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R. N. KENNINGTON.

RELIEF VALVE.

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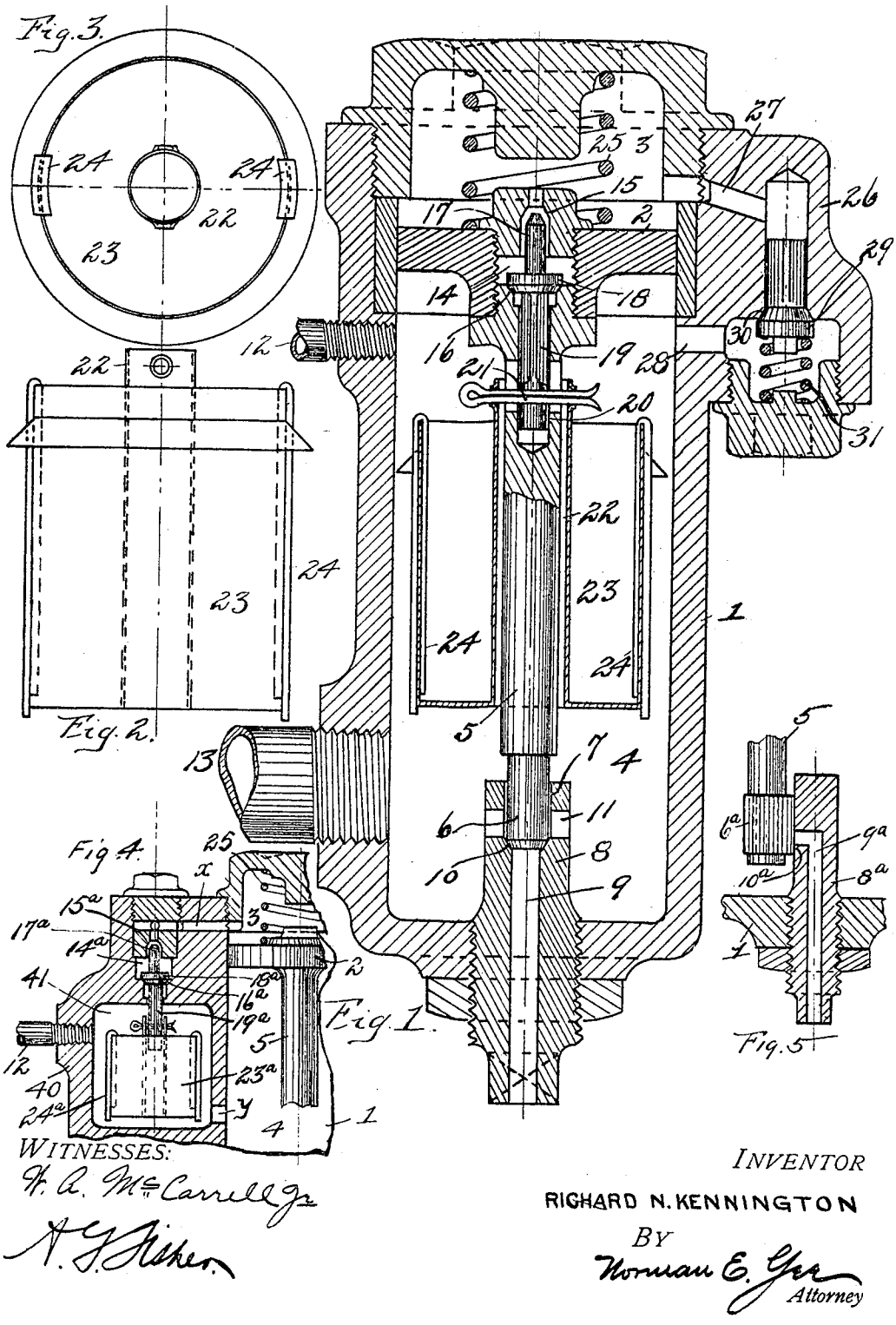

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RELIEF-VALVE.

No. 818,694. Specification of Letters Patent. Patented April 24, 1906.

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To all whom it may concern:

Be it known that I, RICHARD N. KENNINGTON, a citizen of the United States, residing at Altoona, in the county of Blair and State of Pennsylvania, have invented new and useful Improvements in Relief-Valves, of which the following is a specification.

This invention relates to an improved relief-valve comprising means for automatically removing at predetermined intervals the liquid that has been condensed from expansive fluids without the necessity of altering the pressure of the condensed liquid.

To this end the invention contemplates a mechanism embodied in a single-valve structure which can be readily attached directly to the reservoir or trap in which the condensed liquid is held. In this connection it will be understood that the water that has been trapped into reservoirs of air-brake systems, due principally to the reduction of temperature of the air between the compressor or pump and the reservoir, may be removed through the medium of the improved valve contemplated by the present invention, thus removing the difficulty arising from water collecting in air-compressors of air-brake systems.

Another object of the invention is to provide an improved relief-valve comprising means for effecting the separation of chemical elements from lighter expansive fluids which have been condensed through the action of chemical or mechanical agencies.

With these and other objects in view, which will more readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts, which will be hereinafter more fully described, illustrated, and claimed.

The essential features of the invention involved in carrying out the objects above indicated are necessarily susceptible to structural change without departing from the scope of the invention; but a preferred embodiment thereof is shown in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of a relief-valve mechanism embodying the present invention. Figs. 2 and 3 show a side elevation and top view, respectively, of the valve-float. Fig. 4 is a detail sectional view showing a modified arrangement of the float and the cut-off valves controlled thereby for controlling the communication between the chambers 3 and 4, respectively, above and below the controlling-piston. Fig. 5 is a detail sectional view showing a modification in the form of piston-operated valve for controlling the exhaust-outlet to the atmosphere.

Like reference-numerals designate corresponding parts in the several figures of the drawings.

As indicated, this invention possesses special utility in connection with air-brake apparatus, and in carrying out the same no change is necessary in the conventional arrangement of the ordinary air-brake apparatus to which the device may be applied, the valve only requiring its larger chamber to be connected both to the fluid-pressure at the top and the liquid-pressure at the bottom, the diameter of the liquid-pipe being preferably the larger.

A distinctive feature of the present invention resides in the relative smallness of the device compared with the apparatus in connection with which it is employed, thereby not appreciably adding to the weight of the apparatus.

A preferred construction of the valve for the purposes indicated is shown in the accompanying drawings and in its general organization includes a valve-casing 1, preferably of a cylindrical form and having arranged for restricting the play therein a controlling-piston 2, separating the interior of the casing into the upper and lower chambers 3 and 4, which are respectively disposed above and below the piston, as plainly shown in Fig. 1 of the drawings.

The reciprocatory controlling-piston 2 is made rigid with one end of a piston-rod 5, arranged longitudinally of the casing within the lower chamber 4 thereof and formed at its lower end with a valve member 6, working in a guiding-socket 7, provided in the inner upper end portion of an exhaust-nipple 8, fitted in the lower end of the valve-casing and having its longitudinal passage 9 in open communication with the outer air or atmosphere. The inner upper end of the said nipple 8 is provided at the lower end of the guiding-socket 7 with a valve-seat 10, on which is designed to be seated the active end

of the valve member 6, and immediately above the plane of the seat 10 the nipple 8 is provided in its sides with a plurality of circulating ports 11, designed to provide free communication between the lower chamber 4 and the outer air when the valve member 6 is lifted from its seat 10.

In addition to the ported exhaust-nipple connection between the lower chamber 4 and the outer air the latter also has direct communication through the pipe connections 12 and 13 with the reservoir or trap into which the condensed liquid is directed and collected. The smaller pipe connection 12 is arranged near the upper end of the lower chamber 4, while the larger of said connections (designated by the number 13) is arranged near the lower end of the said chamber 4. The said upper pipe connection 12 is designed to be connected with the upper part of the reservoir or trap containing the liquid to be disposed of, and therefore in communication with the dry expansive gaseous fluid in such reservoir or trap, while the lower pipe connection 13 is connected to the bottom part of the said reservoir or trap. This reservoir or trap is not shown in the drawings, as the same is the common trap or receptacle employed in air-brake systems to receive and collect the water of condensation.

The controlling-piston 2 is provided with a circulating-passage 14 therethrough and also with the upper and lower valve-seats 15 and 16, respectively, which may be properly said to be located at the upper and lower ends of the passage 14. In conjunction with the circulating-passage 14 and the upper and lower valve-seats 15 and 16 the body or head of the piston 2 has arranged for movement therein the separate cut-off valves 17 and 18, which respectively coöperate with the valve-seats 15 and 16. What may be properly termed the "upper" cut-off valve 17 is in the form of a beveled valve-spindle operating in the upper portion of the passage 14 and against the seat 15, while the lower cut-off valve 18 is in the form of a beveled valve disk or plate of greater area than the valve 17 and operating within the central part of the passage 14 and against the lower valve-seat 16. The said upper and lower cut-off valves 17 and 18 are rigidly connected and carried by a common reciprocatory valve-stem 19, operating through the lower part of the passage 14 below the valve-seat 16 and held for movement in a guiding-socket 20, formed in the upper end portion of the piston-rod 5, which carries the controlling-piston 2. The lower end of the reciprocatory valve-stem 19 has a pin or equivalent coupling connection 21 with the upper end of the inner sleeve member 22 of a vertically-movable float-cup 23, arranged about and movable upon the piston-rod 5.

The float 23, which, as indicated, is preferably in the form of a cup closed at the bottom and open at the top, is held for sliding movement upon the rod 5 through the medium of the inner sleeve member 22, whereby the float may have a sufficiently independent movement to provide for operating the valves 17 and 18. One of the important features in connection with this float or float-cup 23 is to associate therewith one or more siphon-tubes 24, bent over the top edge of the float-cup and having their shorter inlet-legs arranged within the cup to provide for siphoning out the liquid therein, as hereinafter more fully pointed out.

To provide for overcoming the friction of the controlling-piston 2 and for normally seating the valve 6 on the seat of the exhaust-nipple 8, there is arranged within the upper chamber 3 a pressure-spring 25, bearing at one end against the cap or head of the valve-casing 1 and at its other end against the upper side of the controlling-piston 2.

Offset from the upper side of the valve-casing 1 is an auxiliary by-pass chamber 26, having the upper and lower chamber-ports 27 and 28, which respectively communicate with the upper and lower chambers 3 and 4 above and below the plane of movement of the reciprocatory controlling-piston 2. The line of communication through the by-pass chamber and its ports 27 and 28 is controlled through the medium of a normally seated by-pass valve 29, arranged in the main passage-way through the chamber 26 and held against its seat 30 through the medium of a valve-adjusting spring 31, interposed between the head of the valve 29 and the lower end of the auxiliary chamber 26.

The expansive fluid entering the lower liquid-chamber 4 through the pipe connection 12 passes the valve 18 and through the circulating-passage 14 of the piston 2 into the upper chamber 3, thereby producing an equalization of pressure on both sides of the piston. The condensed liquid enters the chamber 4 through the lower pipe connection 13 and collects in the said lower chamber until a sufficient quantity has accumulated to buoy up the float 23. When this occurs, the rise of the float 23 causes the valve-stem 19 to be moved upward and close the upper cut-off valve 17 against the seat 15, thereby cutting off communication between the upper and lower chambers 3 and 4. In this connection it is to be observed that while the condensed liquid is lifting the float 23 the valve 18 is open a sufficient length of time to permit the expansive fluid to circulate into the upper chamber 3 and effect the equalization of pressure referred to. If for any reason there occurs a reduction of pressure in the air-brake system, the pressure in the lower chamber 4 will be reduced, and inasmuch as the by-pass

valve 29 opens downward the superior pressure in the upper chamber 3 will open the said by-pass valve 29 and again cause an equalization of pressure upon both sides of the piston 2 through the ports 27 and 28. When the pressure of the fluid in the air-brake system rises, the pressure in the lower chamber 4 will become greater than that in the upper chamber 3, and inasmuch as the two chambers are cut off from communication through the upper cut-off valve 17 the piston 2 will be forced upward, thereby raising the valve 6 from its seat and permitting the escape of the condensed liquid into the outer air through the exhaust-nipple 8. When the level of the condensed liquid in the chamber 4 lowers sufficiently, the float-cup 23 will drop and open the upper cut-off valve 17, thereby again permitting the equalization of the pressure in the chambers 3 and 4. The spring 25 then overcomes the friction of the piston 2 and closes the valve 6. If for any reason the float-cup 23 becomes filled with condensed liquid, its weight will hold the lower cut-off valve 18 on its seat, thus closing communication between the chambers 3 and 4, and when a reduction of pressure occurs in the chamber 4 the by-pass valve 29 will open and allow expansive fluid to pass from the chamber 3 to the chamber 4 until the pressures become equal upon both sides of the piston. When the pressure again rises in the chamber 4, it will force the piston 2 upward, overcoming the pressure-spring 25, and since the lower cut-off valve 18 is retained upon its seat by the weight of the liquid in the float 23 the valve 6 will be opened and the condensed liquid pass out through the exhaust-nipple. The liquid in the float will be siphoned out by the siphons 24 as the condensed liquid outside of the float passes out through the exhaust-nipple. When the weight of the condensed liquid in the float is less than the upward pressure of the expansive fluid or gas against the lower cut-off valve 18, such pressure against the said valve will open the same and cause an equalization of the pressures in the two chambers 3 and 4, thus permitting the spring 25 to force down the piston and close the valve 6.

The valve herein described can be readily attached to the main air-reservoir of locomotives and perform the various functions herein indicated or can be applied to any other part of an air-brake system where the liquid of condensation is trapped.

In using the separate terms "fluid" and "liquid" herein it is understood that these terms are given their ordinary significance as applied to fluid-pressure or air-brake systems, as it is not the intention in carrying out the present invention that liquid should ever occupy the upper chamber 3 above the piston 2.

Various structural modifications may be resorted to in the construction and arrangement of the various elements of the valve without affecting the operation thereof or departing from the scope of the invention. For instance, the valve for controlling the exhaust-outlet to the atmosphere may be of different types and still be operated or controlled through the movement of the piston-rod 5. As illustrative of the modifications that may be resorted to in this connection attention is directed to Fig. 5 of the drawings, which shows the valve-casing provided at its lower end with an exhaust-nipple 8^a, having an inner projecting portion provided on one side thereof with a valve-seat 10^a in communication with the passage 9^a through the nipple and adapted to be slidably engaged by a slide-valve 6^a, carried at the lower end of the piston-rod 5 and arranged to cover and uncover the port through the seat 10^a. Aside from the structural difference the slide-valve arrangement just described has precisely the same function and action as the valve 6 heretofore referred to.

Another modification that may be resorted to is illustrated in Fig. 4 of the drawings and primarily consists in an arrangement which provides for removing the float and the parts immediately associated therewith outside of the working plane of the piston 2 and its rod 5. Referring particularly to this modification, the same simply consists in providing the main valve-casing 1 with a supplemental offset-valve casing 40, having therein a float chamber 41, to which chamber is connected pipe connection 12 for the reservoir or trap with which the improved valve is associated. Said float-chamber 41 is provided at the top thereof with a circulating-passage 14^a and also with the upper and lower seats 15^a and 16^a, respectively, which may be properly said to be located at the upper and lower ends of the passage 14^a. Above the upper valve-seat 15^a the float-chamber 41 communicates with the upper chamber 3 of the main valve-casing 1 above the piston 2 through the upper casing-port x, while communication is provided between the main casing 1 below the piston 2 and the float-chamber 41 through the lower casing-port y. The float-chamber 41 accommodates therein the float-cup 23^a, carrying the siphons 24^a and connected to the valve-stem 19^a, which carries the upper and lower cut-off valves 17^a and 18^a, which respectively coöperate with the seats 15^a and 16^a. This construction of the float and valves carried thereby is precisely the same as the corresponding construction shown in Fig. 1 of the drawings, and the only difference between the two forms resides in the fact that in the modification illustrated in Fig. 4 the piston 2 is left solid and the float-controlled valves for controlling communication between the chambers

above and below the piston are arranged, together with the float, in a supplemental valve-casing, which is arranged outside of the plane of the chambers within the main casing. In other respects the function and action is identical with that already described.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described relief-valve will be readily apparent without further description, and it will be understood that various changes in the form, proportion, and minor details of construction may be resorted to without departing from the spirit of the invention or sacrificing any of the advantages thereof.

Having thus described the invention, what is claimed, and desired to be secured by Letters Patent, is—

1. In a relief-valve of the class described, a valve-casing having an exhaust-outlet to the atmosphere, a piston-valve controlling said outlet, and pressure-controlled devices arranged within the casing and comprising means for automatically and intermittently discharging liquid through the exhaust-outlet.

2. In a relief-valve of the class described, a valve-casing having an exhaust-outlet for liquid of condensation and separate fluid-chambers therein, one of said chambers having upper and lower pipe connections with a trap or reservoir for liquid of condensation, and pressure-controlled devices arranged within the casing and comprising means for automatically and intermittently discharging liquid through the exhaust-outlet.

3. In a relief-valve of the class described, a valve-casing having an exhaust-outlet to the atmosphere, a controlling-piston working in the casing and having a rod carrying a valve controlling said exhaust-outlet, and float-controlled valves carried by the piston.

4. In a relief-valve of the class described, a valve-casing having an exhaust-outlet to the atmosphere, a piston-operated valve controlling said exhaust-outlet, float-controlled valves carried by the piston, and a normally closed pressure-opened by-pass valve controlling a by-pass connection between the chambers at opposite sides of the piston.

5. In a relief-valve of the class described, the valve-casing having an exhaust-outlet to the atmosphere, a piston working in the casing and provided with a circulating-passage therethrough and upper and lower valve-seats for the upper and lower ends of said passage, a piston-rod connected with the piston and carrying a valve member coöperating with the exhaust-outlet, a double valve carried by the piston and having its separate members coöperating with the upper and lower valve-seats thereof, and a float arranged within the casing and having a connection with said double valve.

6. In a relief-valve of the class described, a valve-casing having pipe connections with a trap or reservoir for liquid of condensation and also provided with an exhaust-outlet to the atmosphere, a piston working in the casing and having a circulating-passage therethrough and upper and lower valve-seats for said passage, a piston-rod connected with the piston and having a valve member controlling the exhaust-outlet, a valve-stem carried by the piston and having separate upper and lower cut-off valves respectively closing upward and downward and coöperating with said upper and lower valve-seats, a float mounted on the piston-rod and having a coupled connection with said valve-stem, a pressure-spring arranged at one side of the piston, and a normally closed auxiliary by-pass chamber having ports in communication with the separate chambers respectively at opposite sides of the piston.

7. In a relief-valve of the class described, a valve-casing having an exhaust-outlet to the atmosphere, a piston-controlled valve for said exhaust-outlet, a valve carried by the piston to control communication between the chambers at opposite sides thereof, a float-cup working in one of the chambers and connected with the piston-valve, and a siphon carried by the float-cup for automatically siphoning the liquid therefrom under certain conditions.

8. In a relief-valve of the class described, the valve-casing having an exhaust-outlet to the atmosphere, and pressure-controlled devices arranged within the casing and comprising means for automatically controlling the discharge through said outlet, said pressure-controlled devices including a float-cup having a plurality of siphons for transferring the liquid from the inside thereof to the chamber within which the cup works.

9. In a relief-valve of the class described, the combination of the valve-casing having an exhaust-outlet to the atmosphere, a valved piston separating the interior of the casing into upper and lower chambers, and a float arranged in the lower chamber comprising means for opening the passage through the piston before the lower chamber in the valve-casing is filled with condensed liquid.

10. In a relief-valve of the class described, a valve-casing having an exhaust-outlet to the atmosphere, a piston-operated valve controlling said exhaust-outlet, float-controlled cut-off valves arranged to control communication between the separate chambers above and below the piston, and a normally closed pressure-opened by-pass valve controlling a by-pass connection between said chambers at opposite sides of the piston.

11. In a relief-valve of the class described, a valve-casing having an exhaust-outlet to the atmosphere, a controlling-piston working

in the casing and having a rod carrying a valve controlling said outlet, float-controlled valves for controlling communication between the chambers above and below the piston, and a by-pass valve also arranged to control communication between the chambers above and below the piston.

In testimony whereof I affix my signature hereunto in the presence of two witnesses.

RICHARD N. KENNINGTON.

Witnesses:
J. F. CLARK,
Mrs. N. E. GEE.