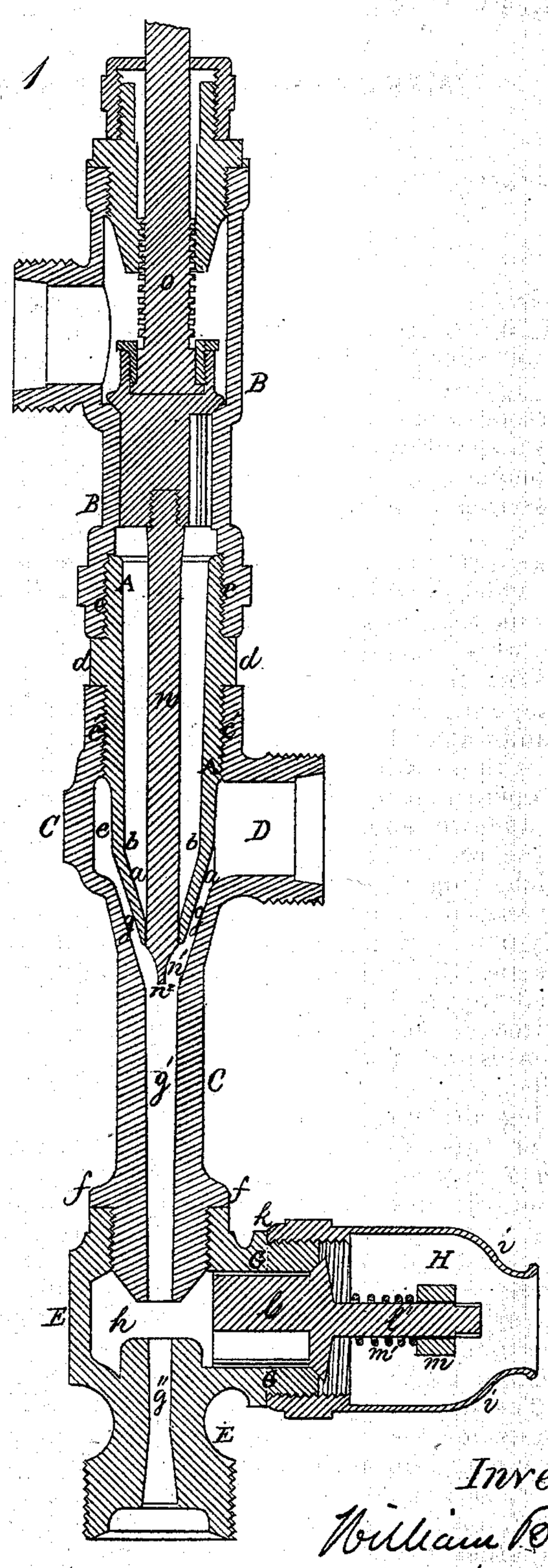
W. B. MACK.

Ejectors.

No. 139,799. Patented June 10, 1873.

Fig. 1



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WILLIAM B. MACK, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN EJECTORS.

Specification forming part of Letters Patent No. **139,799**, dated June 10, 1873; application filed March 11, 1873.

To all whom it may concern:

Be it known that I, WILLIAM B. MACK, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Injectors and Ejectors, of which the following is a specification:

Figure 1 of the accompanying drawing is a central longitudinal section of my improved injector or ejector.

My invention relates to that class of steam injectors or ejectors which employ a solid stem or spindle connected to a suitable steam-valve, or arranged to work independently of the same. It consists mainly in forming the stem with a concave tapering lower end, said stem operating back and forth within a steam cone or tube, formed with a double tapering inner periphery, and operating, by reason of the peculiar shape of its lower end, to form a ring of steam along the center of the delivery-pipe, around which ring a vacuum is formed and the water caused thereby to rush in through the supply-pipe surrounding the ring of steam, condensing the same, and afterward being impelled to the boiler by the force of the steam directed on the point at which the steam condenses; all of which I will now proceed to describe.

In the accompanying drawing, A represents a steam cone or tube, formed at its lower extremity with a nozzle, *a*, having a central annular opening or mouth, and tapering on the interior and exterior, at the angle and distance shown, outward and upward from the mouth of the nozzle *a* to the bottom of the body *b* of the cone or tube A, from which point *b* the interior periphery of the cone or tube A tapers outward and upward to the top, at the angle shown. The upper or main portion of the body of the steam-cone A is formed on the exterior periphery, at the top and bottom, with screw-threads *c c'*, separated by a projecting band or collar, *d*, for the reception of an ordinary angle or other suitable steam-valve, B, which is screwed onto the top of the cone A, and to receive the top of a combining cone or tube, C, the interior periphery of the upper portion of which is formed with screw-threads that engage with the lower screw-threads *c'* of the steam-cone A. The lower portion of the exterior periphery of the body of the cone A, above the nozzle *a*, is made of a smaller diameter than the upper portion to form a passage or chamber, *e*, for the water, which enters from a pipe or tube, D, connecting with one side of the combining tube or cone C, which, within, at the bottom of the water-pipe D, is formed with an annular opening or entrance mouth, to a funnel-shaped annular passage, *g*, that tapers downward a certain distance, at the angle shown, toward the center of the body of the tube C, which is formed with a longitudinal tapering passage, *g'*, narrowing, at the angle shown, toward the bottom of the cone or tube C, which is formed on the exterior with a lip or shoulder, *f*, that forms a seat for the top end of a delivery cone or tube, E, the upper interior periphery of which is formed with screw-threads that engage with screw-threads formed on the exterior of the lower portion of the cone C, the bottom of which is beveled inward and downward toward its exit mouth. The delivery-cone E is formed in the interior with vacuum-chamber *h*, and with a central longitudinal annular passage, *g''*, tapering inward in its downward extension, in continuation of the angle of the passage *g* of the tube C from which passage it is separated by the vacuum chamber *h*, for a certain distance, where it begins to taper outward, at the angle shown, toward the bottom of the delivery-cone E. Projecting from one side of the delivery-cone E is an overflow-pipe, G, formed on the exterior with a lip, *k*, and screw-threads, which receive screw-threads formed on the interior of a cap or cup, H, curved, as shown at *i*, or otherwise suitably contracted at the end. The top of the end of the overflow-pipe G is beveled on the interior to form a seat for a valve, *l*, which plays within the tube or pipe G, and whose stem *l'* is supported by an annular bearing, *m*, connected with the cap H, and is provided with a spiral or other suitable spring, *m'*, whose ends abut against the top of the valve *l* and the ring or bearing *m*. To render the injector more perfect in its operation, and available under circumstances not otherwise possible, it is necessary that the lengths, diameters, and angles of the steam-cone A, and nozzle *a*, and the passages *g g' g''* should be of the proper size,

inclination, and proportion, as shown. Connected with and operated by a screw valve-stem, *o*, arranged within the angle or other suitable steam-valve B, or arranged to operate independently of the angle or other steam-valve, so as to be drawn back or carried forward within the steam-cone A, is a solid stem or spindle, *n*, whose termination n^1 is formed of the peculiar tapering shape shown, its periphery being concave from the shoulder at which the taper commences nearly to the end, the concavity being such that if the stem were longer an enlargement of its end would result. The end of the portion n^1 is not pointed, but terminates in a teat or pin, n^2. The bottom of the stem *n*, above the portion n^1, closely fits the mouth of the nozzle *a*, as shown.

The stem is first withdrawn from the mouth of the nozzle sufficiently far to allow the steam to pass between the shoulder above the portion n^1 and the nozzle. The steam in its passage, being guided by the tapering nozzle, converges toward the point n^2 of the stem, and is deflected slightly by the said concave portion until it leaves the point n^2 in the form of a hollow cylinder of steam, exactly in the center of the tube *g'*, and rushing along the same produces a vacuum in the annular space around it, exhausts the air from the tapering annular space *g*, and causes the water from the tube D to rush in, fill the same, and pass downward into the tube *g'*, surrounding the ring or cylinder of steam, and condensing the same about at the point *x*. The stem *n* is now raised still further to admit an increased volume of steam through the nozzle, the steam being still guided by the tapering portion n^1, as before, and forming a hollow cylinder or steam-space in the water down the tube *g'*, until it reaches the part where it becomes condensed, at which point it bears directly on the water and impels it toward the boiler together with the water of condensation.

It will be seen that the shape of the portion n^1 is such as to guide the steam in connection with the tapering nozzle *a*, as above described; and it will also be seen that the steam is kept in the center of the tube *g'*, and not allowed to strike the sides of the same, no impediment being offered to its passage. This condition is highly necessary in order to produce a vacuum sufficient to draw the water from the supply-tube, for if the steam were allowed to impinge on the sides of the delivery-tube it would rebound, and its force become greatly weakened, and the possibility of forming a perfect vacuum precluded. Hence injectors employing stems with simply conical or straight tapering ends are liable to this objection, and it has been found by actual experience that it is impossible to produce satisfactory results with stems of this form, while my form has been found to operate with as great certainty and as good results as any now in use.

By forming the interior of the upper portion or body of the steam-cone A of a tapering form, a volume of steam is produced in the cone sufficient to prevent any wiring or drawing at the point of exit; and by forming the interior of the steam-nozzle *a* of a tapering form, at the angle shown, when the stem is raised to allow the passage of the steam it directs the steam so as to follow the curved periphery of the stem-termination n^1, and causes it to converge toward the center of the passage *g*, instead of being directed toward the sides of the passage, as it would be likely to do if the stem-termination was formed with a straight tapering periphery. Moreover, by the arrangement of the concave curved periphery of the stem-termination n^1, in combination with the construction and operation of the injector, as above described, the flow of the water and steam is so regulated as to impel or force the water into the boiler without any adjustment of either of the cones or tubes, although the steam may vary from fifteen to one hundred and fifty pounds' pressure to the square inch.

By forming the bottom of the delivery-cone E with a tapering interior passage, *g''*, expanding outward toward its mouth, at the angle shown, the flow of the water is considerably facilitated during high and low pressures of steam.

By curving the overflow-cap or cup H, as shown, or otherwise contracting it toward its mouth, the waste-water is concentrated so as not to spread and expand itself to the detriment of the machinery, to which the cap is attached, while working.

By removing the delivery-cone E, which is readily done by unscrewing it from the combining-cone C, the remaining portion may be used as an ejector.

Having thus fully described my improvements, what I claim as my invention, and desire to have secured to me by Letters Patent, is—

In an injector or ejector, a solid stem or spindle, *n*, arranged to operate back and forth within a steam cone or tube, A, and formed with a concave curved tapering termination, n^1, substantially as and for the purposes specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM B. MACK.

Witnesses:

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