A. S. LYMAN.

ROTARY ENGINE.

No. 187,154. Patented Feb. 6, 1877.

Fig. 1.

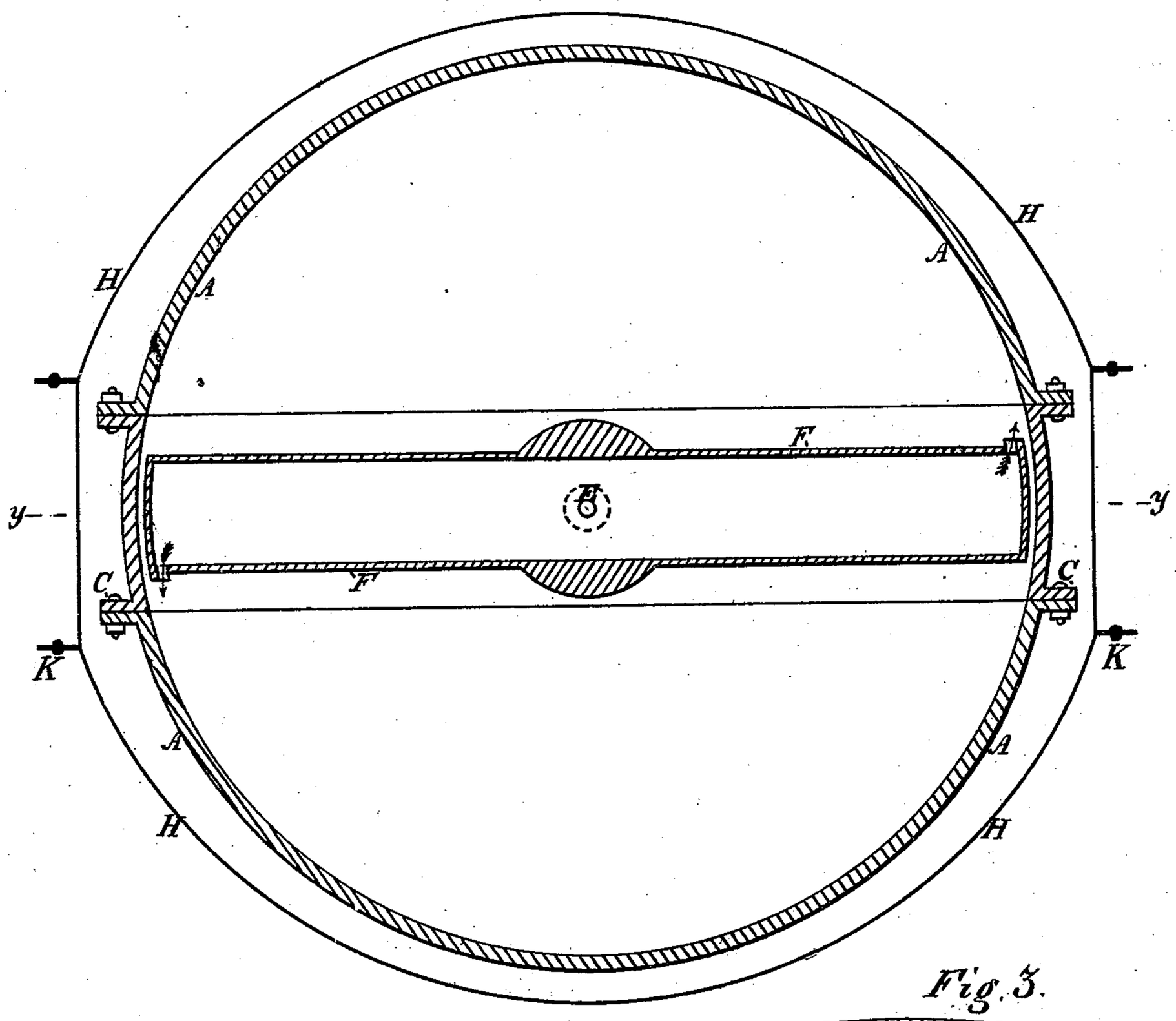
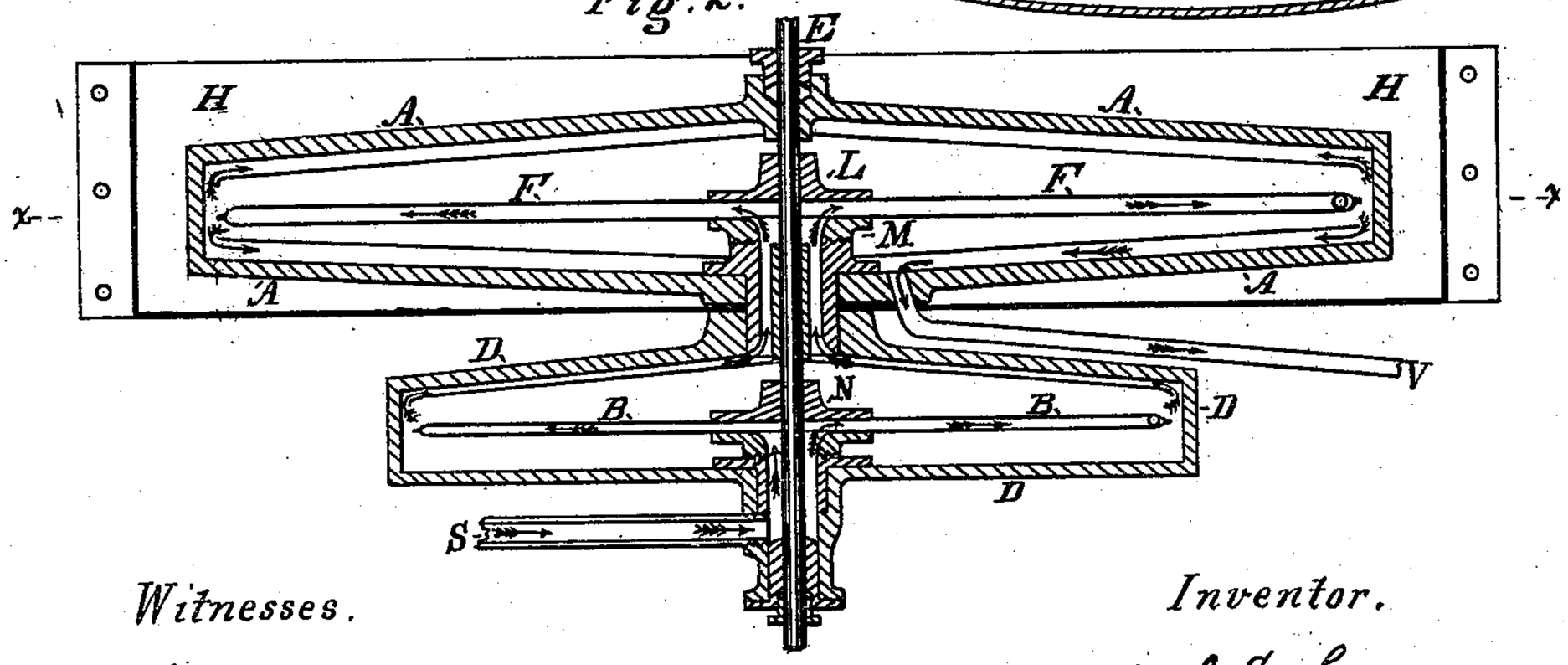


Fig. 3.

Fig. 2.



Witnesses.

W. L. Bennett.

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UNITED STATES PATENT OFFICE.

AZEL S. LYMAN, OF NEW YORK, N. Y.

IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. **187,154**, dated February 6, 1877; application filed February 17, 1876.

To all whom it may concern:

Be it known that I, AZEL S. LYMAN, of the city, county, and State of New York, have invented certain Improvements in Reacting Rotary Engines, of which the following is a specification:

My invention is an improvement on that class of rotaries that are moved by reaction, on the principle of the Barker mill or the turbine, and, being driven by steam, must revolve at a very high speed, even faster than the engines of Avery in this country, or of Ruthven in Great Britain, if we would make them economical in the use of steam.

The object of my invention is, first, to avoid the resistance of the air, which in the case of the Avery engine, though it was well modeled, was so great as not only to seriously retard its velocity and use up a large per cent. of its power, but also to rapidly wear away from its front, so that, as we are told by those who used it, "it was necessary to forge a new face upon it about once in three months."

This resistance of the atmospheric pressure steam in the box in which it revolved, which used up all its power before it moved over two-thirds as fast as the steam escaped from it, will account for its want of economy. I dispense with the resistance of the air by placing the engine in a vacuum-chamber, and surrounding this chamber with water, so as to make it a condenser.

Figure 1 is a horizontal section through *x x* of Fig. 2. Fig. 2 is a vertical section through *y y* of Fig. 1. Fig. 3 is an enlarged cross-section of one of the arms F F.

A A is the vacuum-chamber. H H is the water-reservoir surrounding this chamber, and making it a condenser. E is the shaft, which is keyed in the hubs L and N, Fig. 2, and revolved by the reaction of the steam in the arms F F and B B against the surfaces opposite the openings from which it is escaping, as shown by the arrows in Fig. 1. This is a simple mode of making a compound reacting rotary engine.

Its operation is as follows: The steam enters the smaller engine by the pipe S, passes in the direction of the arrows up through the openings around the shaft, out of the revolving arms B B, and over the false roof on its way toward the vacuum-engine, through the passages surrounding the shaft and the revolving arms F F, escaping from them into the vacuum, as shown by the arrows, when it expands and rushes toward the sides of the case, thence along in contact with the top and bottom, where, as well as on its sides, it is rapidly condensed. In doing this it will sweep the drops of water that are falling from the edge of the false roof between these arms and the heavy cast-iron case A A, out against the sides, and from this the water will flow along the bottom and off by the pipe V toward the additional condenser and vacuum-pump. (Not shown.) The false roof above the arms F F prevents the shower of water from the condensing-surface A A from falling upon the arms and causing great resistance. The false floor is placed below these arms, as shown, so that the condensing vapor shall not flow back by the arms and cause resistance on its way to the lower condensing-surface and the pipe V. The arms F F of the vacuum rotary, as well as the steam-passages into their center, are made several times larger in area of cross-section than the arms B B of the high-pressure rotary.

The vacuum-chamber A A is made in three pieces, which separate at the flanges C C, Fig. 1, so that the bearings of the vertical shaft E and the steam-receiving joint M shall be in one casting, and thus easily kept in line; also that this chamber can be readily opened and the engine examined in all its parts by simply drawing off the water, then taking off the front of the water reservoir at the flanges K, and the front of the vacuum-chamber at the flanges C C.

By this arrangement the joints of the cast vacuum-chamber at these flanges may be left rough, a mere sheet of soft rubber or lead being between them, and the more perfect the vacuum the tighter will be the joints.

In combining the high-pressure rotary with this vacuum rotary I prefer the same form of chamber for the high-pressure, the top and bottom of the center being cast in one piece, so that the bearings of the shaft and the steam-receiving joint may be easily kept in line. The large heavy tube surrounding the shaft

between M and N passes through both engine-cases, and holds them in line while being firmly bolted together.

The arms of the high-pressure rotary should be made much shorter than the arms of the vacuum rotary when combined, because, being greatly retarded by the atmospheric resistance, they will not travel as fast as those that are freed from this resistance.

This single vacuum reacting rotary in its simplest form was devised for driving the rotary pump and fan of my "Apparatus for Purifying, Cooling, and Drying or Warming Air" in dwellings where high-pressure steam is objectionable. I propose also to use it for utilizing the exhaust steam ordinarily wasted from high-pressure engines. In these cases I would return the condensed water to the high-pressure boilers.

Where fuel is very expensive and a large amount of steam is going to waste, this combined rotary would, I believe, be preferable for exhaust steam, the smaller engine receiving it at, say, atmospheric pressure, and the passages between it and the condensing-engine being throttled to such an area that the pressure of the steam in the smaller chamber shall be half an atmosphere, more or less, and the pressure in the largest chamber but, say, one-fifteenth of an atmosphere.

By this mode of using two, three, or more engines the economy in fuel may be increased.

To prevent the condensation of steam before it enters the largest chamber or condenser, some heat should be applied to the bottoms of the smaller chambers by means of the steam-jacket or otherwise.

I claim as my invention—

1. The combination of the water-reservoir H H with the vacuum-chamber A A, inclosing the reacting engine F F, so as to make this vacuum-chamber a condenser, in the manner substantially as and for the purposes specified.

2. The combination of the chamber D D, containing the engine B B, with the vacuum-chamber A A, containing the condensing-engine F F, substantially as and for the specified purposes.

3. The combination of the false roof between the arms F F and the condensing-surface above, to prevent the water of condensation from falling upon the arms and retarding their velocity, substantially as specified.

AZEL S. LYMAN.

Witnesses:
W. L. BENNEM,
JAS. S. WIGHTMAN.