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FEED WATER HEATER.

APPLICATION FILED APR. 14, 1910.

988,224.

Patented Mar. 28, 1911.

FIG. 1.

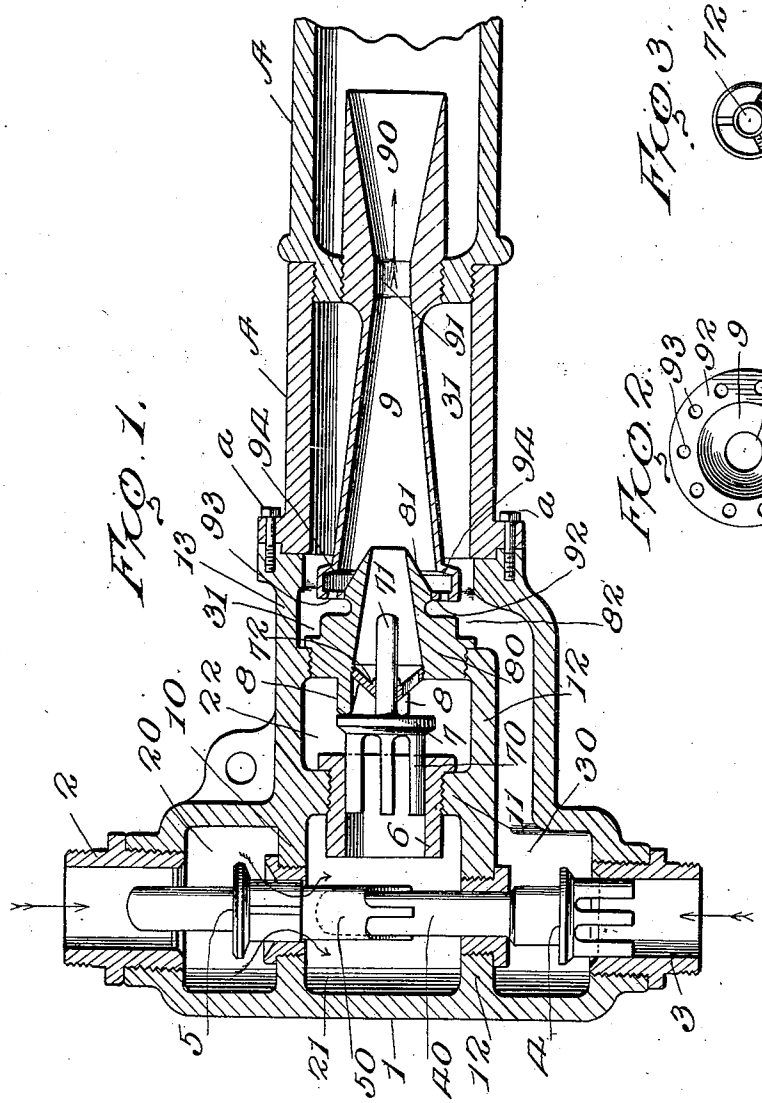

FIG. 3.

FIG. 2.

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FEED-WATER HEATER.

988,224. Specification of Letters Patent. Patented Mar. 28, 1911.

Application filed April 14, 1910. Serial No. 555,554.

To all whom it may concern:

Be it known that we, JARED S. SWEENY and WILLIAM W. GRINDLE, citizens of the United States, residing at Decatur, Macon county, Illinois, have invented certain new and useful Improvements in Feed-Water Heaters; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to certain improvements in feed water heaters, and the like; and the objects and nature of our invention will be readily understood by those skilled in the art in the light of the following explanation of the accompanying drawings showing what we now consider our preferred embodiment from among other formations and arrangements within the spirit and scope of our invention.

The invention consists in certain novel features in construction and in combinations and arrangements as more fully and particularly set forth hereinafter.

Referring to the accompanying drawings;—Figure 1, is a longitudinal section, the various valves of the device being shown in operative opened position. Fig. 2, is a detail end view of receiving end of the combining cone. Fig. 3, is a detail elevation of the guide in the steam nozzle for the emergency valve stem.

1, is the shell or casing of the feed water heater, having a steam inlet opening receiving the nipple 2, to which the steam supply pipe from the steam boiler dome is coupled; and also having a feed water inlet opening receiving the nipple 3, to which the feed water supply pipe is coupled. This feed water supply pipe extends from a suitable feed water pump, such as an injector, delivering the water into the shell at a pressure higher than that of the steam entering the shell through nipple 2.

The steam inlet opens into a steam passage through the casing comprising steam chambers 20, 21, and 22. The nipple 2, opens directly into chamber 20, which is separated from chamber 21, by an internal transverse partition 10, formed with a vertical steam port placing chambers 20, and 21, in communication. Chamber 22 is separated from chamber 21, by a vertical partition 11, having a horizontal steam port or passage placing said chambers 21, 22 in communication.

The shell is formed with a feed water chamber or passage 30, into which the nipple 3, opens and this chamber 30, is separated from the steam chambers by a transverse internal partition 12. A vertically movable check valve 4, is arranged in the chamber 30, to seat against the nipple 3, to close the water inlet when the pressure of the feed water entering through said nipple drops below the pressure necessary to lift the valve. This valve has a vertical stem 40, slidably passing through partition 12, into lifting engagement with the depending stem 50, of a check valve 5, arranged in chamber 20, and adapted to drop and close the steam port through partition 10, and thereby cut off the steam supply when the water supply check valve 4, drops to closing position. The stem 50 is shown formed with an end socket slidably receiving the upper end of stem 40. However, we do not wish to limit our present invention to this or other valve arrangement.

An elongated bushing 6, is inserted in the horizontal opening through partition 11, and forms the steam passage therethrough. An emergency check valve 7, is arranged in steam chamber 22, for the purpose of closing and opening the steam passage formed by said bushing. This valve is under back pressure adapted to be forced against the inner or discharge end of said bushing and thereby close the same against back flow from chamber 22, to chamber 21, but the valve is normally in open position moved forwardly from the end of the bushing and held by the steam pressure against stop lug or lugs 8. The valve 7, is provided with rearwardly extending guide wings 70, longitudinally arranged and slidable within the bushing, and with a forwardly extending longitudinal stem 71, slidable in a central spider-like guide 72, screwed into the rear end of the bore of the steam nozzle hereinafter described, all for the purpose of accurately maintaining the valve in alinement

for free and proper reciprocation under the desired conditions.

The outer side of the steam chamber 22, is formed with a comparatively large threaded opening into which is screwed the externally threaded base portion of the steam nozzle 80. The forwardly contracting or tapering bore of said nozzle is in alinement with the longitudinal axis of the bushing 6, and the stops 8, are rigid with and project rearwardly from the base portion of said nozzle and are arranged around the inlet end of the bore thereof. The nozzle is formed with the forwardly projecting tapered or conical end or surface 81, at the rear terminating in an annular exterior groove or channel 82, intermediate the length of the nozzle.

The shell 1, is formed with a forwardly projecting neck or boss 13, open at the front end, and forming an annular feed water space or chamber 31, around the steam nozzle and annular groove 82, and in direct open communication with the water chamber 30. The feed water pipe A, extending from the shell to the boiler feed water inlet controlled by the usual boiler check valve, is suitably coupled to the boss 13, to form a forward continuation thereof. The pipe A, forms a tight joint with the front end of said boss and is removably coupled thereto as by bolts *a*.

The elongated tubular member of an injector is longitudinally and removably arranged within the pipe A, and the pipe is closed thereby to prevent forward passage of the water and steam except through said tubular body. This tubular body is composed of a forwardly contracting combining cone 9, a rearwardly enlarging or flaring delivery cone 90, and an intermediate contracted cylindrical connecting passage 91.

The receiving end of the combining cone is projected rearwardly into the boss of the shell to centrally and longitudinally receive the steam discharge nozzle 80. The combining cone is formed with an annular end wall 92 forming a central end opening receiving the steam nozzle with said wall snugly and removably fitting around said nozzle intermediate the conical surface 81 and the annular channel 82, thereof. The combining cone is formed with an annular series of water inlet perforations 93, extending transversely through said end wall 92, so that the longitudinal axis of each perforation is approximately parallel with the longitudinal axis of said cone. Said cone is also formed with an internal annular beveled or inclined shoulder or deflecting surface 94, arranged opposite and spaced from said series of perforations. The annular water space or chamber 31, surrounds the combining cone and steam nozzle and extends forwardly into the rear end portion of the pipe A.

The general functions and operations of a feed water heater of our type involving the water heating or forcing injector are fully set forth in our co-pending application for Patent S. No. 504,903 filed June 28, 1909. The operation of the emergency check valve is fully explained in our application Se. No. 539,897, filed Jan. 24, 1910.

In operation, the feed water driven by an injector or other pump, enters the inlet 3, at a pressure above that of the boiler pressure and raises valves 4 and 5, while steam enters inlet 2, at the boiler pressure. Under normal working conditions, the high pressure feed water passes through chamber 30, and passage 82 into chamber 31, and enters the combining cone through openings 93, and is directed forwardly in said cone by engagement with the forwardly tapered surface of the steam nozzle. The steam passes through chambers 20, 21, and 22, (maintaining the valve 7, open) and enters the combining cone through the steam nozzle in the form of a high pressure steam jet and is therein commingled with the high pressure feed water to raise the same to a high degree of temperature, and to drive the column of high pressure feed water in branch pipe A, forwardly with sufficient velocity to open the boiler check. If the boiler check should for any reason fail to open, the feed water will back up through the steam nozzle under sufficient pressure to flip the emergency valve to closed position against the bushing 6, and thereby prevent back flow of water through the steam passages to the boiler. Under such abnormal condition the pressure in the feed water heater will so increase as to prevent proper or normal operation of the feed water injector or pump and thus indicate to the engineer that the boiler check requires removal or repair.

In the present structure, however, advantages are attained by introducing the feed water under high pressure into the combining cone in the form of jets entering the cone longitudinally thereof or in the direction of flow of the water. These longitudinal high pressure jets entering through perforations 93, impinge against the beveled baffle or deflecting surface 94, and are thereby sprayed and directed inwardly and forwardly at an angle against the conical surface 81, of the steam nozzle and thereby further broken up into spray and directed forwardly in the direction of and into the high pressure steam jet discharged from the steam nozzle. By this general arrangement we are enabled to heat the water to a higher degree than heretofore, and furthermore the momentum of the flow of water is not checked in entering the combining cone.

Access can be readily gained to the interior of the shell by uncoupling the pipe A, unscrewing the steam nozzle, and removing the same and the emergency valve, and then if need be, unscrewing and removing the bushing 6. By this arrangement, the steam nozzle and emergency valve can be easily removed for repair or other purposes, without disturbing the steam and water inlet check valves.

It is evident that various changes, variations or modifications might be resorted to in the forms, constructions and arrangements of the parts described without departing from the spirit and scope of the invention and hence we do not wish to limit ourselves to the exact disclosure thereof.

What we claim is;—

1. A feed water heater comprising a shell having a passage for high pressure feed water and a separate passage for feed-water-heating steam, a branch pipe coupled to said shell, a tubular injector body arranged longitudinally in said pipe and open only at its opposite ends and forming a combining cone at its inlet end in open communication with said water passage and a delivery cone opening into said pipe, the inlet end of said combining cone being circumferentially enlarged and forming an inwardly and forwardly tapering feed-water deflecting surface and an inwardly projecting end wall around a central longitudinal steam-nozzle-receiving opening and provided with an annular series of longitudinal feed-water inlet openings opposite and spaced from said deflecting surface, and a contracted steam nozzle secured to said shell in communication with said steam passage and projecting forwardly in said combining cone within and to a point beyond said enlarged portion and deflecting surface, substantially as described.

2. A feed water heater adapted to receive feed water at a pressure higher than that of the boiler to be supplied, comprising a tubular injector member open only at its inlet and delivery ends and forming combining and delivery cones, a steam nozzle projecting forwardly within the inlet end of said member, said member longitudinally receiving the high pressure feed water around said nozzle, means relatively centering said nozzle and member, said member having an internal forwardly and inwardly tapering annular feed-water-deflecting surface spaced from the feed water inlet into said member and surrounding and spaced from said nozzle to deflect the high pressure feed water thereagainst, the exterior surface of said nozzle being tapered to spray said water forwardly into the steam jet issuing therefrom, substantially as described.

3. A feed water heater adapted to operate on feed water at a pressure above boiler pressure, comprising a tubular injector member open only at its inlet and delivery ends and forming combining and delivery cones, and a steam nozzle longitudinally arranged within the inlet end of said combining cone, said cone at its inlet end formed to longitudinally receive the high pressure feed water around said nozzle and having an inwardly and forwardly tapered internal annular deflecting-surface surrounding said nozzle intermediate its length and spaced therefrom to form an annular water passage around the inner end portion of the nozzle and to deflect the high pressure feed water across said passage and against the nozzle, substantially as described.

4. In a feed water heater, in combination, a shell, having a steam passage, a steam nozzle secured in said shell in communication with said passage and having a tapered projecting end, a branch pipe secured to said shell, a tubular injector member secured in said branch pipe and forming a delivery cone discharging into said pipe and a combining cone longitudinally receiving the tapered portion of said nozzle and having an end wall removably fitting on said nozzle and formed with inlet openings around the same and with an annular deflecting surface spaced from said inlet openings and arranged to deflect the water therefrom against the exterior surface of the nozzle, said shell having a water passage for delivering high pressure feed water longitudinally into said combining cone through said inlet openings.

5. In a feed water heater, a water heating and forcing injector comprising a steam discharge nozzle, and a combining cone longitudinally receiving said nozzle and having end longitudinal water inlets and means for breaking up the water within the cone and deflecting the same into the steam jet from said nozzle.

6. In a feed water heater, in combination, a shell, a discharge pipe therefrom and removably coupled thereto, a steam discharge nozzle discharging into said pipe and removably fitted in said shell, and an emergency check valve in said shell behind said nozzle and removable therefrom on the removal of said nozzle.

7. In a feed water heater, in combination, a shell having separate steam and water passages, a discharge pipe from said shell in communication with said passages, a steam nozzle discharging into said pipe and removably fitted in said shell, and a check valve behind said nozzle, said nozzle provided with a check valve stop and with a check valve guide.

8. In a feed water heater, a shell having a steam passage therethrough, a steam nozzle

removably secured in said shell and forming the discharge from said passage, an emergency check valve in said passage behind said nozzle and confined therein by said nozzle and removable therefrom on the removal of said nozzle, said nozzle formed with a check valve stop.

In testimony whereof we affix our signatures, in presence of two witnesses.

JARED S. SWEENY.
WILLIAM W. GRINDLE.

Witnesses:
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