April 5, 1932. C. B. ALLEN 1,852,070

INJECTOR

Filed June 15, 1929 2 Sheets-Sheet 1

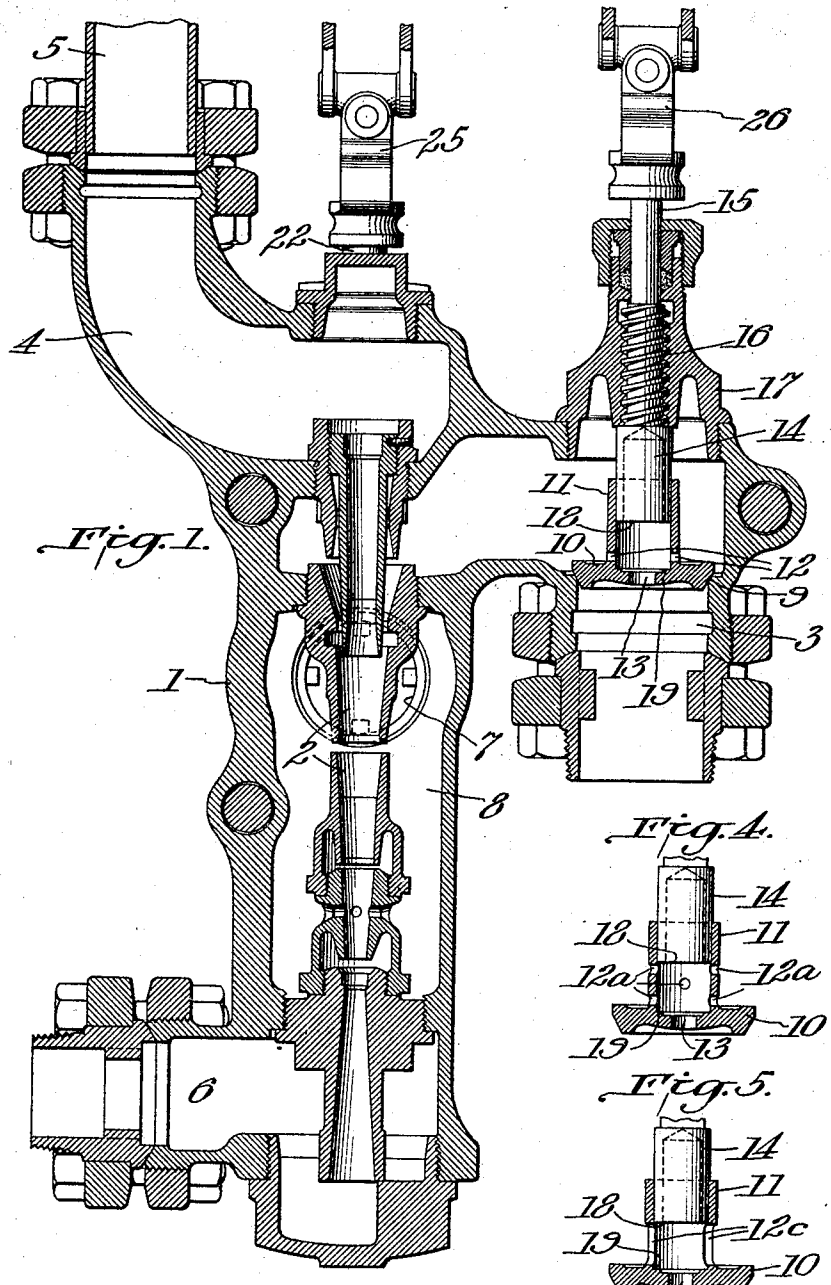

Fig. 1.

Fig. 4.

Fig. 5.

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INJECTOR

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Fig. 2.

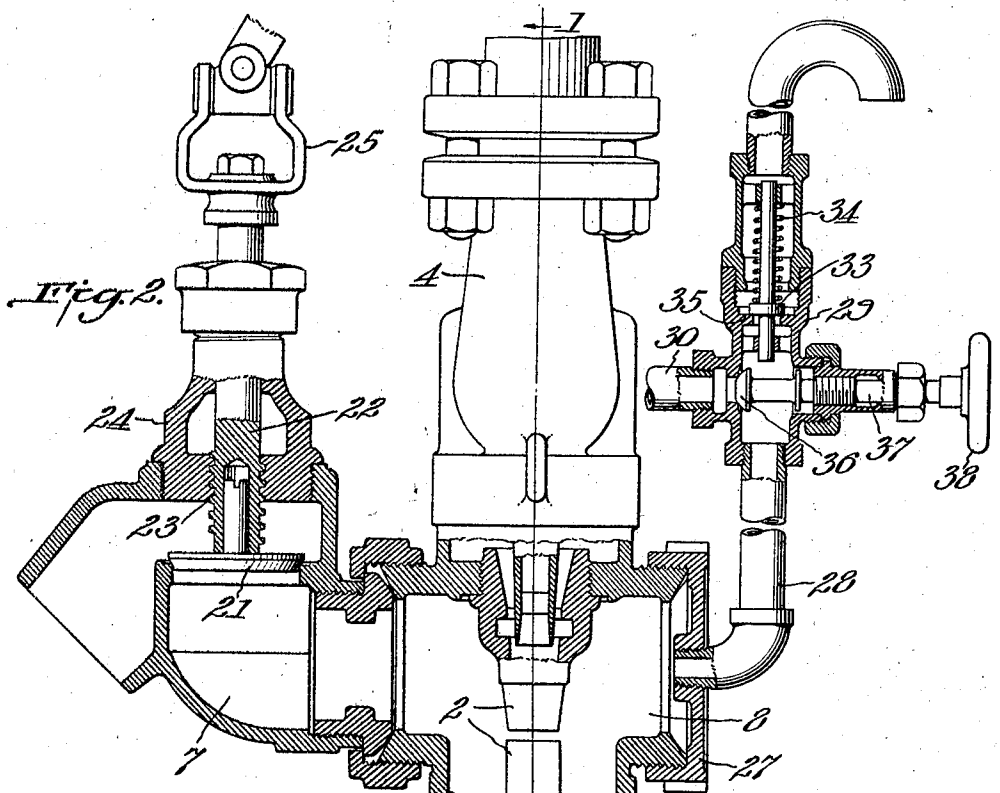

Fig. 3.

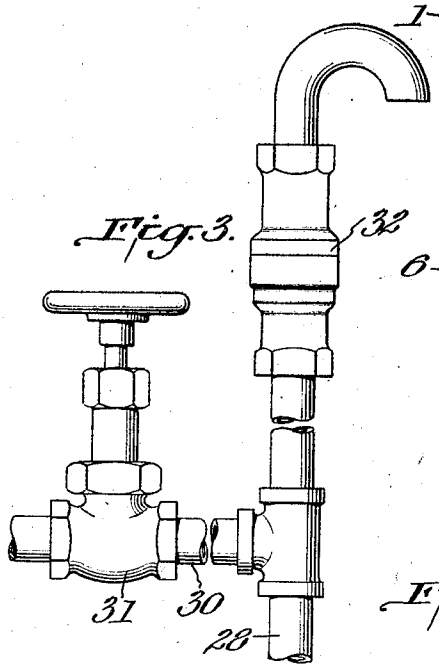

Fig. 6.

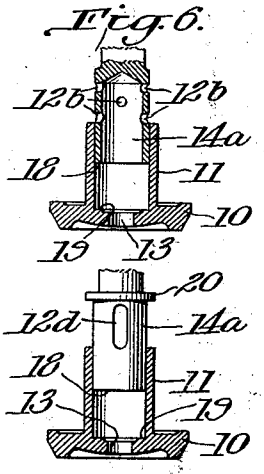

Fig. 8.

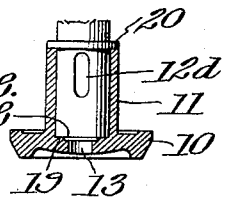

Fig. 7.

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UNITED STATES PATENT OFFICE

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INJECTOR

Application filed June 15, 1929. Serial No. 371,277.

This invention relates to injectors for feeding water to locomotive boilers.

In one type of injectors, of which that shown in the drawings, hereinafter described, is an example, the water inlet of the injector, which is connected to the water tank of the locomotive tender by a flexible pipe or hose, is controlled by a valve which may be manually adjusted toward and away from its seat to regulate the supply of water to the injector, and which may be positively seated.

When back pressure occurs in the injector, due to various known causes, the communication of such pressure to the water inlet is apt to result in blowing off of the hose and breaking of the connection between the injector and the tender tank when a manually operated inlet valve is used, and therefore in some other injectors, particularly those in which regulation of the steam supply is depended upon for regulating the volume of water fed by the injector, a check valve is placed in the water inlet, and this valve is provided with a port which, when the valve is closed, and the injector not operating, will permit steam fed to the injector body to pass back into the hose connection to heat the water. This check valve will automatically seat upon occurrence of back pressure in the injector body. As is well known, the delivery connection, which delivers the water from the injector to the locomotive boiler, is provided with a check valve to prevent feed back from the boiler into the injector, and if this valve should stick, thus opening the injector to boiler pressure, the check valve used in the water inlet will seat under such pressure, preventing blowing back into the tender tank.

It will be seen that both forms of valve have their advantages and disadvantages. The manually operated valve has the advantage of positive control of the feed but will not automatically prevent blowing back into the tank, and the check valve will automatically prevent blowing back but will not control the feed.

One object of my invention is to provide a valve for the water inlet of injectors which combines the advantages of the manually operable valve and the check valve just described, this valve being in the form of a check valve having means whereby it may be adjusted relatively to its seat and provided with a port through which heater steam may be introduced into the feed water, the valve and its arrangement being such that the effective area of this port may be controlled, the lift of the valve disk from its seat regulated to control the feed and the valve positively seated to completely close the water inlet and the port in the valve when desired.

In injectors of the type hereinbefore mentioned in which heater steam, so called, is used, this steam is in some instances supplied to the injector body by permitting the main steam valve of the injector to remain partially open. Sometimes, however, a special conduit is run from the locomotive boiler to the injector body to furnish a separate supply of such steam, this conduit usually being in the form of a small pipe-line controlled by a valve located in the locomotive cab.

Furthermore, it is customary to provide injectors with what is known as a telltale alarm, which is usually in the form of a spring-loaded check valve located in or adjacent to the locomotive cab and connected by a conduit or pipe line with the body of the injector. This telltale alarm operates automatically upon occurrence of high pressure within the body of the injector caused by a cessation of operation or "breaking" of the injector when it is in operating condition, that is, when its steam supply is turned on.

It will be seen that where the separate heater steam supply and the telltale alarm are both used, there are two steam lines or conduits running from the injector to the locomotive cab; and a further object of my invention is to so combine the separate heater steam connection and the telltale alarm valve as to eliminate one of such lines.

From the foregoing, it will be seen that my invention contemplates a water inlet valve, preferably of check-valve type, provided with a heater port and with means for so operating the valve that same may be ad-

justed to any desired opening and so that the effective area of the heater port may be regulated at will. The invention contemplates also the combination with a telltale alarm of means for supplying heater steam to the injector body, as I will proceed now to explain and finally claim.

In the accompanying drawings illustrating the invention, in the several figures of which like parts are similarly designated, Figure 1 is a longitudinal section taken substantially in the plane of line 1—1 of Fig. 2 of an ejector embodying the features of my invention. Fig. 2 is a sectional side elevation of same. Fig. 3 shows a modified form of connections for the telltale alarm. Figs. 4, 5, 6, 7 and 8 show various modifications of the check-valve for the water inlet.

The injector comprises a body 1, having the usual injector tubes, designated generally by 2, used in injectors of this type, and a water inlet opening 3 connected in any suitable way, as by a flexible pipe or hose, (not shown), with the water supply tank on the locomotive tender. The body 1 is also provided with the steam inlet 4, connected by a pipe 5 with the steam space of the locomotive boiler and valve controlled, a water delivery opening 6 connected in the usual manner by means of a pipe and check-valve (not shown) with the locomotive boiler, and an overflow 7 which is in communication with the overflow chamber 8.

The water inlet opening 3 is controlled by a valve having a seat 9 and a disk 10. The disk 10 is provided with a sleeve 11 having holes 12 through which communication is afforded between the interior of the injector body and a heater port 13 in the disk. Into the sleeve 11, and slidable relatively thereto, extends the cylindrical end 14 of a valve stem 15 threaded at 16 into a bonnet 17 carried by the injector body. By means of the threaded engagement between the valve stem 15 and the bonnet 17 the valve stem may be moved relatively to the disk 10 so that the lift of the disk from its seat 9 may be limited to any desired height to control the amount of water admitted into the injector body. Obviously, when the end 18 of the cylindrical portion 14 of the valve stem is screwed down tight against a seat 19 surrounding the heater port 13 the disk 10 will be held fixedly against its seat 9 and the supply of water to the injector completely cut off. Moreover, when this condition exists, it will be apparent that the communication through the openings 12 between the injector body and the heater port 13 will also be completely closed. Any adjustment of the valve stem 15, and hence of the cylindrical portion 14 thereof, may be had to control the effective area of the heater port 13 by more or less obstructing the openings 12, as desired.

The manner of control of the heater port 13 will be particularly apparent when the valve disk and the cylindrical portion of the stem take the modified forms shown in Figs. 4 to 8 inclusive. In Fig. 4, a plurality of openings 12^a, arranged at various heights above the upper surface of the disk 10, provide means whereby any desired number of such openings may be opened or closed to thus vary the passage of heater steam through the port 13 as desired. As shown in Fig. 6, the arrangement may be reversed, the openings 12^b being formed in the hollow cylindrical portion 14^a of the stem rather than in the sleeve 11. As illustrated in Fig. 5, instead of using a plurality of openings, such as the openings 12^a of Fig. 4, arranged at various distances above the top of the disk 10, I may use a plurality of elongated slots 12^c, whereby a similar result is obtained. Also, instead of forming these elongated slots in the sleeve 11, they may be formed in the hollow portion 14^a of the stem, as shown at 12^d, in Figs. 7 and 8. Where the openings are formed in the hollow cylindrical portion of the stem, as in Figs. 6, 7 and 8, I may depend either upon the seating of the bottom of the stem upon the seat 19 of the disk to close the heater port 13, in which case, there must be a good fit between the inner surface of the sleeve 11 and the outer surface of the cylindrical end of the stem, or I may provide the stem with a collar 20 adapted to seat upon the upper end of the sleeve 11, as shown in Fig. 8. It will be apparent that the arrangement of the openings 12^a (Fig. 4), 12^b (Fig. 6) and the slots 12^c and 12^d (Figs. 5, 7 and 8 respectively) provides means effecting elongated apertures which, when the stem portion 14 or 14^a is moved relatively to them have their areas so varied as to vary the effective area of heater port 13.

The overflow 7 is controlled by a check valve 21 adapted to be held to its seat when desired by a stem 22 in screwthreaded engagement as at 23 with a bonnet 24 supported by the body 1 of the injector. This stem 22 may be provided with a universal joint connector 25 from which an operating rod or shaft may run to the locomotive cab.

The valve stem 15 is provided with a universal joint connector 26 and control rod similar to those used in connection with the valve stem 22.

The overflow chamber 8 is provided with a cap 27 into which is fitted a conduit or pipe 28 leading to a combined telltale alarm and steam valve 29 located in the locomotive cab. From this valve, a pipe 30 extends to the steam space of the locomotive boiler.

A modification of this arrangement is shown in Fig. 3 wherein, instead of using a combined telltale alarm and steam valve, I may employ an ordinary steam valve 31 in the pipe 30 and an ordinary telltale alarm valve 32 having substantially the same struc-

tural features as that shown in Fig. 1, but omitting, of course, the steam valve.

The combined telltale alarm and steam valve shown in Fig. 1 comprises a valve member 33, spring-loaded as shown at 34 against a seat 35 and below this seat is arranged the steam valve 36 controlled by a stem 37 and hand wheel 38.

By thus connecting the telltale alarm and the heater steam supply valve, whether the arrangement shown in Fig. 2 or in Fig. 3 is used, with a single pipe 28 leading to the overflow chamber 8, I dispense with one pipe line from injector to locomotive cab, as hereinbefore mentioned, thus simplifying installation and reducing cost of the apparatus without impairing its efficiency.

The operation of injectors provided with the improvements of my invention will, it is believed, be obvious to those skilled in the art, but in the interest of clearness it may be described briefly as follows:—

The injector is mounted in the usual position on the locomotive with the water inlet opening 3 connected by the usual flexible pipe or hose to the water tank on the locomotive tender, the steam inlet 4 connected to a valve-controlled steam supply, the delivery 6 connected by a suitable pipe, check-valve-controlled, to the locomotive boiler, and the overflow 7 so arranged or connected as to have free discharge to atmosphere. The overflow check valve 21 is so adjusted that it may open to exhaust any pressure in overflow chamber 8 to atmosphere, but it will prevent entrance of air into the injector. When the injector is operating normally there is a partial vacuum in the overflow chamber, but if the mixture of water and steam passing through the injector tubes 2 rises above a predetermined temperature, which rise may be due to increased steam pressure, increased temperature of feed, reduction in quantity of water supply, or a combination of these factors, water will issue from the spills of the tubes, raise check valve 21 and issue from the overflow opening. This is the limit of "open overflow" operation. If, now, the check valve 21 is clamped to its seat by stem 22 the water cannot escape from the overflow and the injector will continue to function even though the conditions (increased temperature &c.) which interfere with operation become more severe. When, however, a certain critical temperature or condition is reached, the injector will cease to function or "break". This is the limit of "closed overflow" operation. When this occurs the telltale alarm will operate to apprise the engineer of the fact that the injector has ceased functioning.

In injectors of the type disclosed the valve 9—10 is used to regulate the supply of water feeding into the injector. Should the injector, when operating "closed overflow", "break", as just described, the valve disk 10 will immediately seat, under the influence of the pressure developed within the injector body, and will prevent blowing off of the flexible hose or pipe or blowing back into the tender tank. Under such circumstances the heater port 13 would be open but the effect of this open port would be negligible so far as communication through it of pressure injurious to the water connection is concerned.

When the injector is not feeding water to the locomotive boiler the injector may be used as a heater, for heating the feed water, by admitting steam to the overflow chamber 8 from which chamber it finds its way to the valve 9—10 and passing through the openings in the sleeve or stem thereof flows through the heater port 13 into the water in the flexible pipe or hose. The amount of steam passing thus into the feed water may be regulated by adjustment of the cylindrical portion 14 of the stem 15 in sleeve 11. This feature of valve 9—10 is particularly advantageous where a slight opening of the main steam valve controlling communication with inlet 4 is used to supply heater steam to the injector. Where a separate heater steam supply, such as pipe 28, is used, the amount of steam may be regulated by adjustment of valve 36 or 31, or by such valve in combination with the regulation afforded by valve 9—10. Should too much heater steam be supplied, the telltale alarm will warn the engineer of this fact.

Obviously, if desired, the disk 10 may be clamped against its seat 9 by so depressing the stem 15 that the end of its cylindrical portion 14 seats against seat 19, or so that collar 20 seats against the top of sleeve 11, thus not only preventing opening of the valve 9—10 but completely closing the heater port 13 as well. Such closing of valve 9—10, when there is no pressure in the injector body, will prevent water from entering the injector under the slight hydrostatic head maintained by the body of water in the tender tank.

It is to be noted, moreover, that by forming the end of stem 15 as a hollow cylinder 14, the water which fills the space defined by the hollow cylinder 14 and sleeve 11, will balance the valve when water is being fed through same to the injector. This water will not, however, interfere with proper adjustment of the valve, for the reason that it may escape from the space within cylinder 14 and sleeve 11 as readily as it enters same. The effect is primarily a balancing of the pressures upon the two sides of the valve during normal operation.

Although I have hereinbefore described my invention in its application to the boilers of locomotives, it is to be understood that it is not limited to this particular application but may be used in connection with any boiler so long

as the requisite pressure fluid, such as steam, and a supply of water are available.

Various changes are contemplated as within the spirit of the invention and the scope of the following claims.

What I claim is:—

1. In an injector, a body provided with an opening, an automatic check valve for said opening including a valve seat, a valve member for cooperation with said seat and provided with a port, and means for limiting movement of the valve member away from its seat and for positively seating same, said means operating to control the effective area of said port.

2. In an injector, a body provided with an opening, an automatic check valve therefor including a valve seat, a valve member for cooperation with said seat and provided with a port, an adjustable valve stem, a guide member carried by said valve member and cooperating with said stem to guide said valve member relatively to said seat, said stem being operable to limit the movement of said valve member away from its seat and to positively seat same and to control the effective area of said port.

3. In an injector, a body provided with a water supply opening, an automatic check valve therefor including a valve seat, a valve disk for cooperation with said seat and provided with a port, a valve stem, a guide sleeve carried by said disk and embracing said stem, said disk being slidable toward and away from said seat relatively to said stem and guided on said stem by said sleeve, said stem operative to limit movement of said disk away from said seat and to positively seat same and to control the effective area of said port.

4. In an injector, a body provided with a water supply opening, an automatic check valve therefor including a valve seat, a valve disk for cooperation with said seat and provided with a port, a valve stem cooperating with said disk and adapted to limit the movement of said disk relatively to its seat and operable to positively seat same, and cooperating means on said stem and disk providing openings communicating with said port, said openings adapted to be controlled by movement of said stem relatively to said disk.

5. In an injector, a body provided with a water supply opening, an automatic check valve therefor including a valve seat, a valve disk for cooperation with said seat and provided with a port, a valve stem cooperating with said disk and adapted to limit the movement of said disk relatively to its seat and operable to positively seat same, and cooperating means on said stem and disk including a sleeve carried by said disk and in sliding engagement with said stem, said means providing openings communicating with said port, said openings adapted to be controlled by movement of said stem relatively to said disk.

6. In an injector, a body provided with a water supply opening, an automatic check valve for controlling said opening including a valve seat and a disk cooperating therewith, said disk provided with a port and a sleeve surrounding same, a valve stem in sliding engagement with said sleeve and axially adjustable in said body to limit movement of said disk away from its seat and operable to positively seat same, said sleeve and stem forming cooperating valve members one of which is provided with an aperture establishing communication between the interior of said body and the port of said disk, adjustment of said stem relatively to said disk serving to vary the effective area of said port by varying the area of said aperture.

7. In an injector, a body provided with a water supply opening, an automatic check valve for controlling said opening including a valve seat and a disk cooperating therewith, said disk provided with a port and a sleeve surrounding same, a valve stem in sliding engagement with said sleeve and axially adjustable in said body to limit movement of said disk away from its seat and operable to positively seat same, said sleeve and stem forming cooperating valve members one of which is provided with means effecting an elongated aperture establishing communication between the interior of said body and the port of said disk, adjustment of said stem relatively to said disk serving to vary the effective area of said port by varying the area of said aperture.

8. In an injector, a body provided with a water inlet opening, a combined automatic check and manually operable valve for said opening including a seat and disk, said disk provided with a port, a sleeve projecting from said disk and surrounding said port, and a valve stem provided with a portion cooperating with said sleeve and forming therewith a chamber in the sleeve to receive a body of water for balancing said disk when same is operating as a check valve, said stem operable to positively seat said disk.

9. In an injector, a body provided with a water inlet opening, a combined automatic check and manually operable valve for said opening including a seat and a disk, said disk provided with a port, a sleeve projecting from said disk and surrounding said port, and a valve stem provided with a hollow cylindrical portion cooperating with said sleeve and forming therewith a chamber to receive a body of water for balancing said disk when same is operating as a check valve, said stem operable to positively seat said disk.

10. In an injector, a body provided with a water inlet opening, a combined automatic check and manually operable valve for said opening including a seat and a disk, said disk

provided with a port, a valve stem cooperating with said disk and to which the disk is relatively movable for operation as a check valve, and means on said stem and disk providing a chamber with which said port communicates, said chamber adapted to receive a body of water through said port to balance said disk when same is operating as a check valve, said stem operable to positively seat said disk.

11. In an injector provided with means for furnishing a heating fluid to the supply of water for the injector and an alarm device for signalling cessation of operation of the injector when in operating condition, a conduit apart from the injector and connecting said injector and alarm device, and a conduit leading from a source of heating fluid and connected with the conduit of said alarm device.

12. In an injector provided with means for furnishing a heating fluid to the supply of water for the injector and an alarm device for signalling cessation of operation of the injector when in operating condition, a conduit apart from the injector and connecting said injector and alarm device, a conduit leading from a source of heating fluid and connected with the conduit of said alarm device, and a valve interposed in the conduit for the heating fluid for controlling the admission of such fluid to the conduit of the alarm device.

13. In an injector for steam boilers, a body provided with an overflow chamber, an alarm device located remotely from said injector, a conduit apart from said injector body and connecting said alarm device with said overflow chamber and providing a means whereby said alarm device may function when the injector ceases to operate while in operating condition, means in said injector whereby a heating fluid may be supplied to the water fed to the injector, and a conduit connected with a source of heating fluid and communicating with the conduit of said alarm device for supplying heating fluid to said means.

14. In an injector for steam boilers, a body provided with an overflow chamber, an alarm device located remotely from said injector, a conduit apart from said injector body and connecting said alarm device with said overflow chamber and providing a means whereby said alarm device may function when the injector ceases to operate while in operating condition, means in said injector whereby a heating fluid may be supplied to the water fed to the injector, a conduit connected with a source of heating fluid and communicating with the conduit of said alarm device, and a valve interposed in said heating fluid conduit for controlling the passage of fluid therefrom into the alarm device conduit, whereby a single conduit may serve to supply heating fluid to said injector and to conduct fluid under pressure from the injector to said alarm device.

15. In an injector, a body provided with a water inlet opening, a combined check and manually operable valve for said opening including a seat, a valve disk for cooperation with said seat, and adjustable means for varying the effective opening of said valve when same is operating as a check valve, and to positively seat said disk, to thereby automatically and manually control the feed of water to the injector.

In testimony whereof I have hereunto set my hand this 7th day of June A. D. 1929.

CHARLES B. ALLEN.