

(No Model.)

H. H. BATES.
STEAM SEPARATOR.

No. 578,192.

Patented Mar. 2, 1897.

Fig. 2.

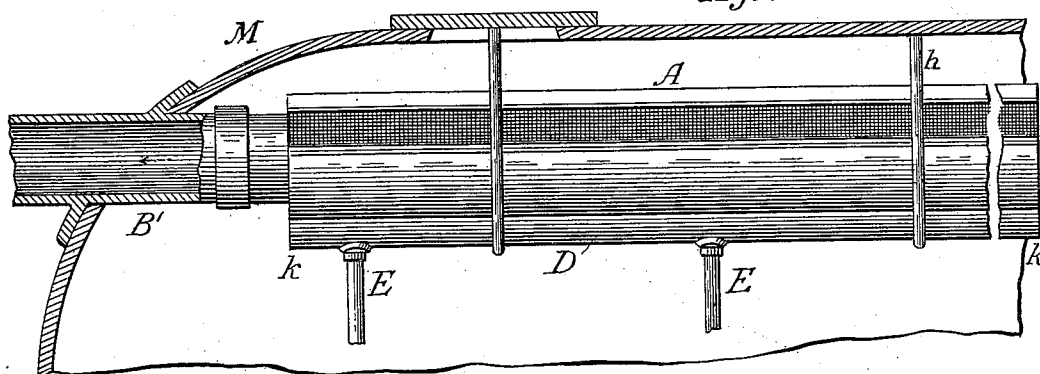
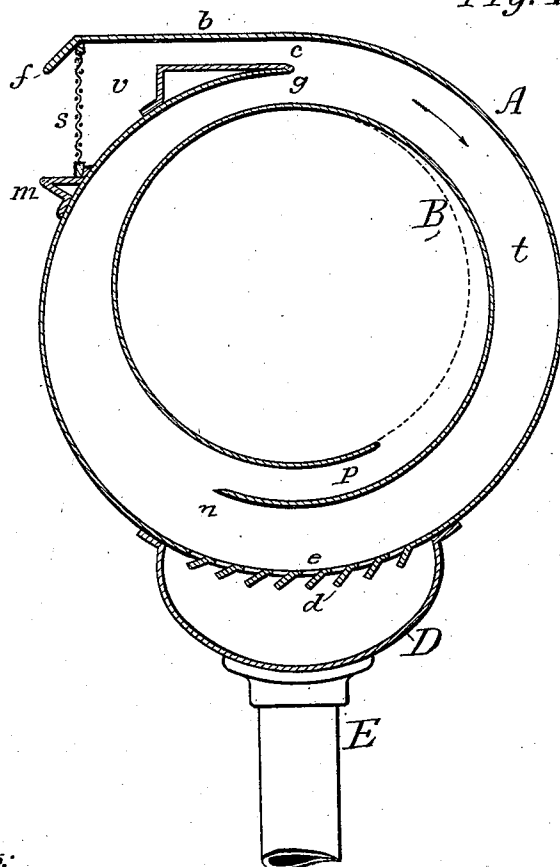


Fig. 1.



witnesses:

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HENRY H. BATES, OF WASHINGTON, DISTRICT OF COLUMBIA.

STEAM-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 578,192, dated March 2, 1897.

Application filed October 22, 1896. Serial No. 609,725. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. BATES, a citizen of the United States of America, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Steam-Separators; 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.

Reference is made to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a cross-section of my improved device, and Fig. 2 is a side elevation of a portion of the same in place in a marine boiler of well-known construction.

Like letters of reference refer to like parts upon the drawings.

The details of the several parts will be described below.

My invention relates to improvements in steam-separators, especially those adapted to be used in the interiors of steam-boilers or in a steam-dome attached thereto adapted to the purpose. Most of the separators in common use within the boilers of sea-going vessels are quite apt to ship water with the incoming steam when sudden demands are made on the latter or as the water in the boiler is violently thrown about by the motions of the vessel, and there is no adequate provision for excluding or throwing out the same.

It is my object to provide a device which shall perform all the functions of a separator with efficiency under the conditions affecting sea-going boilers, including the capacity for throwing out any and all water accidentally entering with the steam, while guarding as well as may be against such entrance.

In the drawings, A is a pipe or elongated drum designed to be secured in any substantial manner in a horizontal position along the upper part of a boiler interior, in the steam-space thereof, and to take steam from the driest part of the space where it is least impregnated with free moisture. This pipe (which is closed at the ends except the outlet) is of scroll or volute form in cross-section as to that portion within the boiler, the edges of the plate or sheet of which the said

pipe is composed not being coincident or joined, as in a tubular pipe, but one being drawn in on a smaller radius than the other, so as to leave a long narrow offset or passage *c* between the opposed edges to provide for the entrance of the steam in which the pipe is immersed in a thin tangential sheet or stream. To this is affixed a short tangential chute *b*, entering horizontally at the top of the pipe and extending widthwise the whole length thereof or as far as may be desired. This chute insures the proper tangential direction to the entering sheet of steam and regulates the flow. Its upper side is prolonged considerably beyond the lower side and is provided with a downturned flange *f* at the edge to shed drip from above.

s is a vertical screen of stout woven wire or other foraminous material, the mesh being as close as may be and yet insure ample steam-passage, proportioned to the capacity of the chute to carry steam to the interior of the separator. The function of this screen is to receive and break the impact of heavy masses of water thrown violently upward toward the chute-entrance by the uprush of steam or in consequence of the motions of the vessel. It also serves to exclude impurities which might clog the separator. A ledge or sill *m* is provided at some distance below the chute for the screen to rest upon, and this also serves in a measure to check the uprush of water from below.

v is a vestibule formed between the screen and the entrance to the chute. The throat or passage *c* of the chute into the scroll-pipe should be of due relative proportional area to the final delivery or exit pipe, hereinafter mentioned, so as not to deliver steam in excess or deficiency of the capacity of the latter to dispose of it—that is to say, it should not materially exceed the said exit-pipe in entire cross-sectional area nor be very greatly less.

Within the said scroll-pipe A is secured a second scroll-pipe B, centrally located. This also has non-coinciding edges, one overlapping the other a short distance, with a narrow interval between, forming the passage *p*. The plate in this instance is wrapped in the opposite direction from that of A—that is, the volute is disposed reversely, so that the opening or entrance of the passage *p*, formed by

the overlapping edges, does not face the current. This passage *p* should not be wider than passage *c*. It is located near the bottom of the pipe, with the entrance a little beyond the center. The edge *n* of the entrance to this passage is preferably made thin and sharp and may be serrated, if desired. The curved passage-way *t* between plates A and B from the inlet *c* to the said edge *n* is between two concentric walls, so as to be of uniform width, which is practically equal to the combined width of *c* and *g*, hereinafter mentioned. At edge *n* of passage *p* the width of the curved main passage-way suddenly increases by the width of *p*, whence it converges between curved non-concentric walls until it arrives at throat *g*, which should not be wider than passage *c*, and discharges parallel thereto.

The passage *p* leads tangentially into the interior of scroll-pipe B, whence an exit-way is provided for the steam through a tubular extension or pipe B' of practically the same diameter as scroll-pipe B, (indicated in dotted lines,) passing through the shell of the boiler. The connection of this tubular extension B' with scroll-pipe B is made secure and steam-tight at the point of juncture where the scroll departs from the original radius, and the space between scroll-pipe B and scroll-pipe A at the end is also made secure by an end plate *k* or other suitable means. The scroll-pipes are also securely closed at the other extremity by suitable means.

Beneath the bottom of scroll-pipe A along its length is secured a hollow trough-like addition D. The floor of scroll-pipe A immediately above this trough is perforated, as at *e*, with outlet-apertures, preferably struck out of the metal of the pipe, so as to leave downwardly-inclined projections *d* adhering to the sides of the perforations toward the current, along which the water can pass outward into trough D. To the bottom of the said trough D outlet or drainage pipes E are secured at suitable intervals. These communicate with the interior of the trough and descend below the low-water line in the boiler, their lower extremities being provided with suitable check-valves. (Not shown, as their function and mode of operation are well known.)

In Fig. 2, M indicates a portion of the shell of a boiler in which the separator is located. B' is the tubular exit-pipe.

Instead of being cylindrical or composed of cylindrical elements, as shown, the scroll-pipes may be conical, with the larger ends farthest from the exit-aperture and converging toward the same; but this is a more expensive construction.

In cases where the construction of the boiler does not admit of a separator in the steam-space thereof the above-described separator may be used externally by a suitable connection between the chute *b* and the steam-space of the boiler at its uppermost point and also

a provision for drainage-pipes E to discharge into the boiler below low-water line. In such case the screen *s* should be at the juncture of the chute with the boiler or may be dispensed with.

The operation is as follows: The device being introduced and secured in a horizontal position within the steam-space in the upper part of a boiler through a suitable manhole or otherwise, the proper exit for the steam will be through exit-pipe B', leading out through the shell of the boiler. To escape by this pipe, the steam must first enter the scroll-pipe A through the vestibule *v* and passage *c* of the tangential chute *b* in a thin sheet or stream, which being distributed along the whole length of the separator-pipe and throughout the steam-space avoids concentration of the uprush of steam and water at any one point and tends to obviate the taking in of wet steam. The thin sheet of inflowing steam thus forced forward by the pressure within the boiler necessarily takes a direction practically tangential to the curvature of scroll-pipe A and is whirled rapidly around in a vortex while seeking exit where the pressure is lower. The dry steam eventually finds its exit through B' by way of the narrow reversely-formed passage *p* and scroll-pipe B; but the water particles in the entering stream being of greater specific gravity and consequently endowed with greater momentum than the steam particles are pressed constantly against the wall of scroll A by centrifugal action in their forward travel and cannot make the turn requisite for them to find an exit through the passage *p*. On the contrary, they press constantly outward, and on arriving at the perforations *e* in the floor of the pipe they follow the projections *d* and are trapped within the trough D, whence they eventually find their way back to the boiler through the drainage-pipe E, the check-valves on the bottom of the latter allowing the escape of the same, while preventing any backflow from the water of the boiler to the separator. Any surplus of water which does not escape on the first round continues on its vortical course and joins the main current again on emerging from the passage *g*. The sharp edge *n* (which may be serrated) effectually combs out any chance particles which may be enmeshed in the steam entering the passage *p*.

I claim and desire to secure by Letters Patent—

1. In a steam-separator for boilers, a scroll-shaped pipe, closed at the ends except an outlet, and having a narrow tangential opening extending along the length of the pipe on its curved portion, substantially as specified.

2. In a steam-separator for boilers, a scroll-shaped pipe, closed at the ends except an outlet, and having a narrow tangential opening extending along the length of the pipe on its curved portion, in combination with a tangential chute conterminous with said open-

ing and a screen of foraminous material guarding the entrance of the said chute, substantially as specified.

3. In a steam-separator, a scroll-shaped outer pipe or drum having a narrow tangential opening extending along the pipe, in combination with an inner scroll-shaped pipe centrally located therein, having a narrow tangential opening extending along its length and reversely placed with reference to the tangential opening of the said outer pipe, substantially as specified.

4. In a steam-separator, a scroll-shaped outer pipe or drum, having a narrow tangential opening extending along its length, a scroll-shaped inner pipe centrally located within the said outer pipe, having a narrow tangential opening extending along its length and reversely placed with reference to the tangential opening of the said outer pipe, the ends of the said scroll-pipes being closed except at an exit-aperture located at one end of the inner scroll-shaped pipe, with a tubular pipe leading from said aperture, substantially as specified.

5. In a steam-separator, a scroll-shaped outer pipe or drum, having a narrow tangential opening extending along its length, a scroll-shaped inner pipe centrally located within the said outer pipe, having a narrow tangential opening extending along its length and reversely placed with reference to the tangential opening of the said outer pipe, the

ends of the said pipes being closed except at an exit-aperture located at one end of the inner scroll-shaped pipe, a tubular exit-pipe, a trough affixed beneath the said scroll-shaped outer pipe along its length, perforations in the said outer pipe between it and the said trough, inclined projections adhering to one side of the perforations extending below the shell of the said outer pipe within the trough, and outlet-pipes extending from the said trough below the low-water line of the boiler, substantially as specified.

6. A steam-separator for boiler interiors, consisting of the scroll-shaped pipe or drum A having the narrow tangential opening *c* extending along its length, tangential chute *b*, screen *s*, scroll-shaped pipe B centrally located within the said pipe A, having a narrow tangential opening *p* extending along its length and reversely placed with reference to the tangential opening of the said pipe A, the ends of the said scroll-shaped pipes being closed except an exit-aperture at one end of the inner pipe B, exit-pipe B', perforations *e*, projections *d*, trough D, and outlet-pipes E, all substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY H. BATES.

Witnesses:

JOHN H. SIGGERS,
V. B. HILLYARD.