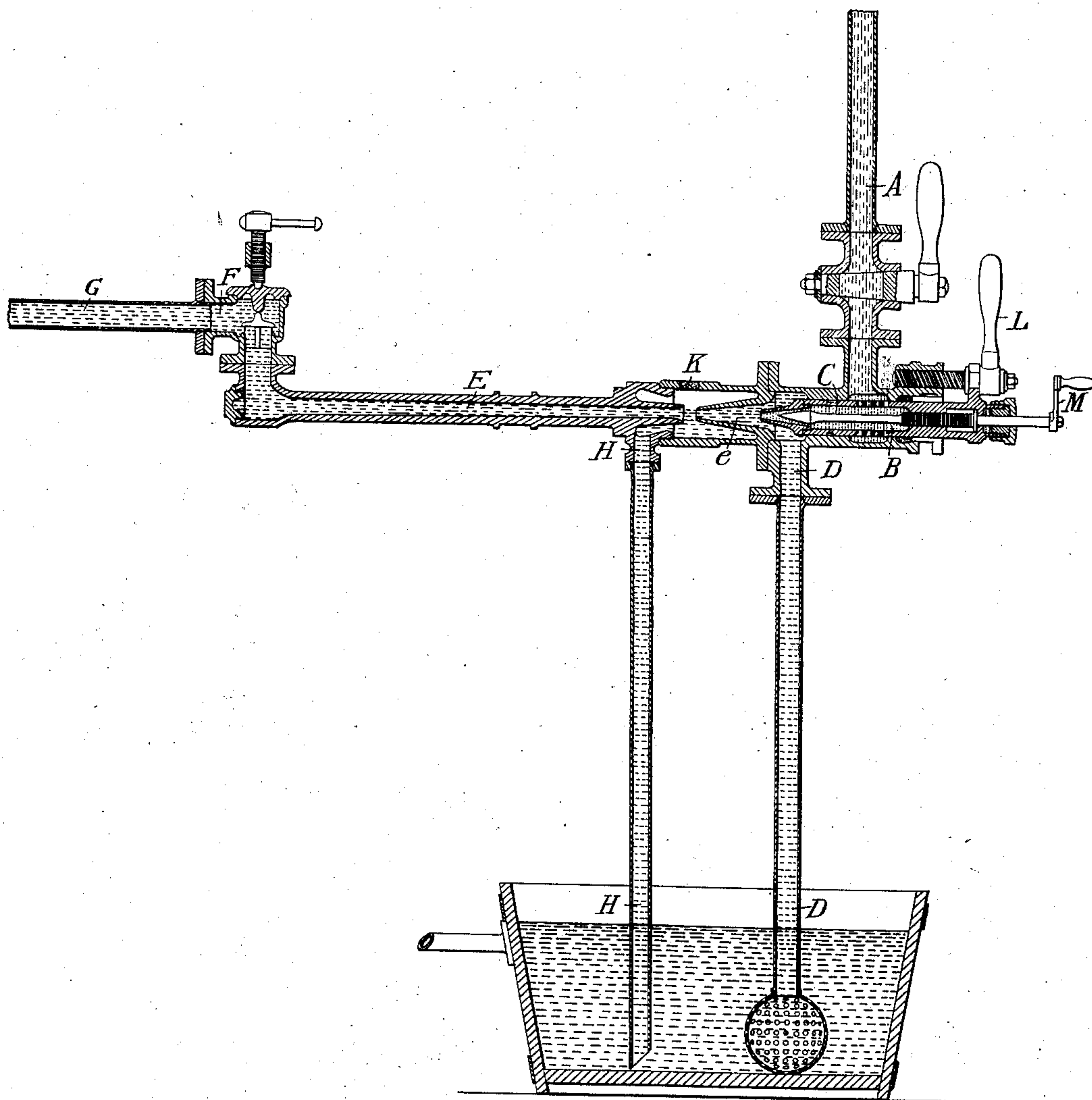


FEED WATER APPARATUS FOR STEAM BOILERS.

Patented Apr. 24, 1860.



UNITED STATES PATENT OFFICE.

HENRY GIFFARD, OF PARIS, FRANCE.

IMPROVED FEED-WATER APPARATUS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. 27,979, dated April 24, 1860.

To all whom it may concern:

Be it known that I, HENRY GIFFARD, of Paris, in the Empire of France, have invented certain new and useful Improvements in Feed Apparatus for Steam and other Boilers; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing, which represents a sectional view of my feed apparatus.

This invention relates to a peculiar construction and arrangement of apparatus for supplying the feed-water or other liquid to steam or other boilers. According to this invention the impulsive force of a steam jet or blast is made to raise and force the fluid required. For this purpose an apparatus of a peculiar construction, but having no working or moving parts, is employed. This apparatus, which may be considerably modified without changing the principle of its action, consists, according to one arrangement, of a steam-injector, which receives the steam from the boiler and directs it in a continuous jet into a small passage, the lower end or mouth of which is expanded sufficiently to admit of the entrance of a stream of water, which, by surrounding the steam-jet pipe, forms an annular jet of water with the steam-jet in the center. The water is drawn from a well, tank, tender, or vessel in any convenient situation. This arrangement of jets may, however, be reversed—that is, the steam-jet may be annular and the water-jet in the center of it; or two steam and water jets may be used in certain cases, such as where the condensation of the steam is not sufficiently rapid, owing to the heated state of the water in the hot well or tank of the engine.

The water has an impulsive force imparted to it by the steam-jet, and simultaneously receives a considerable amount of heat therefrom before it enters the boiler. On issuing from the narrow passage above referred to, the jet of water enters a second passage, which is expanded slightly at its lower end for a short distance, and also at its upper end, such expansion of the upper portion being gradual from the commencement of the lower expansion. This lower expansion or conveyance serves to maintain the entering jet compact,

while the upper diverging portion serves to diminish gradually and without shock the impetus which has been imparted to the fluid.

A small valve is interposed between the boiler and the jet-pipes, so as to prevent the escape of water from the boiler when the feed apparatus is out of action. By making the steam or water jet pipe movable or adjustable in regard to each other by means of screws or other suitable regulating apparatus, the quantity of water elevated and forced may be controlled to a great nicety.

By a slight modification of this apparatus it may be made to serve as a cock. This apparatus is therefore used with great advantage as a substitute of the means heretofore employed for the supplying of boilers with water, it being an accessory to the boiler, operating independently of the engine, and, being composed of parts the action of which require no motion, is not liable to wear out.

The feeding of the boiler is effected by means of my apparatus at all pressures of steam from one-fifth of an atmosphere. It is only necessary to regulate the jet of water according to the tension at the time being of the steam in the boiler.

It will be obvious that the feed-water is heated to a temperature more or less high, according to the pressure or tension of the steam. The supplying of the boiler with water is therefore effected without loss of heat or force; and in order that my said invention may be fully understood, I shall now proceed more particularly to describe the same, and for that purpose I shall refer to the drawing hereunto annexed, which represents a vertical section of a very simple arrangement of my apparatus, which may be modified and varied in many ways.

A is a steam-pipe communicating with the boiler. B is the steam-jet pipe, which is fitted with a contracted nozzle, and receives the steam direct from the boiler through pipe A, and discharges it in the form of a constant or continuous jet into a species of small chimney, *c.* This chimney is expanded at the bottom, so as to admit of the free passage of an annular jet of water, which is drawn up through the pipe D by the action of the steam-jet in the chimney from the hot-well or other supply-reser-

voir, and is thus brought into immediate contact with the steam, which transmits an impulse to it, and simultaneously raises its temperature. A short distance beyond this chimney is a double mouth-piece, E, one extremity of which is gradually contracted inward, so as to unite or collect in one compact vein the liquid jet, which issues from the mouth of the chimney *e* in a more or less broken or scattered state, while the upper portion of the mouth-piece is expanded gradually, so as to cause the jet to lose successively and without shock to the liquid the speed which it has attained, so that it may arrive at the upper portion of the apparatus at a pressure at least equal to that of the boiler without possessing any notable speed, and consequently without loss of *vis viva*.

Above the expanded mouth-piece E, or at any other convenient part of the apparatus, is fitted a valve, F, the object of which is to prevent the escape of water from the boiler when the apparatus is not at work. To this valve is attached the pipe G, which conducts the feed-water to the boiler. The delivery and the suitable proportion of water to be injected in relation to the power of the steam-jet and to the smallest diameter of the double mouth-piece E is adjusted or regulated by means of the regulating-screw operated by the handle L, the effect of which is to increase or diminish the distance between the nozzle B and the lower end of the chimney *e*, and thereby enlarging or contracting the annular jet of water.

The regulation may be made automatically or by the apparatus itself. For this purpose the nozzle is made to be movable upon guides and free to slide within a box, and the steam-pressure, acting upon this apparatus, will cause a counteracting-spring to be more or less compressed, such spring being adjusted to suit the pressure of steam employed and the size of the annular jet of water at the entrance of the chimney. The jet of steam is regulated or stopped at pleasure by means of a conical plug-valve, *c*, fixed to a screw-threaded shaft, and arranged in a central or axial position in relation to the steam-jet pipe B. This valve is operated by turning the crank M.

H in the drawing represents the overflow-pipe. Openings or windows K may be formed in the outer case for facilitating the examination of the state of the jet and general working of the apparatus, which openings may be covered with glass; or an entire casing of glass may be employed, if found desirable. Below the atmospheric pressure water can condense steam only when its temperature is below 100° centigrade. In case the initial temperature of the water in the hot-well or reservoir or tender (when applied to locomotive-engines) should be too high, which cannot always be avoided, to condense the entire quantity of

steam issuing from the nozzle, it would be requisite to divide the actuating steam-jet into two parts—the first portion, acting as above described, drawing up the water and imparting to it only a fraction of the necessary speed, and the second portion, arriving by another pipe, and having its annular sectional form properly regulated, would impart to the vein or jet a fresh impulse in the diverging mouth-piece to any point where the ejected water would still possess a portion of the pressure of the boiler. Now, with this portion of pressure above the pressure of the atmosphere, the water could condense the fresh amount of steam, which would then no longer act, except with the difference of the total pressure already acquired, and would thus be introduced into the boiler under the most favorable conditions.

This principle may be modified and worked out in various ways. In all cases the water may also be made to flow in the center, and the steam surrounding it for the first impulse, and vice versa, but taking care always to be provided with an adjusting arrangement for regulating the various sections of jets, and for acting also as a stop-cock. This apparatus may also be fixed in any convenient position, whether horizontal, vertical, or oblique. The improved feed-injector may also be employed in feeding boilers in which other liquids than water are evaporated, such as ether, sulphuret of carbon, &c.

It is evident from the foregoing that many modifications of this instrument may be made, and that the same may be used for various purposes other than that herein described, so that I do not restrict my invention to the particular form or to the particular purpose herein described; but

What I claim as new, and desire to secure by Letters Patent, is—

1. The method of supplying vessels under pressure with any non-elastic fluid by the direct action of steam or other gaseous fluid, also under pressure, when this fluid is brought into contact with and enters the aforesaid vessel along with the non-elastic fluid, to which it has first given the necessary force to overcome the resistance, substantially as described.
2. The general construction, arrangement, and combination of apparatus for forcing water or other liquids by the direct action of a jet or jets of steam or other gaseous fluid, substantially as hereinbefore described.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

H. GIFFARD.

Witnesses:

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