(No Model.)

W. E. EASTMAN.

AUTOMATIC FEED REGULATOR FOR LIQUID FUEL.

No. 387,055. Patented July 31, 1888.

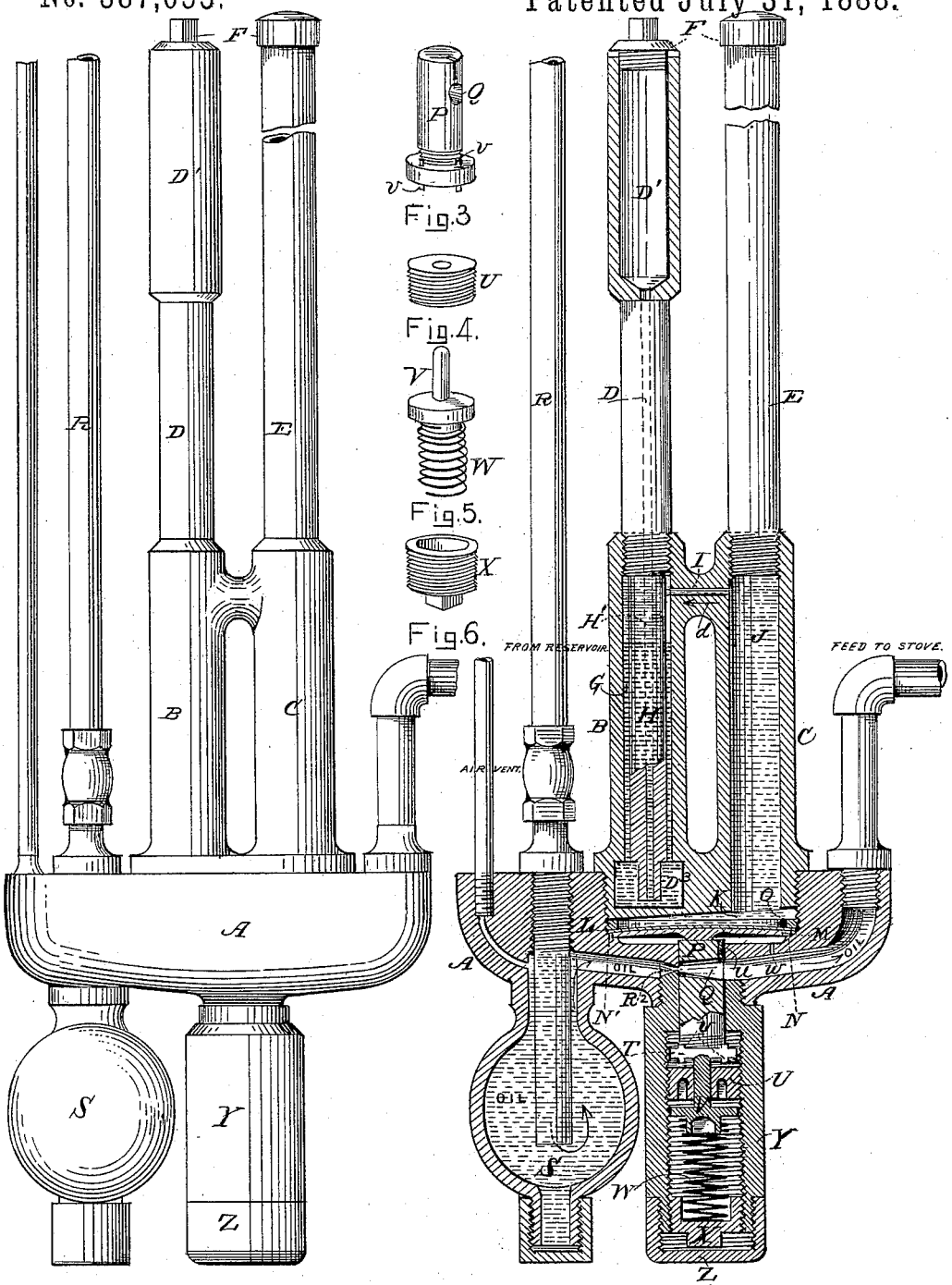

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Witnesses,
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UNITED STATES PATENT OFFICE.

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AUTOMATIC FEED-REGULATOR FOR LIQUID FUEL.

SPECIFICATION forming part of Letters Patent No. 387,055, dated July 31, 1888.

Application filed March 14, 1887. Serial No. 230,905. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. EASTMAN, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Automatic Feed-Regulators for Liquid Fuel, of which the following is a specification.

The object of my invention is to provide a reliable automatic feed-regulator to stoves adapted to heat cars, one which embodies improved methods over a previous patent granted to me for a similar invention, and which is numbered 308,955, bearing date December 9, 1884. Therein the necessity of a skilled manipulator was requisite to the successful operation of that invention, which was precluded by the requirements of the business to which it appertained, the widely-divergent traffic and the constant change of employés under whose observation and care my invention was worked proving so detrimental to its successful application that I have sought in the present improvement to simplify and perfect the same. A brief reference to said Letters Patent, page 2, lines forty to forty-five, inclusive, foreshadows possibilities which have culminated in realities.

In the perfectness of my present improved invention I have attained the desired requirements through the mechanical devices herewith illustrated in the drawings, consisting in a circular chambered base upholding duplex attached tubes containing mercury and alcohol, respectively, threaded into and communicating with said chamber, which also contains two diaphragms which operate to depress a valve through the pressure exerted by the aforesaid fluids to control the flow of liquid fuel to the point of combustion. A spring-actuated follower forces said valve upwardly, the latter being inclosed within a cylindrical case pendently attached by threading into said base at the bottom, said cylindrical case being closed by a suitably-threaded cap, which also protects a recessed nut upholding said spring. Contiguous to the cylindrical case, a bulbous residuum-chamber, forming an integral part of said chambered base, receives the filling-tube, the oil therefrom rising and flowing through an inclined duct within said base, the quantity of oil being limited by the vertical movement of the aforementioned spring-actuated valve to a corresponding duct leading therefrom and communicating with the stove or place of combustion. To remove sediment, a screw-cover at the bottom is detached, which closes the neck of said residuum-chamber.

Figure 1 is a side elevation of my invention disconnected from the stove, Fig. 2 being a vertical longitudinal central section of the base and contiguous parts. Fig. 3 delineates in perspective the valve and adjusting-nut attached; Fig. 4, the gage-nut; Fig. 5, the spring-actuated follower; and Fig. 6, the receiving-nut, all arranged in relation to their proper assemblage.

Like letters of reference designate the same features throughout the several views thereof, referring to which—

A indicates the chambered base receiving and supporting the cylindrical reservoirs B and C, containing mercury and alcohol, respectively, said liquids being fed thereto through the vertical tubes D and E, the former containing the mercury and the latter holding the alcohol. Said tubes are properly capped and sealed, as at F, the mercury-tube D having a terminal chamber, D′, at its highest point to permit the expansion of its contents, while its lower body, D^2, is reduced in its diameter so as to form an annular chamber, G, which receives the mercury indicated at H. To increase the capacity of said annular chamber, its diameter at the bottom is enlarged, with a corresponding further reduction of the end of said mercury-tube, as observed at D^3. A communicating-duct, I, connects said cylindrical reservoirs and permits the alcohol, designated at J to flow in the direction of the arrow *d*, to rest upon and fill that portion of the chamber G not occupied by the mercury, as at H′. It will be observed that the cylindrical reservoirs B and C are united at their extremes, the foot being threaded into the base A, thus forming the inclined upper line of inclosure to the chamber K, which receives the impervious resilient diaphragm L and a lower resisting-diaphragm, M, the peripheries of each being seated upon shoulders surrounding the floor of said chamber, as at N N′, the latter shoulder receiving said resilient dia-

phragm, whose perimeter is secured so as to form an oil-tight joint by the threaded locking-ring, O, the resisting-diaphragm resting loosely on its shoulder N. Its purpose is to form an interjacent communication between the sensitive part L and its coacting part P. The reservoir C opens directly into the chamber K, admitting the contents of said chamber to rest upon said diaphragm L, and by which the latter is actuated to operate the slide-valve P, which governs and regulates the flow of liquid fuel through the open conical passage Q as it enters the filling-tube R from the main reservoir of liquid fuel. (Not herein shown, but fully set forth in the Letters Patent previously quoted.)

S is the residuum-chamber for the collection and retention of sediment which might otherwise impede the nice adjustment and free movement of said valve. To the bottom of the latter I affix an adjusting-nut, T, its purpose being to limit the predetermined upward movement of the valve, the rotation of which is prevented by the usual spline or key, *u*, while the projections *v v* prevent the contiguous surfaces from approaching closely, thereby forming a chamber for the deposit of sediment, should such collect.

U designates the gage or check nut, whose office is to regulate and limit the downward movement of said valve P, the follower V being actuated by a helical resisting-spring, W, which compensates for the pressure of the diaphragms exerted through the expansion of the contents of the reservoir C, and is upheld by the receiving-nut X, threaded within the end of the receiving-tube or valve-case Y, sustaining the valve P and its operative devices, all of which are securely closed in by the screw-cap Z.

A drain-duct, *w*, empties the chamber K of any surplus oil which may escape from the filling-tube in its passage through said valve.

I will now proceed to describe the operation, practically, of my improved invention, which is as follows: The mechanical devices being organized as illustrated in Fig. 2, mercury is supplied to the tube D, partially filling the annular chamber and tubular orifice, after which the tube E receives the alcohol, a part of which is superimposed upon the mercury, as at H′, receiving the expansive force of the same as quickly as it is affected by any increase of temperature. The alcohol (necessarily responsive to any movement of the mercury) immediately increases the pressure upon the diaphragm L, which assumes the convexity illustrated in its normal condition with only a minimum pressure, the valve P consequently assuming its highest position through the exerted force of the spring-actuated follower V, at which point the lesser diameter of the orifice Q is for about one-third of its width exposed to the circular oil-passage R^2, whose flow is limited thereby. Should, then, the pressure continue upon said diaphragm, the fall of the valve increases the flow of oil steadily until the orifices are exactly opposite each other. When the maximum flow is reached, the continued downward movement decreases the flow in the same ratio through the gradual reduction of said opening until the diaphragm assumes a concaved position, when the supply is diminished to its original capacity, the gage and adjusting nuts being so regulated that the oil-supply may not be entirely shut off.

To facilitate the dislodgment of air, the plane of the foot J, forming the upper wall of the chamber K, has a true incline, the highest point of which is contiguous to the orifice in the same.

It is apparent, then, that the aforesaid valve, with its ingenious accessories, is automatically perfect in its adjustment within predetermined limits, sensitive only to the increase and decrease of temperature, by which it is wholly controlled, and which in its turn controls absolutely the oil-flow, its mechanical construction precluding any liability to displacement through the constant jarring, pounding, and all the ordinary disturbances incidental to its employ on steam-railroads in contradistinction to my aforesaid patented invention, which, through the mechanism therein shown, has proven unreliable.

Having described the construction and operation of my improved invention, what I desire to secure by Letters Patent of the United States, and claim, is—

1. In an organized apparatus automatically regulating a flow of liquid fuel between the points of supply and combustion, the base A, provided with the chamber K and passage R^2, the chambers B and C, supported by said base A and provided with an intercommunicating duct, I, permitting alcohol to enter the contiguous chamber B and rest upon mercury therein contained, the mercury-tube D, thereto attached, provided with an expansion-chamber, D′, and the alcohol-tube E, communicating with the chamber C, all arranged to coact with the residuum-chamber S, the tube R thereto communicating, the valve-casing Y, the valve P therein contained, provided with the conical opening Q, the diaphragms L and M, adapted to receive the pressure of the alcohol, thereby actuating said valve downward, and the spring W, compensating for the pressure of the diaphragms, substantially in the manner and for the purpose set forth.

2. In an automatic liquid-fuel regulator, the chambers B and C, the passage I, connecting said chambers, the base A, provided with the chamber K and passage R^2, the casing Y pendently attached to said base, the spring W therein contained, the receiving-nut X, upholding said spring, the follower V, thereby supported and actuated, and the gage-nut U, all adapted to operate in combination with a slide-valve, P, provided with an opening, Q, for the constant transmission of oil, the resisting diaphragm M, resting upon said valve, and the resilient diaphragm L, adapted to receive the pressure of

the alcohol, whereby said valve is actuated to lessen or to increase the flow of oil to the stove, as in the manner set forth.

3. In an automatic liquid-fuel regulator, the combination, with the chambers B and C, provided with the duct I, and the tubes D and E, the diaphragms L and M, the base A, provided with the chamber K and oil-passage R^2, the casing Y, and the assembled devices V W X U therein contained, of a valve, P, provided with an adjusting-base having one or more projections, *v*, thereon to permit the discharge of sediment, and a transverse conical opening, Q, adjacent to its head to permit the passage of the liquid fuel, substantially as described.

4. In an automatic fuel-regulator, the combination, with the diaphragms L and M, the casing Y, the valve P, provided with the opening Q, and projections *v*, the adjusting-nut U, threaded within said casing Y, the follower V, spring W, and nut X, of the base A, provided with a chamber, K, having annular shoulders N N′ to receive the peripheries of said diaphragms, a passage, R^2, for the transmission of oil, a drain-duct, *w*, permitting the escape of oil from said chamber K, a residuum-chamber, S, provided with a duct for the liberation of air, and the chambers B and C, having a duct, I, to establish communication, as herein described.

5. In an automatic liquid-fuel regulator, the base A, provided with the chamber K and passage R^2, the residuum-chamber S, the casing Y, the valve P, provided with the opening Q, the spring W, and the diaphragms L and M, all combined and adapted to co-operate with a duplex-chambered receptacle, B C, provided with an intercommunicating duct, I, and an inclined base contiguous to said diaphragms to facilitate the dislodgment of air from the chamber K, as in the manner and for the purpose specified.

In testimony whereof I have signed this specification in presence of two attesting witnesses.

WM. E. EASTMAN.

Witnesses:
F. P. BARTLETT,
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