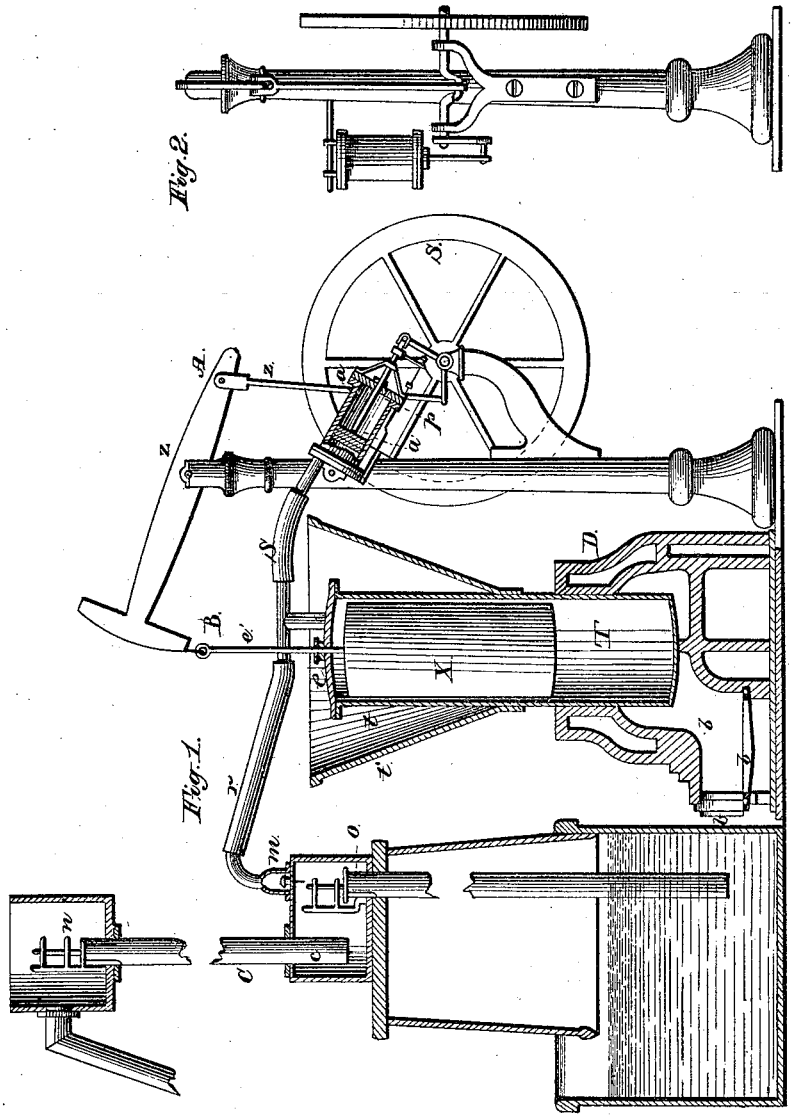
D. W. VAN RENNES.

CALORIC ENGINES FOR RAISING WATER.

No. 185,199. Patented Dec. 12, 1876.

Fig. 2.



Witnesses:

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UNITED STATES PATENT OFFICE

DIRK WILLEM VAN RENNES, OF UTRECHT, ASSIGNOR OF PART OF HIS RIGHT TO YAN BAREND HENDRIK VAN ROYEN, OF ARNHEM, AND PIERRE JOSEPH HENRY BAUDET, OF UTRECHT, NETHERLANDS.

IMPROVEMENT IN CALORIC-ENGINES FOR RAISING WATER.

Specification forming part of Letters Patent No. **185,199**, dated December 12, 1876; application filed June 9, 1876.

To all whom it may concern:

Be it known that I, DIRK WILLEM VAN RENNES, of Utrecht, Kingdom of the Netherlands, have invented certain Improvements in Caloric-Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed drawing, making a part of the same.

This invention consists in an engine in which the alternate expansion and contraction of air shut up in a vessel, within which moves a second cylinder acting as a repeller, and which is placed partly in a furnace, or is heated by a flame, and is partly surrounded by a refrigerator, so as to allow the air contained within it alternately to expand and contract, acts directly on a liquid which is to be raised.

This engine has three essential parts: First, an iron cylinder composed of two parts, whose sides have a different thickness. Within the cylinder moves a repeller, of wrought-iron, which, in every double range, allows the air to leave and enter the cylinder, whose lower part is heated in a furnace or by means of a flame, and whose upper part is continually cooled by means of a surrounding water-box. Second, a box provided with valves, one of which (the eduction-valve) opens on a pipe in which the water is repulsed by the pression of the air, while the other opens on a pipe through which the water or other liquid may ascend into the box, and the third acts as a safety-valve. Third, a regulator intended to make the repeller move alternately in the heated and cooled parts of the cylinder.

In the drawing annexed hereunto the regulator bears the letter A, the cylinder with furnace and water-box B, the valve-box C.

I. The cylinder with furnace and water-box: The cylinder T *t* is composed of two parts—the upper part, *t*, of wrought-iron, and the lower part, T, of cast-iron. Within the cylinder the repeller X, of wrought-iron, hollow, and hermetically closed, is left to ascend and descend freely, leaving to the surrounding air sufficient space for circulating. The furnace D receives fuel at *b b*, and heats the lower part T of the cylinder T *t*. The air contained within this part is heated and expanded. The furnace has a chimney, and may be either portable, or in masonry, or may be totally dispensed with when the cylinder is heated by a flame. The upper part of the cylinder, of wrought-iron, bears a cover with a stuffing-box, and is surrounded by a water-box, *t'*, intended to cool this part. The cooler is screened from the surface by an intervening layer of air or any other substance. Whenever the repeller X has attained its upper position the air which is underneath will be strongly heated and expanded. Whenever the repeller descends within the cylinder the air will be driven into the upper part, *t*, where it will be cooled and contract, through the action of the cold water which surrounds this part. So, by making the repeller rise and descend within the cylinder, the air contained within will be alternately heated and expand, will be cooled and contract. By a special provision the air contained within the cylinder may be put into communication with the outer air, both whenever the repeller attains its highest and its lowest station. This aim is attained by means of a sliding valve adapted on one side of the motor or regulator *a*. By this contrivance the expanded hot air finds an issue immediately after having acted on the fluid and propelled the piston of the motor or regulator *a*, and, on the contrary, cold air is admitted as soon as the atmospheric pression exceeds the pression of the cooled air within the cylinder. Under circumstances this sliding valve may be dispensed with.

II. The valve-box C: This box, together with the ascension-pipe and the repulsion-pipe, constitutes a pump. The eduction-valve *n* in the repulsion-pipe allows the water to rise into this pipe, and prevents its running back again. The valve opens whenever the pression of the air within the cylinder T *t* is higher than the atmospheric pression and the pression of the liquid in the repulsion-pipe taken together. The valve is shut when the two pressions are in a state of equilibrium. The admission-valve *o* opens whenever the rarefaction of the air within the valve-box C

is sufficient, and then it allows the water to rise into the box. It is shut whenever this cause is suspended. The valve *m* at the end of the pipe *r*, being lighter than the liquid, withholds this liquid from entering into the cylinder, which could otherwise happen at a very high rarefaction of the air in the cylinder T *t*. In this manner it may be called a safety-valve. It may be easily understood that any other system of valves may equally answer the said purposes.

III. The regulator A: The repeller X rises and sinks within the cylinder T *t*, being moved by a motor, *a*. This regulator is a small oscillating cylinder, in which moves a piston, *a'*, connected by a rod and crank with the fly-wheel. An elastic tube, S, allows the heated air of the cylinder T to enter into the upper part of the cylinder and to repulse the piston *a'*. When the air in the cylinder T *t* is cooled the piston *a'* rises through the pression of the atmospheric air, which enters into the small cylinder *a* through a hole in its cover. The repeller X, connected by a rod and crank with the fly-wheel, will rise and sink in consequence of the sinking and rising of the small piston *a'*. The velocity of this motion may be regulated arbitrarily by partly shutting the hole *p* in the cover of the cylinder.

What I claim as my invention is—

The combination, in a device for raising water or any other liquid, of the cylinder T *t*, in which air is made to alternately expand and contract by a displacer, the regulator *a*, the valve-box C, and valves *o* and *n*, substantially as described, and for the purpose set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

D. W. VAN RENNES.

Witnesses:

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G. V. LUNEMBURG.