

No. 608,463.

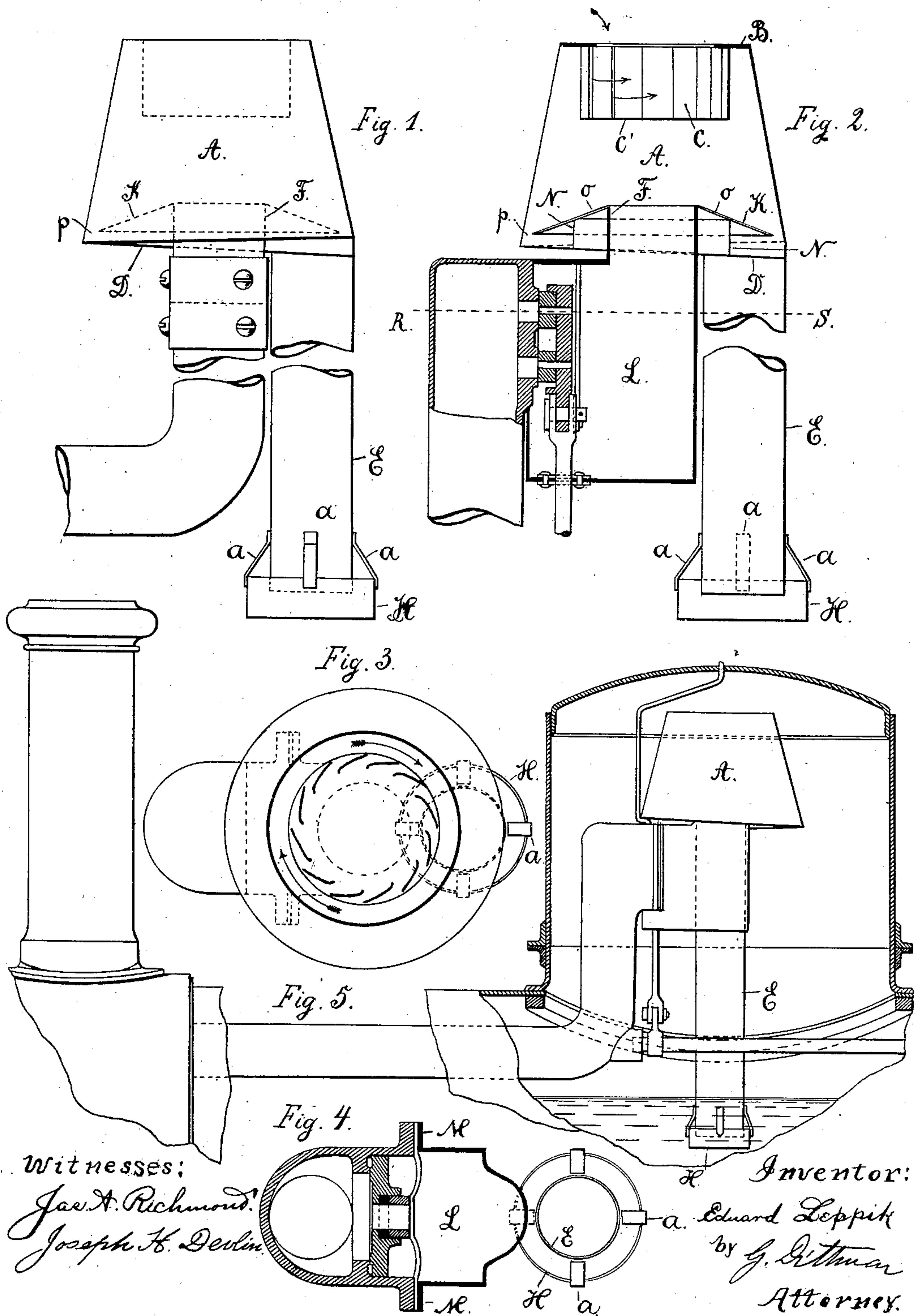
Patented Aug. 2, 1898.

E. LEPPIK.

CENTRIFUGAL STEAM AND WATER SEPARATOR.

(Application filed June 15, 1897.)

(No Model.)



UNITED STATES PATENT OFFICE.

EDUARD LEPPIK, OF WARSAW, RUSSIA.

CENTRIFUGAL STEAM AND WATER SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 608,463, dated August 2, 1898.

Application filed June 15, 1897. Serial No. 640,876. (No model.) Patented in France December 18, 1896, No. 262,812; in Belgium December 18, 1896, No. 125,247; in England December 20, 1896, No. 29,339, and in Austria December 7, 1897, No. 47/5,274.

To all whom it may concern:

Be it known that I, EDUARD LEPPIK, a subject of the Emperor of Russia, residing at Warsaw, Poland, in the Empire of Russia, have invented certain new and useful Improvements in Centrifugal Separators of Water Particles from Steam, (for which I have received patents in France, No. 262,812, dated December 18, 1896; in Belgium, No. 125,247, dated December 18, 1896; in Austria, No. 47/5,274, dated December 7, 1897, and in England, No. 29,339, dated December 20, 1896, and for which applications were made in Germany and Russia January 25, 1898, which are still pending;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of this invention is to provide an apparatus for eliminating the water particles from the steam during its passage from the boiler to the cylinder. The steam is passed through a turbine fixed on the inner part of the drum, whereby the water particles contained in the steam will be eliminated in consequence of the centrifugal tendency caused by the turbine. The eliminated water particles are conducted back through a tube into the water of the boiler, while the dry steam is led away through a second tube into the cylinders of the engine.

In the accompanying drawings, Figure 1 is a side elevation of the centrifugal separator. Fig. 2 is a vertical cross-section. Fig. 3 is a plan of Fig. 2. Fig. 4 is a view along line R S, Fig. 2. Fig. 5 shows the apparatus within the dome of a locomotive.

The centrifugal separator consists of a conical drum A, Figs. 1, 2, and 5, which is partially closed at the top by the ring B. Fixed rigidly to the ring B is the turbine C, extending down into the drum A. The bottom of turbine C is closed by the imperforate plate C'. The drum A is terminated below by a helical bottom D, which descends gradually toward a pipe E. Thus this pipe E extends from the lowest part of the bottom D into the boiler, and therein, by means of attaching-

5. Entering the drum through the bottom D a pipe F is provided, carrying at its upper extremity the conical surface K. This surface K is perforated by a series of openings *o*. The conical surface K terminates before reaching the vertical walls of drum A, whereby the channel *p* is formed, Figs. 1 and 2.

Between the wall of the drum A and the tube F extends the vertical wall N, dividing the space included between drum A and tube F into two parts and cutting the orifice of the pipe E. The tube F is either cut away smoothly outside of the bottom D or enters a box L, which is provided with a flange *m m*, according to the position of the regulator-head in the smoke-chamber or in the steam-dome, Figs. 1, 2, and 5. If the regulator-head is placed in the steam-dome, the box L will be fastened to the regulator-head by means of the flanges *m m*, so that the whole apparatus is inclosed within the steam-dome. The tube E extends into the water of the boiler.

The operation of the apparatus is as follows: If the regulator-head of the steam-engine is opened—that is to say, if steam is allowed to enter the cylinder—the pressure of the steam within the apparatus will be slightly less than the pressure within the boiler. Consequently the steam flows through the turbine C into the drum A, while the water of the boiler ascends to a certain height within the pipe E—that is to say, the water ascends in pipe E until the weight of the water column equals the difference between the pressures within the boiler and the apparatus. As the turbine C is immovable and is closed at its bottom by the imperforate plate C', the steam flowing through the turbine-channels moves in a tangential direction toward the circumference of the drum, whereby the centrifugal force takes effect on the particles of the steam. The centrifugal force produces in the water particles the tendency to describe circles as large as possible, whereby the water is collected on the walls of the drum A, while the lighter steam acquires a rotatory motion in the middle part of the drum. Thence the steam in a dry state passes through the tube F to the engine-cylinder. Further, the eliminated

water particles are caused by the combined effect of the weight and their centrifugal tendency to collect on the lower part of the bottom D, where by passing through the channel *p* it flows on the inclined surface of the bottom D toward the pipe E and returns thereby into the boiler.

The vessel II, consisting of a cylindrical vessel open at the top and with an imperforate bottom, is provided for the purpose of preventing the ascent of steam-bubbles from entering the pipe E from below. With this object the upper edge of vessel II is extended above the lower extremity of the pipe E.

To facilitate the escape of any steam-bubbles that might by any possibility enter the pipe E from below, there are provided near the upper edge of the conical surface K round openings *o*, whereby said steam-bubbles can pass into the upper part of the dome.

Owing to the fact that the channel *p* is more or less obstructed by downflowing water, the steam-bubbles ascending through pipe E will naturally pass into the annular space below the openings *o*.

If the regulator is reversed, the water will thereupon fall or rise in the pipe E, the apparatus always working in proportion to the steam consumption, for with the increase of the volume of steam admitted to the cylinder the velocity of the steam passing through the turbine is increased, as is also the rotatory flow through the drum, or, in a word, the operation of the apparatus is accelerated.

The turbine must be constructed of sufficient capacity to provide for the maximum consumption of steam in a unit of time.

Since the weight of the column of water in the pipe E equalizes the difference in pressure in the boiler and in the drum A, the bottom of this drum should not be placed less

than sixty centimeters above the highest level of the water in the boiler in the case where the velocity of the steam-outflow does not exceed thirty-five meters per second. For the same reason should a greater velocity be attained the apparatus should be placed proportionately higher.

The apparatus does not require any attendance, as none of its parts are movable and as it is not subjected to a pressure greater than one-eighteenth of an atmosphere.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

A separator of water particles from steam consisting of a drum arranged within the boiler, said drum being closed partially above by an annular ring carrying a fixed turbine open above and closed below, said drum being further provided with a helical bottom adapted to drain the water separated toward a drain-orifice therein, and a drain-pipe open at both ends and extending into the water of the boiler and provided at its lowest extremity with a vessel adapted to retard as much as possible the entrance of bubbles into the drain-pipe, and of an eduction-pipe extending into the said drum and provided at its upper end with a conical cap pierced with holes adapted to allow for the escape of any ascending steam-bubbles, and of a vertical circular partition inclosing the holes aforesaid and cutting the said drain-orifice, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

EDUARD LEPPIK. [L. S.]

Witnesses:

ERNST FRANZ V. PODISY,
KEJETON VLODOWSKI.