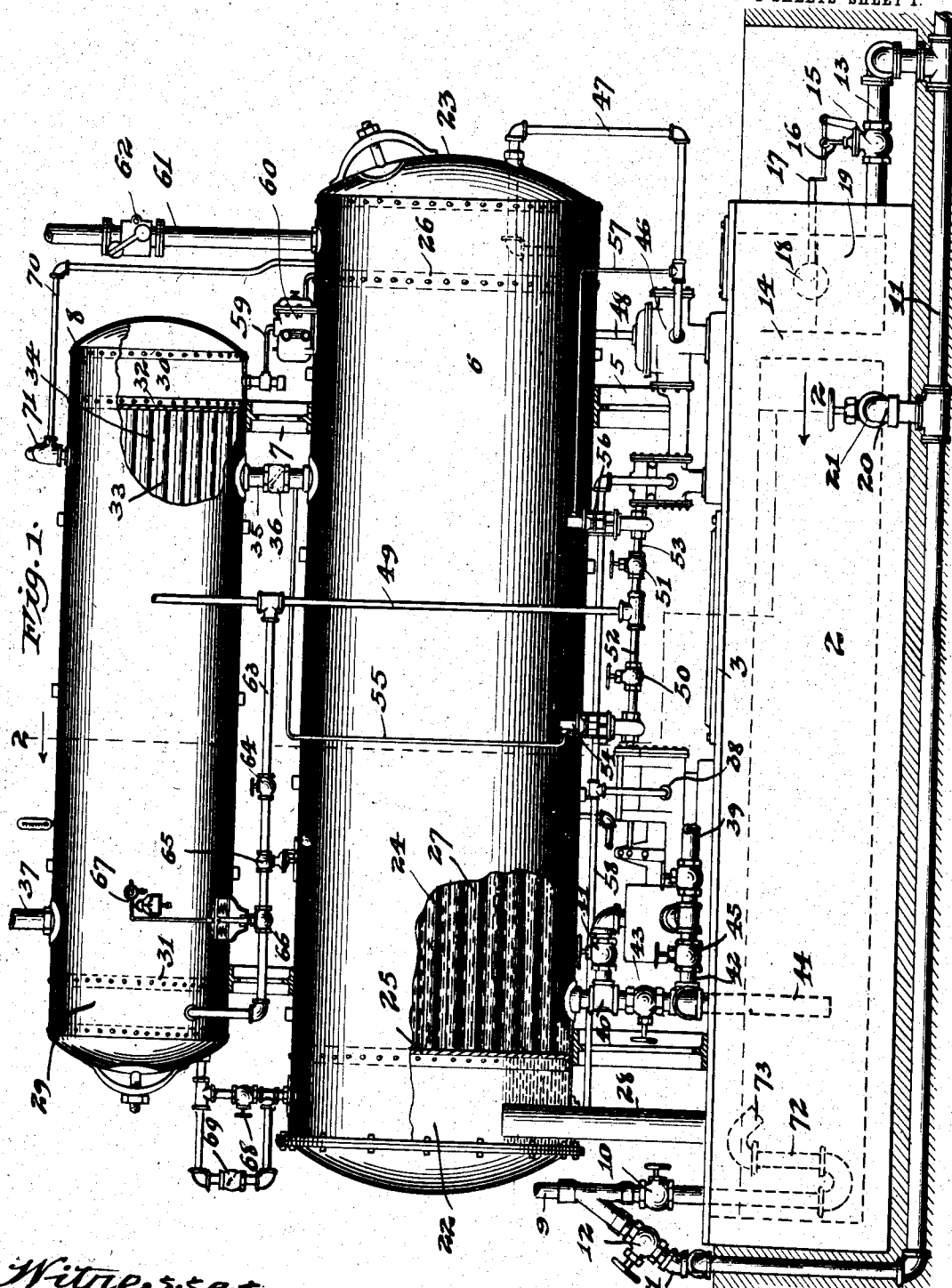


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 WASHING AND FILLING SYSTEM FOR LOCOMOTIVE BOILERS.
 APPLICATION FILED AUG. 27, 1909.

990,482.

Patented Apr. 25, 1911.

2 SHEETS-SHEET 1.



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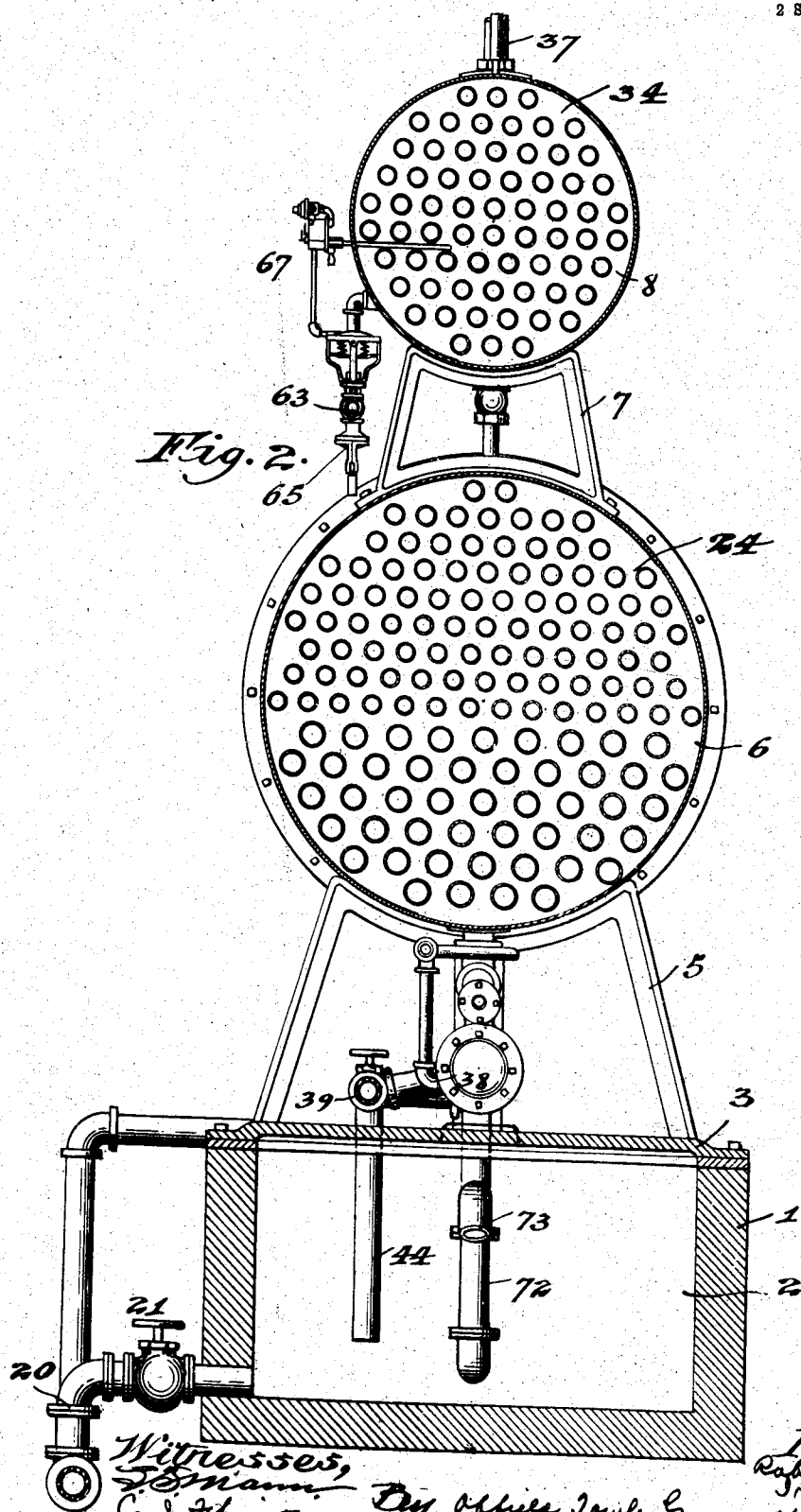


Fig. 2.

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UNITED STATES PATENT OFFICE.

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WASHING AND FILLING SYSTEM FOR LOCOMOTIVE-BOILERS.

990,482.

Specification of Letters Patent.

Patented Apr. 25, 1911.

Application filed August 27, 1909. Serial No. 514,901.

To all whom it may concern:

Be it known that we, ROBERT L. GIFFORD and IRVING COWLES, citizens of the United States, and both residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Washing and Filling Systems for Locomotive-Boilers.

This invention relates to washing out and filling systems for locomotive boilers and it has for its salient objects to provide an apparatus by which nearly all of the units of heat contained in blown out water can be recovered and transmitted to fresh supplies of water to be used for heating or other purposes as for refilling and washing locomotive boilers; to provide an apparatus so organized that the waste water from the boilers is transferred to a closed tank and the heat of the steam, incident to the relief of pressure utilized for heating other water, and lower pressure steam taken off and similarly utilized by creating a partial vacuum in the reheating apparatus; to provide a mechanism so organized that in the event of a deficiency of heat from waste water, a supplemental supply derived from steam from an auxiliary source will be automatically turned into the heating apparatus to bring the water to the desired temperature; to provide an apparatus so organized that the supplemental steam used for boosting will be utilized, not for heating the entire supply, but only so much thereof as is necessary for immediate use, thereby insuring both economy and rapid heating of the water needed for immediate use; to provide an apparatus so organized that the circulating pumps which impel the water through the system will be automatically short circuited and water pumped back to the intake side of the pumps whenever the delivery pipe or pipes is or are shut off and the pressure in the system rises above the predetermined point at which a relief valve controlling the short circuiting passages is set; to provide a system so organized that the supply of live steam for boosting purposes is admitted automatically through temperature controlled valve mechanism; to provide a system so organized that the steam evolved from the waste water and utilized for heating is condensed and the water of condensation added to the fresh water supply, while the impure water is automatically discharged to the sewer; to provide an appa-

ratus so organized that in the event the return pipe, through which the waste water reached the apparatus, is left open, the apparatus will nevertheless remain sealed and fully operative; to provide an apparatus so organized that in case of accumulation of water of condensation more rapidly than it is consumed, the supply will automatically overflow into the waste water tank and so avoid filling the condenser and reducing its condensing capacity; to provide an apparatus which is entirely automatic in all of its operations of furnishing a supply of fresh water at a predetermined temperature and this regardless of fluctuations in the supplies of waste steam and water from the locomotive; to provide an apparatus which is extremely compact and comparatively simple, and in general to provide improvements in details of construction and arrangement in an apparatus of the character referred to.

In the drawings which clearly illustrate our improved system, Figure 1 is a side elevation showing the construction, relative positions and connections of the various parts of the system, and Fig. 2 is a sectional view taken on plane 2-2, Fig. 1.

The entire apparatus is mounted on a concrete structure 1 in the form of a vat 2, this vat being sealed by a cover 3. Saddle frames 5 rest on the structure 1 and support a large condenser tank 6, while a number of saddle frames 7 mounted on top of the tank 6 support the booster condenser and heating tank 8, the entire apparatus thus requiring very little floor space. The pipe 9 serves to convey the blow off steam and hot water from the boiler to be cleaned to the vat 2, a valve 10 being interposed to close this pipe if desired. Piping 11 branches off from the pipe 9 in advance of the valve 10 and leads directly to, preferably, a sewer, this piping including also a valve 12. Piping 13 connects with the vat at the bottom and outlet end thereof and with the sewer piping 11. Near the outlet end of the vat a partition 14 extends transversely across the vat, but whose upper end terminates a distance below the top edge of the vat. In the piping 13 is interposed a valve 15 whose stem 16 connects with lever mechanism 17 carrying a float 18 at its inner end within the section 19 of the vat so that when the fluid in section 19 rises to a certain level the valve 15 will be opened. The main

compartment of the vat connects from its bottom with piping 20 which leads to the sewer piping 11, a valve 21 being interposed.

5 The main heating and condenser tank 6 is divided into left and right end compartments 22 and 23, and the central compartment 24 by the partitions 25 and 26 which are connected together by the flues 27 within the compartment 24. A pipe 28 leads from the top of the main vat 2 and extends into the left end compartment 22. The booster heating tank is also divided into left and right end compartments 29 and 30 by partitions 31 and 32 connected together by flues 33 passing through the middle compartment 34. A pipe 35 connects the upper part of compartment 24 with compartment 34, a check valve 36 being interposed in this pipe to allow flow toward the compartment 34, but to prevent return flow therefrom into the compartment 24. Extending from the upper part of the compartment 34 is piping 37 which leads to the boiler to be cleaned and filled. A pump 38 receives water from a water-main 39 and operates to force this water through piping 40 into the lower part of the middle compartment 24 of the main heating tank 6, the valve 41 being interposed in this piping. Piping 42 serves to connect the water-main directly with the compartment 24 and is controlled by a valve 43. An extension 44 from this piping leads into the main vat 2 to the bottom thereof so that the vat can be flushed and washed out when desired, flow through this extension being controlled by the valve 45. A vacuum pump 46 is connected through piping 47 with the lower part of the left end compartment 23 of tank 6 and delivers through pipe 48 to the compartment 24. The pumps are mounted on the structure 1 and receive their steam supply from piping 49 connected with a steam generating source, the valves 50 and 51 interposed in branches 52 and 53, respectively, controlling the steam supply to the pumps 38 and 46, respectively.

Included in the branch 52 between valve 50 and pump 38 is an automatic governor valve 54 connected through piping 55 with the upper end of the compartment 24 of tank 6 and this governor valve is so adjusted that it will automatically shut off steam supply to the pump 38 if the pressure in compartment 24 reaches a predetermined maximum. In the branch 53 between the valve 51 and pump 46 is included an automatic governor valve 56 connected through pipe 57 with pipe 47, this governor valve acting to shut off the steam supply to pump 46 whenever the vacuum in the end compartment of the tank 6 rises above a predetermined value. The exhaust steam from the pumps escapes through piping 58 into pipe 59 and thence into the end compartment 22.

Piping 59 connects the lower part of the end compartment 30 of tank 8 with the end compartment 23 of tank 6, a trap 60 being interposed so that fluid will flow from the compartment 30 to compartment 23 only when a certain level is reached in compartment 30. The upper end of compartment 23 connects with the exterior through pipe 61 in which is interposed an automatic back pressure valve 62. The end compartment 29 of tank 8 is adapted for connection with the live steam pipe 49 through piping 63, a valve 64 controlling said piping. An adjustable reducing valve 65 is also included in piping 63 to cut down steam pressure to any desired value. Between the reducing valve and the compartment 29 the piping 63 also includes a valve 66 which is thermostatically controlled by thermostatic mechanism 67 which is exposed to the interior of compartment 34 to be effected by the temperature therein. The thermostatic mechanism is adjustable so that the valve 66 is controlled to adjust the steam flow into the compartment 29 in accordance with the temperature in compartment 34. The compartment 29 is also adapted for connection with the upper end of compartment 22 through valve 68 which may be shunted by check valve 69. The upper end of compartment 23 is adapted for connection through piping 70 with the upper end of compartment 34, a valve 71 being interposed in said piping and actuated only when a certain pressure is reached in compartment 34 to open the passageway from compartment 34 to compartment 23.

The operation of the system can now be followed. Valves 12 and 21 and 68 are normally closed and valve 10 is opened to allow the hot water and steam to flow from the boiler into the vat compartment 2, this compartment being sufficiently large to receive and to hold all the water. The water and steam coming from the boiler have still considerable pressure and temperature, and when the large vat is reached the pressure is immediately relieved and the water begins to boil. The blow off steam, of course, after reaching the vat immediately escapes through pipe 28 into the end compartment 22 of tank 6, and the steam generated upon boiling of the water in the vat will also flow through pipe 28 into the compartment 22. Boiling of the water will continue, at least, until its temperature falls to 212 degrees. However, vacuum pump 46 is set in operation and creates vacuum in the end compartments 22 and 23 and in the vat so that boiling of the water in the vat will continue until the temperature falls considerable below 212 degrees. The amount of vacuum generated by the pump can be adjusted by the back pressure valve 62. By means of this vacuum effect, therefore, all the useful heat units contained in the blow off water

can be liberated. None of the dirt in the water can possibly reach the tank 6 as only steam and vapor generated by the boiling of the water will flow to the tank, and, therefore, the tank is always clean. Besides, the steam and vapor, after condensing in the tank, will form soft water free from all minerals or foreign substances. The lower end of pipe 10 is given a reverse curve to form a vacuum seal 72. The end 73, preferably, deflecting toward the outlet end of the vat so that any dirt in the water will be flushed toward the sewer end. Pump 38 is also set in operation and valve 41 opened so that water is forced into the compartment 24 about the flues 27 and thence through pipe 35 into compartment 34 about the pipes 33 and through piping 37 to the place of consumption. The hot steam and vapor received in compartment 22 from the vat distributes itself through the flues 27 and into the right end compartment 23, the heat of the steam and vapor being extracted by the water surrounding the flues and the steam and vapor condensed. This water of condensation is sucked into piping 47 and forced by the pump 46 into the compartment 24 to mingle with the water supplied to said compartment from the main 39. If the water heated in compartment 24 and flowing through compartment 34 is sufficiently hot, the thermostatic mechanism 67 will not be effected and valve 66 will remain closed. If, however, the water is not sufficiently hot to be used the thermostatic mechanism 67 becomes active to open valve 66 will remain closed. If, however, the water is not sufficiently hot to be used the thermostatic mechanism 67 becomes active to open valve 66 to connect live steam from steam pipe 49 with the end compartment 29 of tank 8 and this live steam flows through the flues 33 and radiates additional heat to the water in compartment 34 until the water is sufficiently hot, and thus the water is automatically maintained at proper temperature. Whenever the pressure in the steam compartments of the condenser 6 exceeds that in the steam compartments of condenser 8, steam will flow through check valve 69 and through flues 33 and assist in heating the water. When, however, the pressure is greatest in condenser 8 this valve will close. The condenser 8, therefore, constitutes a booster mechanism which assists in heating the supply water and which is automatically connected with live steam to boost up the temperature if sufficient heat is not available from the blow off steam and water. The condensed steam in tank 8 finds its way into the compartment 30 and thence through piping 59 and trap 60 into the end compartment 23 from whence it is delivered by pump 46 into compartment 24 to add its remaining heat to the water in said compartment. The

booster tank can also be used alone by adjusting the thermostatic mechanism 67 and the reducing valve 65 so that the proper amount of steam can flow to heat the water in the tank to any desired degree. Both tanks can also be used independently of blow off water and steam for heating water. When this is desired valve 68 is opened to connect compartments 29 and 22, and thermostatic mechanism 67 and reducing valve 65 are adjusted so that the proper amount of live steam can flow directly from the steam pipe 49 through the tanks to heat the water therein. Under normal conditions, however, valve 68 is closed.

Piping 70 with the valve 71 forms a relief path should the piping 37 be closed, as, when the pressure of the water in the tanks becomes sufficient to open valve 71, the water will overflow through piping 70 and into compartment 23 from whence it will be forced by pump 46 back into compartment 24, and if the water in the end compartments 22 and 23 rises above the level of pipe 28, it will escape into the vat and thence into the sewer piping. The relief valve 71 however, will not become effective unless controlling valve 54 refuses to act. If this controlling valve acts properly it will cause disconnection of steam supply from pump 38 as soon as pipe 37 is closed, and supply of water to compartment 24 will be discontinued until the pipe 37 is again opened. If, during active operation of the booster tank the pipe 37 is closed or resistance there-through increased the expansion of the heated water in compartment 34 will open relief valve 71 and the overflow taken care of, back flow of the water into the compartment 24 under such conditions being prevented by the valve 36. By closing valve 10 and opening valve 12 the blow off water and steam can be diverted directly to the sewer if desired. The vat can be emptied directly to the sewer by opening valve 21, the valve 42 being opened at the same time so the vat will be thoroughly flushed out and cleaned by the water from main 39. In our improved system, therefore, nothing but pure, clean water is delivered for washing out and refilling purposes. The dirty water from the boiler is diverted directly to the sewer, but only after the useful heat is extracted therefrom, this thorough extraction of heat being made possible by the novel use of vacuum effect which will cause steam and vapor to be given off by the water until very little heat is left therein. The booster mechanism is automatically rendered effective to add heat to the water when necessary so that the delivered washout and refilling water is always at a desired temperature. All relief and safety connections and appliances act entirely automatically so that the system requires very little attention. No cleaning of

the tanks is necessary as only clean water flows therethrough.

Having thus described our invention with its various novel and very desirable features, we desire to secure the following claims by Letters Patent.

1. In a washout and refilling system for locomotive boilers, the combination of a sealed vat for receiving blown-off products, a blow-off main connected therewith, a water heater having steam circulating space in communication with the upper steam space of said vat, means for creating and maintaining a partial vacuum in the steam spaces of the vat and water heater substantially continuously during the period a locomotive boiler is blown off into said vat, and suitable circulating and conducting means for circulating refilling water to be reheated through said heater and conducting it to the round house stalls.

2. In a washout and refilling system for locomotive boilers, the combination of a sealed vat for receiving blown-off products, a blow-off main connected therewith, a water heater having steam circulating space in communication with the upper steam space of said vat, means for creating and maintaining a partial vacuum in the steam spaces of the vat and water heater substantially continuously during the period a locomotive boiler is blown off into said vat, mechanism for withdrawing the water of condensation from said water heater as formed, and suitable circulating and conducting means for circulating refilling water to be reheated through said heater and conducting it to the round house stalls.

3. In a washout and refilling system for locomotive boilers, the combination of a sealed blow-off vat, a blow-off main leading from the round house to, and communicating with said vat, a main water heater internally constructed to form a closed steam condenser, having its steam space in communication with the steam space of said vat, cooperating vacuum inducing mechanism associated with said main heater-condenser whereby circulation of steam into the latter is augmented and back pressure minimized, a secondary heater into which the water passes from the main heater, a source of auxiliary steam, suitable connections for admitting said auxiliary steam to said secondary heater and suitable circulating and conducting means for circulating refilling water to be reheated through said heaters and conducting it thence to the round house stalls.

4. In a washout and refilling system for locomotive boilers, the combination of a sealed blow-off vat, a blow-off main leading from the round house to, and communicating with said vat, a plurality of water heaters, each internally constructed to form a

closed steam condenser, piping connecting the steam space of one of said heaters with the steam space of said vat, piping connecting the steam spaces of the several heaters with each other, connections between the water spaces of the several heaters whereby water may be circulated from that heater directly connected with the vat serially through the other or others, vacuum inducing mechanism acting on the steam spaces of said heaters, means for inducing circulation of water through said heaters, a source of auxiliary steam, suitable connections for admitting said steam to one or more of said heaters and thermostatically-actuated valve mechanism arranged to control the admission of auxiliary steam.

5. In a washout and refilling system for locomotive boilers, the combination of a sealed blow-off vat, a blow-off main leading from the round house to, and communicating with said vat, a plurality of water heaters, each internally constructed to form a closed steam condenser, piping connecting the steam space of one of said heaters with the steam space of said vat, piping connecting the steam spaces of the several heaters with each other, connections between the water spaces of the several heaters whereby water may be circulated through them serially, means for inducing circulation of water through said heaters, vacuum-inducing mechanism acting on the steam spaces of said heaters, a source of auxiliary steam, suitable connections for admitting said steam to one or more of said heaters, a reducing valve controlling the pressure of auxiliary steam admitted, and automatic valve mechanism arranged to control the period of admission to auxiliary steam, said automatic valve mechanism being thermostatically controlled by the temperature of the water undergoing the heat.

6. In a washing and filling system for boilers, the combination of a closed vat for receiving hot blow off water, a condenser having steam compartments and having a water compartment through which water may circulate to be heated, said steam compartment having connection with the vat at a point above the level of the water in said vat whereby said water is prevented from flowing from the vat to the steam compartment, a vacuum pump connected with said steam compartment, said pump delivering to the water compartment of the condenser to pump the water of condensation from the steam compartment into the water compartment to be mixed with the water to be heated, the extraction of the water of condensation cooperating with the condenser to create a vacuum effect in the steam passages and thereby in the vat, whereby the pressure on the water in the vat is reduced and vapor and steam generated at low pres-

5 sures to flow into the steam compartments of the condenser.

7. In a washing and filling system for locomotive boilers, the combination of a main heater having pipes through which steam may circulate, a sealed vat and a communicating passage extending from said vat to the steam space of said main heater, an auxiliary heater having pipes through which steam may flow, communicating passages between the steam spaces of the main and auxiliary heaters and between the water spaces of the main and auxiliary heaters, means for causing water to flow serially through said heaters from the main heater to the auxiliary heater, means for preventing back flow of water from the auxiliary heater to the main heater, a source of auxiliary steam connected with the steam space of the auxiliary heater, means automatically controlled by the temperature of the water in the auxiliary heater to control the flow of auxiliary steam to the latter and supplemental connections between said heaters whereby auxiliary steam can at will be fed simultaneously to both heaters.

8. In a washing and filling system for boilers, the combination of a main heater having a steam compartment and a water compartment, an auxiliary heater having a steam compartment and a water compartment, a check connection between the water compartments of the heaters for allowing flow of water from the main heater to the auxiliary heater but for preventing back flow of water directly from the auxiliary heater to the main heater, means for forcing water into the main heater water compartment, an outlet from the auxiliary heater water compartment for conveying heated water to a place of consumption, means for causing steam to flow through the steam compartments of the heaters to heat the water circulating through the water compartments, a relief connection between the water compartment of the auxiliary heater and the steam compartment of the main

heater, and an overflow outlet from the main heater steam compartment.

9. In a washing and filling system for boilers, the combination of a main heater having a steam compartment and a water compartment, an auxiliary heater having a steam compartment and a water compartment, a check connection between the water compartments of the heaters for allowing flow of water from the main heater to the auxiliary heater, but for preventing back flow of water directly from the auxiliary heater to the main heater, means for forcing water into the main heater water compartment, an outlet from the auxiliary heater water compartment for conveying heated water to a place of consumption, means for causing steam to flow through the steam compartments of the heaters to heat the water circulating through the water compartments, a relief connection between the water compartment of the auxiliary heater and the steam compartment of the main heater, a pump for returning overflow water from the main heater steam compartment to the water compartment of the main heater, and an overflow outlet for the water from the main heater steam compartment.

10. In a heating system of the character described, the combination of a blow-off pipe, a sealed vat into which said blow-off pipe enters and discharges, a self-acting seal controlling the passage through said pipe and arranged to admit blow-off products under a predetermined pressure, a water heater condenser in communication with the upper part of said vat and means for creating vacuum effect in said vat to cause the generation of steam therein at pressures below atmospheric pressure.

In witness hereof, we hereunto subscribe our names this 23rd day of August 1909.

ROBERT L. GIFFORD.
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Witnesses:

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