it is especially adapted to the pumping of organs.

My invention consists generally of two vessels, preferably made of iron, the general shape of the interior of the vessel being hemispherical cavities. These cavities are inclosed by flexible diaphragms or sheets, preferably of india-rubber, though other suitable material may be used. These rubber or flexible inclosing-sheets are supported by and actuate two connecting-rods, which actuate a vibrating beam, supplying the power required. The motion of this beam operates a three-way cock, which throws the pressure alternately into each vessel and exhausts the other.

My invention will be readily understood from the accompanying drawings, in which A and B represent the two vessels. C and C′ represent the flexible diaphragms, which are held between two vertical horizontal plates or collars, T T′ and W and W′, connected with and fast to the vertical connecting-rods X X′, which rods X X′ are connected to the vibrating beam R. This beam is supported upon the vertical standard D′, and vibrates around a pivot fixed thereon.

The confining plates or collars T T′ W W′ have their corners rounded, as shown, and the upper plates, T T′, which are designed to enter far into the vessels, have their rounded surfaces curved well up. By this arrangement the cutting of the flexible material by the sharp corners is prevented.

Water is supplied to the vessels A and B by the passages Y and Y′. Water enters the central chamber, containing the three-way cock, by means of a passage, I. (Shown in Figure 2. The three-way cock is shown at N, and the delivery-port at O.

In the position shown in Fig. 2 the chamber A is filled with water, and the rod X is just completing its upward stroke. As soon as it has reached its full throw the three-way cock N is reversed by mechanism to be described. Thereby the outlet-passage O in the bed-plate of the machine is put in communication with the chamber A, and the inlet-passage I is put in communication with the chamber B by means of the connecting-passage Y′. It is plain that this reverse movement of the three-way cock must be done at the end of the stroke, and suddenly; otherwise the water would be gradually shut off toward the completion of each stroke, thereby interfering with the free action of the machine.

The three-way cock is extended out through the frame of the machine, and is shown at V, Fig. 1. It has connected to it a crank, P, which moves and reverses the valve.

Pivoted on the standard D′ is the vibrating lever D. This lever is connected to the crank P by the link M, which controls the three-way cock. The vibrating lever D is provided at its extremities with two collars, L and L′, which surround the rods X X′, and are larger than those rods, so as to play vertically with freedom.

Between the collars L L′ and the shoulders at the upper end of the rods X X′ are springs S S′, which serve to operate the vibrating lever D in a manner to be described.

At the center of the lever D, above its pivot, are two slots, G. Supported in a box or frame on the standard D′ is a bolt, E, provided with tooth F, sliding vertically in such box, and provided at its upper extremity with a horizontal bent arm, J, which serves to raise such bolt E from its engagement with one or the other of the slots G in the lever D. The bolt E is provided with a pin, H, which projects through a slot in the inclosing-box, and is acted against by a spring, K, which serves to throw down such bolt. The vibrating beam R has two pins, $N^2$ $N^1$, which engage with the projecting bent ends of the arm J, and raise the same at the end of each stroke.

The operation of the machine can now be understood. In Fig. 1 water is entering the vessel B and flowing out of the vessel A, so that the rod X′ is being elevated and the rod X depressed; consequently the spring S is being pressed between the shoulder on the rod X and the ring C, thereby tending to throw

down the left end of the lever D. This movement is prevented by the tooth F of the bolt E, which engages with the left-hand slot in the lever D. As soon as the pin $N^1$ engages with the arm J the bolt E will be raised, thereby compressing the spring K, the tooth F will be raised from the left-hand slot in D, the spring S will act against the lever D and throw down the left end thereof, thereby reversing the three-way cock N, which movement causes a reverse stroke, and allows the tooth F to engage with the right-hand slot or notch in the lever D. This engagement prevents the movement of such lever, notwithstanding the operation of the spring S′, which is being compressed between the collar L′ and the shoulder on the rod X′, and the valve N is therefore locked until the completion of the stroke, when it is once more reversed.

It will thus be seen that the valve N remains wide open in whatever position it may happen to be until the conclusion of the stroke, and then is suddenly reversed, and that this result is accomplished by locking the valve-moving mechanism by means of a pawl, which is only tripped at the conclusion of the stroke, thereby allowing the moving spring to act suddenly and surely.

I am aware of the patent to Nider, August 31, 1869, No. 94,235, and do not claim anything there shown.

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

1. A hydraulic engine which consists of two vessels closed with flexible diaphragms, having one surface only in contact with the water, which control and are connected with connecting-rods at the opposite ends of a vibrating beam, and a three-way cock or valve for the purpose of alternately admitting a water-pressure to one of the vessels, and simultaneously discharging the other vessel, substantially as described.

2. In combination with a double-acting hydraulic engine provided with two flexible diaphragms, having one surface only in contact with the water, a single valve controlling the pressure and delivery, which valve is itself kept wide open until the conclusion of the stroke, and is then suddenly reversed, substantially as described.

3. In combination with a double-acting hydraulic engine and a single cock controlling the water delivery and supply, as shown, a vibrating lever, which controls such valve, and is itself moved by the operation of the vibrating beam through the intervention of two compressible springs, substantially as described.

4. In combination with a double-acting hydraulic engine, the means shown, consisting of a trip-bolt for locking the controlling-valve and reversing it suddenly at the end of the stroke, substantially as described.

5. In a double-acting hydraulic engine, the combination of valve N, operated by link M, vibrating lever D, provided with slots G, and a bolt, E, substantially as described.

6. In combination with a double-acting hydraulic engine, a controlling-valve, N, operated by link M, and vibrating lever, D, provided with slots G and moved by springs S S′, and locked by a bolt, E, until the conclusion of each stroke, substantially as described.

7. In combination with a vibrating beam, R, a valve-controlling lever, D, and a bolt, E, provided with a double arm, J, actuated by connections with the beam R, substantially as described.

LEVI K. FULLER.

Witnesses:
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