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J. H. BULLARD.

BOILER FEEDING DEVICE.

(Application filed Dec. 24, 1900.)

(No Model.)

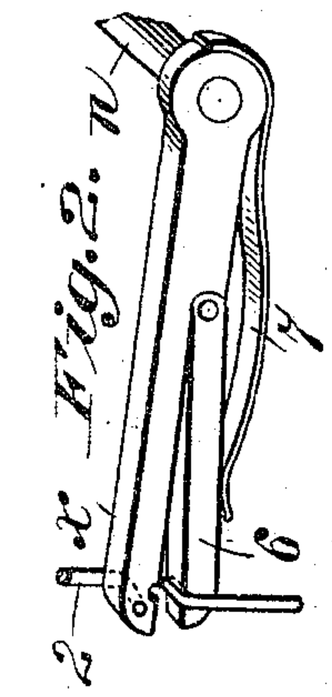

Fig. 2.

Fig. 1.

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BOILER-FEEDING DEVICE.

SPECIFICATION forming part of Letters Patent No. 685,568, dated October 29, 1901.

Application filed December 24, 1900. Serial No. 40,994. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. BULLARD, a citizen of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Boiler-Feeding Devices, of which the following is a specification.

This invention relates to feeding devices for steam-boilers, and especially to the boilers of steam-propelled road-vehicles.

The object of the invention is to provide boilers of this class with separate feeding devices and actuated by separate means, but automatically controlled by one device common to both, whereby water may be admitted to the boiler as required.

In vehicles of this class three general lines of construction have been followed. One is to provide a feed-pump which is set in motion by the operator of the vehicle according to the requirements of the boiler, as indicated by the level of water in the boiler by means of a gage-glass under the eye of the operator. Another plan has been to provide a steam-pump set in operation by one of the well-known thermally-actuated mechanisms, which is governed by the level of the water in the boiler, and the third plan has been to provide a feed-pump which is continuously actuated by the axle of the vehicle when the latter is moving, and so regulating the delivery of water to the boiler from said pump as nearly as possible to replace that used by the engine in the form of steam. All of these systems of feed-water supply have their disadvantages. The first is objectionable in that many vehicles fall into the hands of inexperienced persons, who forget to start the pump. The second plan requires the expenditure of too much steam, as the capacity of the boiler of road-vehicles is so small that it requires the frequent operation of the pump to maintain a normal level in the boiler. The disadvantages of the third plan are, first, that it is exceedingly difficult to regulate the pump to that degree of nicety which will supply just the quantity of water required, and, second, if the vehicle is left standing for any length of time, even under a low fire, the quantity of water in the boiler gradually becomes reduced until finally the limit of safety is passed. This invention overcomes the defects of all of these above-enumerated methods by making use of two of them—viz., the steam-pump and the pump actuated by movement of the vehicle—and providing connections from an automatically-operating device to each of them, whereby when the vehicle is in motion one of these systems will supply the boiler with water and when the vehicle is standing still the other system will be employed, both being controlled by said automatic device under these different conditions.

The drawings consist of one perspective view, Figure 1 embracing a boiler, a pump operated from the vehicle-axle, a steam-actuated pump, suitable connections between said pumps and boiler, and a conventional water-supply, and it shows also the automatic device whereby either pump may be set in motion; and Fig. 2, which shows, on an enlarged scale, a detailed part of the automatic valve-operating mechanism.

Referring now to the drawings, *a* indicates the boiler.

b indicates a pump, which is operated by an eccentric-rod *c*, connected with the eccentric *d* on the axle *e*. Only a small portion of the axle is shown in the drawings. *f* indicates a steam-actuated pump, the steam-cylinder *g* of which is connected by a pipe *h* with the boiler. In said pipe is a valve *i*. The automatic device shown herein, whereby the movements of these two pumps *b* and *f* are controlled, is similar in construction to that covered by my United States Letters Patent, dated February 13, 1900, No. 643,319, and consists, essentially, of a pipe having a long horizontally-extending U-shaped loop therein. The upper branch *j* of said loop lies just below the water-level in the boiler when it is at its normal height. Said upper branch *j* is by a suitable extension connected with the top of the boiler, as shown. The lower branch *k* of the said U-shaped loop after passing through a jacket *l* is by a suitable extension connected with the lower end of the boiler. Thus, as described in my said Letters Patent, any fluctuation of the water-level in the boiler

will cause a like fluctuation of the height of the water in the branches *j* and *k*, and if the water-level falls sufficiently to permit steam to enter the branch *j* it will cause an expansion thereof sufficient to operate certain valves, as described later on. To take advantage of this expansion, a metal yoke *m* is attached to the branch *j* near one end thereof and extends in the opposite direction somewhat beyond the elbow connecting branches *j* and *k*, and in the end of this yoke is supported a rock-shaft *n*, having an arm *o* thereon, which engages with another arm *p*, located on said elbow at the end of the U-shaped loop. When any change in length of the branch *j*, due to the expansion thereof, takes place, it will thus operate to rock the shaft *n*.

q indicates a water-tank, which is represented in a purely conventional form.

r is a pipe connecting the pump *b* with said tank, and *s* is a pipe extending from said pump to the jacket *l*. From the opposite end of said jacket a pipe *t* extends to the boiler. These last-named pipes *s* and *t*, together with the jacket *l*, constitute the conduit through which water from either of the pumps reaches the boiler.

In the pipe *s*, close to the pump, is a check-valve *u*, and between said valve and the pump a pipe *v* branches off and runs back to the water-tank *q*. In this pipe *v* is the valve *w*, provided with a long stem, which has a pivotal connection with an arm *x* on the end of the rock-shaft *n* in a manner hereinafter described. Under normal conditions this valve remains open and is closed by the upward movement of its valve-stem. Now, assuming that the water-level in the boiler *a* has fallen sufficiently to allow steam to enter the upper branch *j* and expand it, the rock-shaft *n* will be actuated, as stated, and the arm *x* thereon will effect the closure of the valve *w*. This having taken place, water from the pump *b*, forced into the pipe *s*, must pass under the check-valve *u* against the boiler-pressure and thence on through the jacket *l* and pipe *t* to the boiler. As soon as normal water-level has been restored in the boiler the contraction of the branch *j* will again open the valve *w* and the water from the pump *b* will again resume its normal course through the pipe *v* back to the water-tank. By means of this construction the pump *b*, being always in action, is always ready to supply the boiler, as above described. If the valve *w* were placed in the pipe *r*, whereby when the boiler required no water the pump would be receiving none, it would be found difficult to prime said pump and get it in proper working condition in such manner as to insure prompt delivery of water to the boiler. This is because air gets into the pump; but these difficulties are never encountered if the pump is made to pump a continuous stream from the tank back into the tank, and by the operation of a valve, as above described, this stream is momentarily diverted into the boiler as the latter requires it. The action of the pump *b*, however, depends entirely upon the movements of the axle *e* of the vehicle, and if the latter is left standing without entirely extinguishing the fire steam will accumulate in the boiler and escape through the safety-valve, thus gradually reducing the water-supply. Of course it is impracticable to extinguish and relight the fire under the boiler when a stop is to be made for any length of time, and therefore means must be provided whereby water may be supplied to the boiler as required, even though the vehicle remains for a long time stationary, under which circumstances it is deprived of the services of the pump *b*.

It is obvious that the supply of water to the boiler should be automatically regulated while the vehicle is at rest as well as when in motion, and to accomplish this the movements of the rock-shaft *n*, actuated by the expansion of the pipe *j*, are employed to set in motion one of the feed-pumps or to cause the water to be directed into the boiler from the other one. As stated, the valve *i* is a valve in the steam-pipe *h*, running from the boiler to the steam-cylinder *g* of the pump *f*. *y* is a rock-shaft having one arm *z* in engagement with the stem of the valve *i*, and 1 is another arm on *y* in engagement with a vertical rod 2, the lower end of which engages the end of the arm *x*. The valve *i* is opened by an upward movement of the stem thereof. The rod 2 at this point of connection with the arm 1 has more or less play vertically in the end of the arm 1 in one direction, which is provided for by passing the rod 2 freely through the end of the arm 1 and locating two nuts 3 above and below the end of the said arm. The nut below the arm 1 is the actuating-nut, the one above the arm being normally a little distance above the upper surface of the latter. The connection of the arm *z* with the stem of the valve *i* is effected in the same manner as that of the arm 1 with the rod 2, the nuts on the stem of the valve *i* being separated sufficiently to allow a little play of said arm *z* without opening said valve *i*. Thus the rock-shaft *y* may be more or less oscillated by a movement of the rod 2 when the valve *w* is closed; but this movement of *y* will not operate the valve *i*. The pumping-cylinder *g* is connected with the tank *q* by means of the pipe 4, and by means of a pipe 5 it is also connected with the pipe *s* between the check-valve *u* and the boiler. Now it is obvious that if the arm *x* is to operate both the valve *w* and the valve *i* it must operate one ahead of the other, or every time the valve *w*, for instance, is closed to cause water to be forced into the boiler by the pump *b* the valve *i* would simultaneously be opened, setting in motion the steam-pump, which would also force water into the boiler. Therefore to guard against this simultaneous operation of the feed-pump enough play is permitted to the arm *z* and the nut above it on the

valve-stem to permit the closing of the valve *w* before the said arm *z* will operate to open the valve *i*. As soon as the valve *w* is closed, then the pump *b* forces the water into the boiler, and the latter being of comparatively small capacity the expansion of the branch *j* is arrested before the movement of the arm *x* can operate to open the valve *i* of the steam-pump; but when the vehicle is stationary, then if the expansion of the pipe *j* causes the arm *x* to swing upwardly, as described, said upward movement will not be arrested by the injection of cold water into the boiler by the operation of the pump *b;* but after closing the valve *w* it will continue until the valve *i* opens and effects the operation of the steam-pump *f*. It is obvious that when the valve *w* comes to its seat means must be provided for permitting the continued upward movement of the arm *x* to effect the opening of the valve *i*. Provision is made for this by splitting the arm *z* in a horizontal plane from its free end back toward the rock-shaft *n*. The lower half 6 thereof is pivoted to the upper half of said arm and normally held in close contact therewith by a spring 7, which is sufficiently rigid to effect the closing of the valve *w*, a pin on the end of the stem of said valve lying between the lower part 6 of the arm *x* and the main body thereof, the two parts of the arm *x* being substantially one piece as far as the actuation of said valve *w* is concerned either in opening or in closing it. However, when the vehicle is stationary and the arm *x* is actuated it first closes the valve *w*, as above described, and the upper part of the arm *x*, to which the rod 2 is connected, then continues its upward movement until the valve *i* opens. When the normal water-level has been reached, the arm *x* swings downward until it closes the valve *i* and encounters the lower part 6 of said arm, whose spring 7 has meanwhile held the valve *w* closed. The arm *x* by its continued downward movement carries down the stem of the valve *w* and opens it. The space between the under side of the nut 3 and the upper side of the arm 1 at the moment the valve *i* closes is sufficient to permit the downward movement of the rod 2 far enough to open the valve *w*.

Means are also shown herein for manually operating the pump *f* independently of the automatic means; but this forms no part of the present invention, it having been covered in an application for Letters Patent of the United States filed by me on August 1, 1900, under Serial No. 25,555, and it consists of an arm 8 on the rock-shaft *y* and an operating-rod 9, extending from said arm to a point within convenient reach of the operator, whereby said rock-shaft may be oscillated to open the valve *i* independently of the automatic operation thereof. The automatically-operating mechanism for imparting the required movements to the arm *f* to effect the feeding of water to the boiler may be of any desired type which will impart the required movements to the rock-shaft *n*. The one shown herewith was selected as illustrative of a type only.

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

1. In a steam-propelled vehicle, the combination with the boiler thereof, of water-feeding devices for the latter consisting of a pump operatively connected with a moving part of the propelling mechanism of said vehicle and actuated thereby when the vehicle is moving; a second pump actuated by the pressure in the boiler; an automatically-operating mechanism whereby either of said pumps may be adapted to feed water to the boiler, and means for setting said second pump in operation, independently of said automatic mechanism, substantially as described.

2. In a steam-propelled vehicle, the combination with the boiler thereof, of water-feeding devices for the latter consisting of a pump operatively connected with a moving part of the propelling mechanism of said vehicle and actuated thereby when the vehicle is moving; a second pump, actuated by the pressure in the boiler; an automatically-operating mechanism whereby said first-named pump only may supply water to the boiler, when the propelling mechanism of the vehicle is in motion, and whereby said second pump may be adapted to supply the boiler when said propelling mechanism is at rest, independently of said first-named pump, substantially as described.

3. In a steam-propelled vehicle, the combination with the boiler thereof, of water-feeding devices for the latter consisting of a pump operatively connected with a moving part of the propelling mechanism of said vehicle and actuated thereby when the vehicle is moving; a second pump, actuated by the pressure in the boiler; suitable connections from a source of water-supply to said pumps, and from the latter to the boiler; an automatically-operating mechanism, and connections between the latter and said pumps whereby one of the latter may be adapted to feed water to said boiler in advance of the other, substantially as described.

4. In a steam-propelled vehicle, a boiler, and two water-feeding devices, one mechanically operated by a connection from a moving part of the vehicle, and operable only when the latter is moving, and the other operated by a steam connection from the boiler thereto, a valve for controlling the delivery of water from said mechanically-operated pump to the boiler, and a valve for controlling said steam connection, combined with one automatically-operating device, whereby said valves may be separately actuated, substantially as described.

5. In a steam-propelled vehicle, a boiler and two water-feeding devices, one mechanically operated by a connection from a mov-

ing part of the vehicle, and operable only when the latter is moving, and the other operated by a steam connection from the boiler thereto, a valve for controlling the delivery of water from said mechanically-operated pump to the boiler, and a valve for controlling said steam connection; a thermally-actuated device whereby said valves may be separately actuated, combined with means for manually actuating the valve in said steam connection, independently of said thermally-actuated device, substantially as described.

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