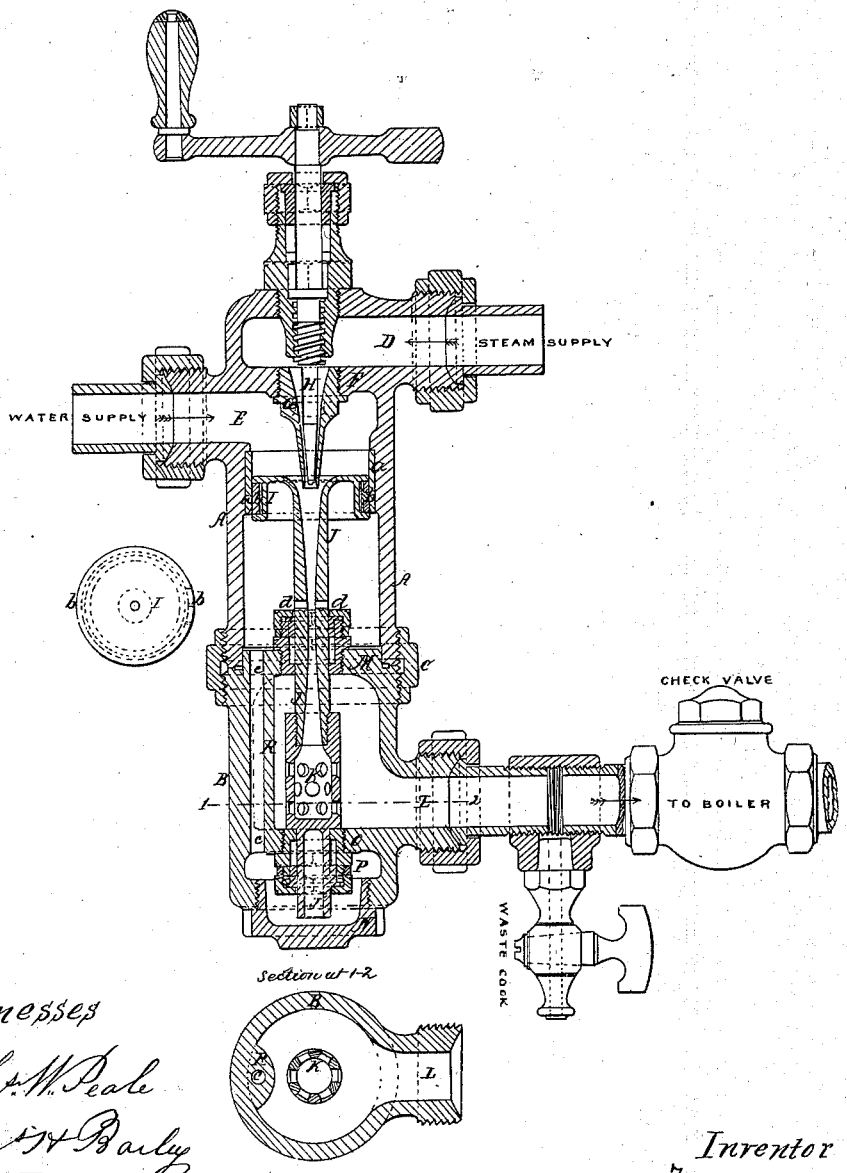
# W. SELLERS.

## GIFFARD INJECTOR.

No. 49,445. Patented Aug. 15, 1865.




Witnesses

Chas. W. Peale

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# UNITED STATES PATENT OFFICE.

WILLIAM SELLERS, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN THE GIFFARD INJECTOR.

Specification forming part of Letters Patent No. **49,445.** dated August 15, 1865.

*To all whom it may concern:*

Be it known that I, WILLIAM SELLERS, of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in the Giffard Injector, whereby this instrument is made self-regulating; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

In this instrument, as heretofore constructed, the supply of water and steam has been regulated by means of screws, levers, or other devices controlled by hand, so that wherever the tension or pressure of the steam varies, the attendant is obliged to readjust the supply of water in order that the instrument may work to the best advantage, and whenever the pressure falls below the point to which the instrument has been adjusted a readjustment becomes necessary to prevent a waste of water at the overflow.

In many boilers, such as the locomotive, and others having a small water and steam capacity compared to their heating-surface, and where the demand for steam is very irregular, the variations of the steam-pressure are considerable and very frequent, and the amount of attention required for regulating the injector becomes a serious inconvenience.

The object of my invention is to make this regulation self-acting and dependent upon the amount of steam or water admitted to the instrument, and to utilize a power until now wasted at the overflow. The overflow, as heretofore used, has been for the purpose of permitting the escape of the water before it has attained sufficient velocity to enable it to enter the boiler when the jet is first started, and also to permit, when the jet is in motion, the superabundant water or steam to escape without stopping the operation of the instrument.

It has long been known that the overflow was not necessary after the jet was fairly established, and the steam and water supply properly regulated; but it has not been known heretofore that when the jet is stopped by a superabundant supply of water, no provision being made for waste, an amount of lateral pressure may be obtained at the point of overflow nearly equal to that in the boiler. It has also been long known that the fluid-jet, in passing the point of overflow, will not, when in excess, carry along with it into the boiler any fluid that may be in contact with it, so that, if the overflow-chamber should be closed up, a moderate vacuum can be produced there by this action of the jet.

The nature of my invention consists in using the pressure created by an overflowing jet to adjust the parts of the instrument so as to check the tendency to overflow, and in using the partial vacuum created by an excess of steam over water-supply to adjust the instrument to the new conditions without wasting any water at the point of overflow.

The means employed by me for utilizing the power mentioned will be more fully understood from the following description, in which I illustrate a manner of regulating the instrument by an automatic adjustment of the water-supply only.

The outer shell or case of the injector I make in two parts, A and B, united by a nut, C, having a right-hand screw-thread in one side and a left-hand one in the other, with corresponding threads on the parts A and B. The part A is provided with two nozzles, D, for the admission of steam, and E for the admission of the water, the two being separated by the plate F. In the center of the plate F, I provide a nozzle, G, for the steam-jet, the amount of steam that can be discharged from this nozzle being regulated by the tapered plug H, which may be operated by a screw, lever, or other convenient device.

The interior of the case A beyond the water-nozzle E is bored out for a short distance, and fitted with a cylindrical brass lining, *a a*, which is turned out to receive the packing *b b* in the piston I. This piston forms the upper or receiving end of the receiving and discharging pipe J J, which has its axis coinciding with that of the steam-discharge nozzle G. The pipe J J is so arranged as to be capable of moving to or from the nozzle G, so as to enlarge or contract the annular space between the exterior of G and the interior of the receiving-pipe, thereby governing the amount of water which can be admitted to the action of the steam escaping from the nozzle G. The pipe J J is gradually contracted through about half its length, when it commences to enlarge, and gradually increases until it discharges into the perforated chamber K, and subsequently into the space between it and

the case B, which surrounds it. The part B of the outer shell or case is provided with a nozzle, L, from which the water discharged from the chamber K can be conducted into the boiler. There must be provided a waste cock or valve to enable the water escaping from the perforated chamber K to be discharged freely into the atmosphere, for the purpose of establishing the jet when first started. So soon as this is accomplished this waste must be closed, and will be of no further use so long as the jet is in motion. It may be placed in any convenient position, and is shown upon the pipe leading to the boiler. Between this and the boiler a check-valve must be employed to prevent the return of the water when the instrument is stopped.

The shell or case B is closed at one end by a plate or head, M, which projects into the case A, in which it is accurately fitted, for the purpose of maintaining the axis of the receiving and discharging pipes J J in the line of the axis of the steam-nozzle G. The other end of the case B is closed by a screw-cap, N, accurately fitted, so as to prevent any leakage of air or water. Between the cap N and the head M, I provide a second head, O, forming a chamber, P, between them, the use of which will be hereinafter described, both heads M and O being provided with stuffing-boxes, which allow the pipe J J and the extension J′ of the chamber K to play freely longitudinally without permitting the escape of any water discharged from the chamber K.

Between the heads M and O, and opposite the nozzle L, I form a projection, R, cast with the outer case, B, through which I drill a small hole, *c c*, making a communication between the upper chamber in the case A and the chamber P in case B; and it is important that this shall be perfectly sound, so as to prevent any escape of water into it that has once passed from the perforated chamber K. Through the axis of the receiving and discharging pipe J J, and a short distance above its smallest diameter—that is, toward its receiving end—I drill a small hole, *d d*, which I call the "overflow," for the purpose of allowing an escape of water when a too abundant supply is admitted at the receiving end.

The operation of the instrument is as follows, viz: The waste-cock between the instrument and boiler must first be opened; then admit the supply of water, allowing it to flow through this waste; let on the steam, when an immediate increase will take place in the volume of water escaping at the waste, showing that the jet has been established. The waste-cock may now be closed, and the water will flow into the boiler. But in case there should be too much water admitted at the receiving end of the pipe J J, the superabundance will escape through the holes *d d* into the chamber in the case A, thence through the hole *c c* into the chamber P in the case B, and will continue so to do until both chambers are full, when it will exert a pressure upon the end J′ of the pipe J J and piston I, causing the whole to move toward the steam-discharge nozzle G, thus diminishing the water-supply until the quantity admitted is in exact proportion to the supply of steam. The relative positions of these nozzles will then remain the same until some change takes place in the pressure of the water-supply or the tension of the steam.

Supposing, now, the tension of the steam in the boiler should increase, or that the tapered plug H should be drawn back from the opening in the nozzle G, so that a large quantity of steam should be discharged, the increased velocity of the jet will carry along with it into the boiler some of the water which had previously escaped through the openings *d d*, causing a partial vacuum under the piston I. The pressure of water will then cause it to recede from the nozzle G, thus admitting more water, until the equilibrium is again established.

The lower chamber, P, is not necessary to the operation of the instrument; but by its use I increase the amount of surface exposed to pressure from the overflow, thereby increasing the sensitiveness of the adjustment, and also prevent the escape of any waste in case the packing in the head O should leak.

From the foregoing it is evident that the instrument, when constructed as described, has its water-supply automatically adjusted to suit any condition of steam-supply, whether dependent upon variation of boiler-pressure or the regulation of the steam-supply by hand, the quantity of water delivered by the instrument depending wholly upon the amount of steam admitted. Hence in working the instrument it is only necessary to regulate it for capacity by adjusting the steam-supply.

To make the instrument entirely self-adjusting and capable of maintaining the water in the boiler at a uniform height, requires only that the position of the plug which regulates the steam escaping from the steam-discharge nozzle should be regulated by the height of the water in the boiler. Almost any of the numerous devices in use which govern the water-supply by the height of the water in the boiler would answer the purpose, and could be readily applied; and to determine whether the jet is in motion, a light safety-valve may be attached to either the upper or lower overflow-chamber, and weighted to an extent sufficient to produce a pressure in this chamber capable of moving the receiving and discharging pipe. Then, with a check-valve in the water-supply pipe which will permit the water to flow to the instrument, the failure to work would instantly be notified by the escape of steam and water at this safety-valve.

The water-supply may be regulated by various other methods than by the adjustment of the receiving-pipe; and this pipe may be adjusted by the weight of the water escaping at the overflow without regard to its pressure, the theory of my invention consisting in using the overflow-water either in its escape in greater or less quantity or in its tendency to escape, to

perform one functional adjustment, while the drawing back of the overflow-water or the tendency to draw back performs the opposite functional adjustment. I have described this adjustment as being made in the water-supply only; but it must be evident to any intelligent mechanic that the power which I have discovered in the instrument may be made to control the regulation of other parts of the instrument, either in connection with the water-supply or entirely distinct therefrom. Thus, if the lower cap, N, be removed, the hole *c c* stopped up, and a yoke be made to unite the lower part of the discharge-pipe J J to the nut of the tapered plug H, and this nut of H be made free to slide endwise in the outer casing, A; or if it be made a part of this yoke, the yoke being on the outside of the case A, the water and steam supply would be adjusted simultaneously, for when the steam was in excess the tendency to draw back the overflow-water, or the drawing it back, would pull down the receiving-pipe J J to give more water, and also the tapered plug H, cutting off some of the steam. Thus the adjustment would be effected with less movement of the discharging-pipe J J. Or if the overflow-water should be allowed to pass into a supplementary cylinder and there act against a movable piston, that piston could be attached to any part of the instrument requiring adjustment. Thus it could as well move a valve in the steam-supply pipe, or even the tapered plug H to regulate the steam-supply, as it does the discharging-pipe J J. Hence I do not limit my invention to the special devices shown, nor to the particular arrangements described; but

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

The use of the overflow *d d* or its equivalent in the Giffard injector, in combination with a reservoir to retain the overflow-water in contact with the jet, for the purpose specified.

WM. SELLERS.

Witnesses:

CHAS. W. PEALE,

JAS. H. BAILEY.