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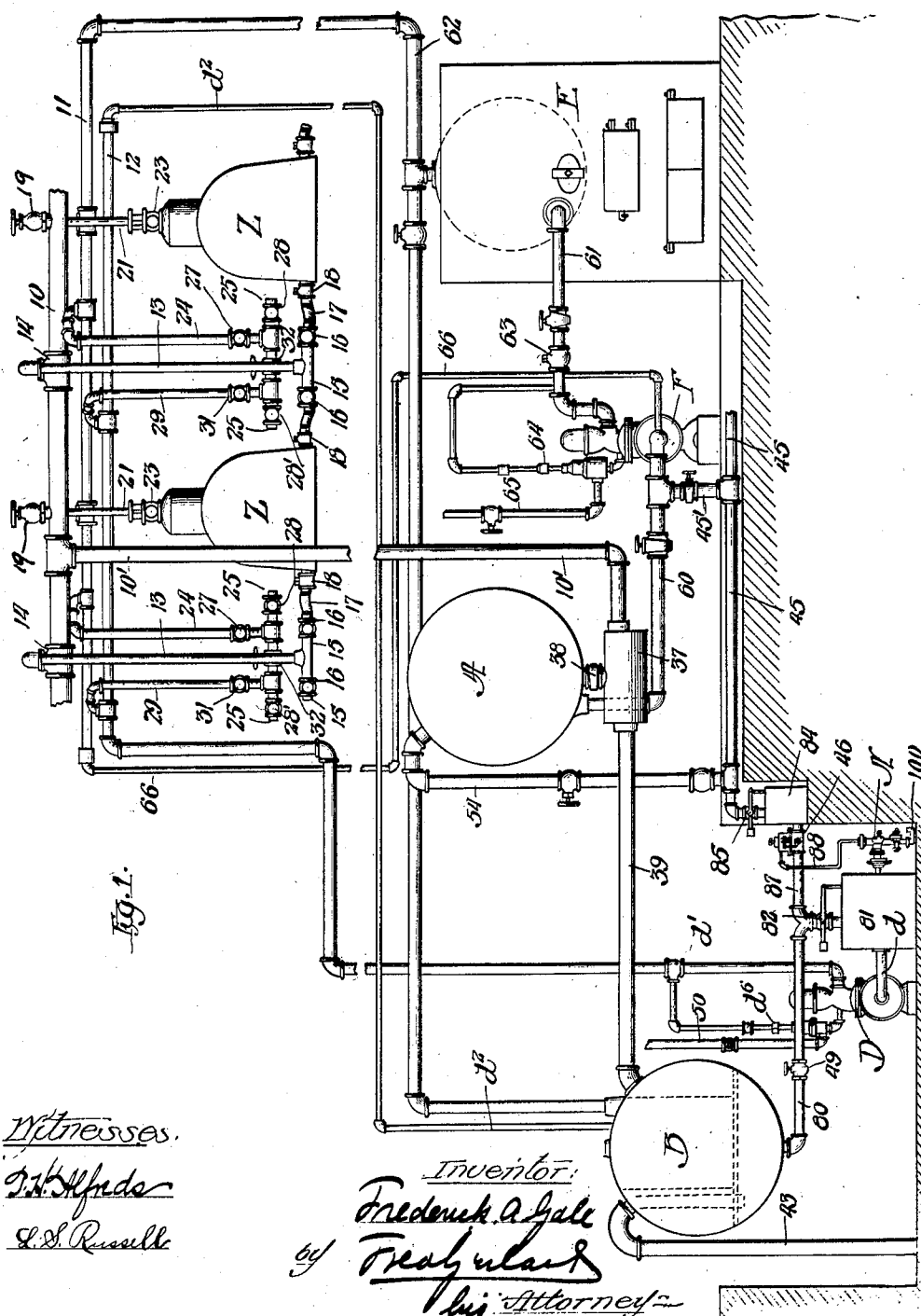
PATENTED SEPT. 18, 1906.

F. A. GALE.

APPARATUS FOR WASHING OUT AND REFILLING LOCOMOTIVE BOILERS.

APPLICATION FILED MAR. 24, 1906.

4 SHEETS—SHEET 1.



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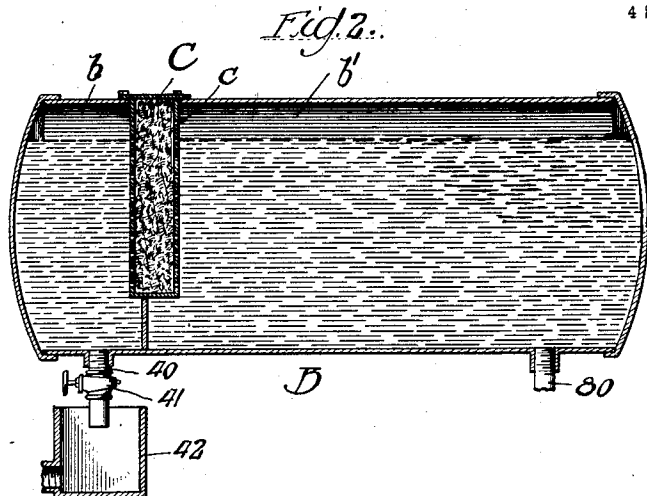
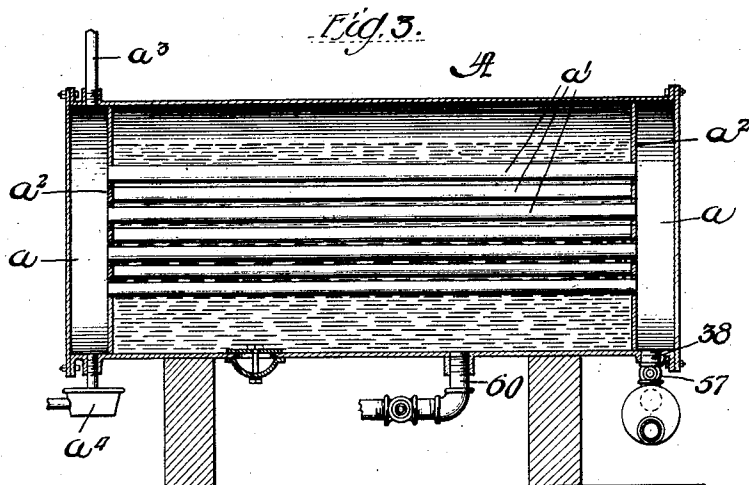
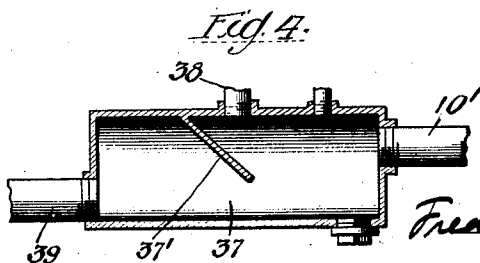
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4 SHEETS—SHEET 2.



Witnesses:

T. H. Alfred

Leone S. Russell

Inventor:

Frederick A. Gale

by *Frederick A. Gale*
Att'y.

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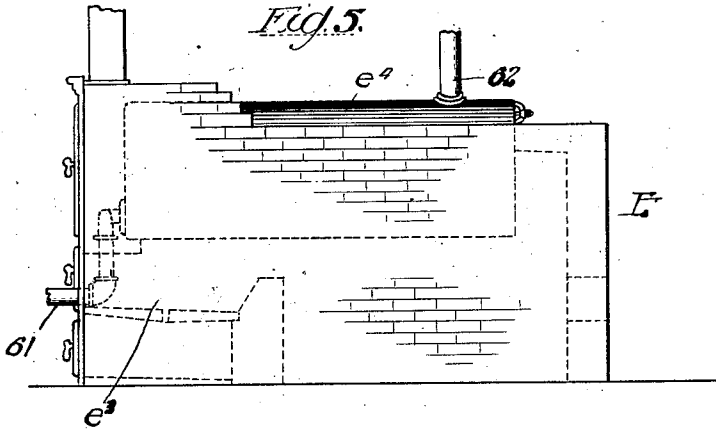
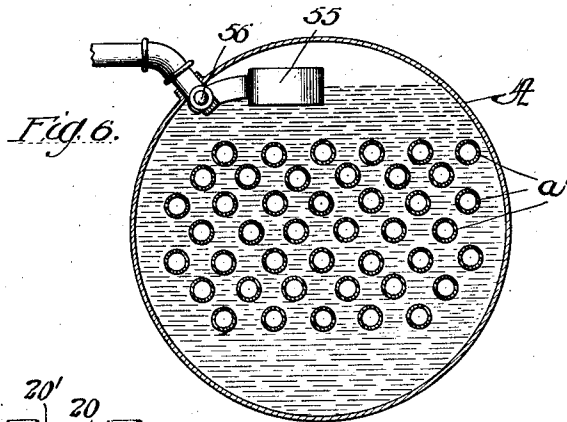
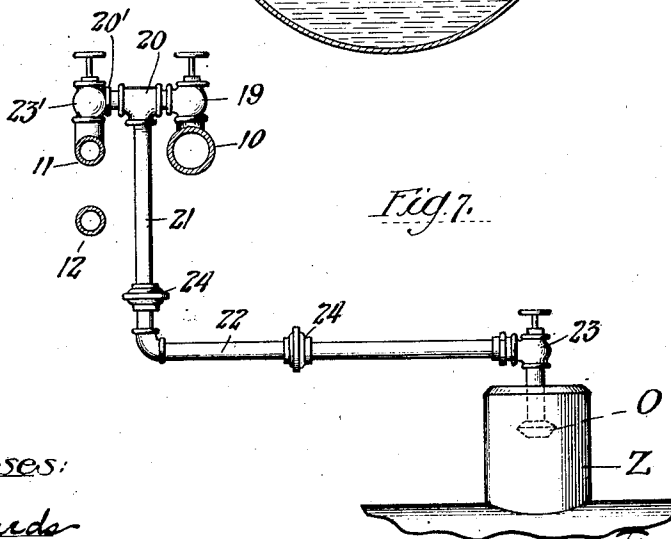
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4 SHEETS—SHEET 3.



Witnesses:

T. A. Alford
Wm. P. Bond

Inventor

Frederick A. Gale

By. Frazer & Co.
Attys.

No. 831,337.

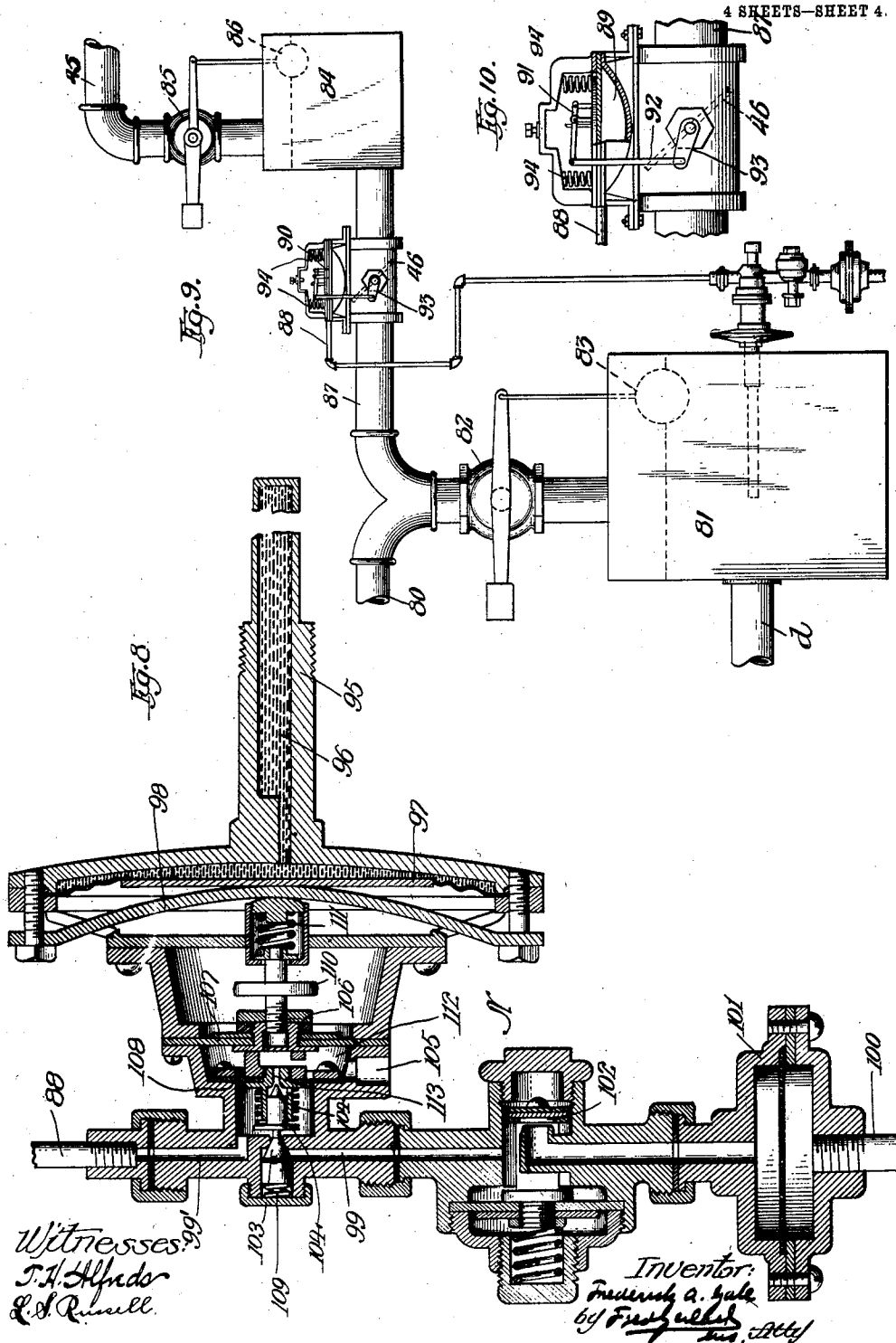
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4 SHEETS—SHEET 4.



UNITED STATES PATENT OFFICE.

FREDERICK A. GALE, OF CHICAGO, ILLINOIS.

APPARATUS FOR WASHING OUT AND REFILLING LOCOMOTIVE-BOILERS.

No. 831,337.

Specification of Letters Patent.

Patented Sept. 18, 1906.

Application filed March 24, 1906. Serial No. 307,803.

To all whom it may concern:

Be it known that I, FREDERICK A. GALE, a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Washing Out and Refilling Locomotive-Boilers, of which the following is a full, clear, and exact description.

The invention relates to roundhouse equipments, and more particularly to apparatus for washing out and recharging locomotive-boilers.

One object of the present invention is to utilize the blow-off water for washing out a locomotive, and thus effect a material saving in the amount of water used and also saving the heat units of the blow-off water.

Another object of the invention is to provide apparatus whereby the temperature of the water used for washing out is supplied to the roundhouse-main at the desired temperature without the necessity of mixing cold and hot water at or near the discharge connection. A resultant advantage of this feature of the invention is that the temperature of the water used for washing out the boiler is not dependent on the workman employed for washing out boilers and being automatically regulated requires no attention from the workman. In practice it has been found that some workmen are disposed to use water at lower than proper temperature, wherefrom cracking of the boiler or crown-sheet thereof is likely to result.

The invention further designs to provide apparatus which makes possible quick recharging of the locomotive-boiler.

Still another object of the invention is to provide improved apparatus in which the blow-off steam is directly utilized to heat the feed-water used for the locomotive-boilers and comprising a fuel-heater whereby the feed-water will be superheated, so that the boiler when filled with such water will contain both steam and water necessary to put the locomotive in condition for service. This apparatus is very economical, because it is only necessary to increase the temperature of the feed-water by a superheater, in which fuel is consumed to supply the deficiency necessary to raise the temperature of the feed-water, to promptly render the locomotive serviceable.

Lastly, the invention designs to provide improved apparatus for washing out and recharging locomotive-boilers.

The invention consists in the several novel features hereinafter set forth, and more particularly defined by claims at the conclusion hereof.

In the drawings, Figure 1 is a diagrammatic view of the improved apparatus, the pipe connections located in the roundhouse or near the engine-stalls being shown in elevation at the top of the sheet, and other apparatus, which may be located at any convenient place, being also shown in elevation. Fig. 2 is a view in vertical longitudinal section of the reservoir for receiving and containing the blow-off water. Fig. 3 is a similar view of the feed-water heater and reservoir. Fig. 4 is a similar view of the separator, whereby the blow-off steam is separated from the blow-off water. Fig. 5 is a side elevation of the superheater. Fig. 6 is a transverse section of the feed-water heater shown in Fig. 3. Fig. 7 is a detail view showing the pipe-mains and the manner of connecting the dome-cock of a boiler to the feed-water and blow-off mains. Fig. 8 is an elevation of the apparatus for automatically regulating the temperature of the water used for washing. Fig. 9 is a section of the thermostatically-controlled mechanism for operating the valve for admitting cold water to the mixing-tank; and Fig. 10 is a detail view, partly in section, of the valve for admitting cold water to the mixing-tank.

The roundhouse is equipped with a series of pipes comprising a blow-off main 10, a feed-water main 11, and a main 12 for washing-water. These extend around the roundhouse and are provided with taps or connections in suitable number, according to the capacity of the roundhouse.

Each blow-off connection for the blow-off main 10 comprises a pipe standard or leg 13, connected to the blow-off main, as at 14, and branch pipes 15, connected to the lower end of pipe 13, each of which is provided with a valve 16 for respectively controlling communication between the blow-off main and a locomotive-boiler Z at each side of the pipe 13. Pipe 13 is arranged midway between two engine-stalls, so that a locomotive at either side can be simultaneously blown off through said pipe, or, if desired, a locomotive can be blown off through both of its cocks 18. A flexible pipe 17 is adapted to connect either of the branch pipes 15 with a blow-off cock 18, usually provided at each side of the locomotive-boiler. The blow-off water and sedi-

ment in the locomotive-boiler will by reason of the pressure in the boiler be forced through cocks 18, flexible pipes 17, valve 16, and pipes 15 and 13 into the blow-off main. The connections for blowing off steam (see Fig. 7) into the blow-off main each comprise a valve 19, connected to main 10, pipe 20, pipe-standard 21, and a pipe 22, one end of which is adapted to be connected to a valve 23, usually provided in the dome of the boiler. Pipes 21 and 22 are provided with flexible joints 24 for convenience in connecting the dome of the boiler to the blow-off and feed-water mains. When this connection to the dome has been made, the blow-off steam can pass through pipes 22 21 20 and valve 19 into the blow-off main 10. The connection, comprising pipes 21 and 22, serves also as a filling connection.

A pipe 20' is connected to pipe-standard 21 and to a valve 23', which is connected to feed-water main 11. (See Fig. 7.) This connection makes it possible to introduce feed-water into the boiler through the dome connection. The feed-water main is also connected by a pipe standard or leg 24 to branches 25, which have terminals adapted to be connected by flexible pipes, such as 17, to the blow-off cocks at the sides of the locomotive. A valve 27 controls supply of feed-water to branches 25, and a valve 28, adjacent one terminal of one of the branch pipes 25, controls passage through said terminal. Valves 32 and 28' control passage of feed-water to the other terminal of pipe 25. Obviously by means of valves 28, 32, and 28' feed-water can be supplied through either or both of the branch pipes 25 to the boilers adjacent the leg 24.

The wash-out main 12 is connected to supply washing-water to branches 25 by a pipe-standard 29, which is connected to said branch and is provided with a valve 31 for controlling the passage of washing-water to said branches. Valve 32 is arranged between the couplings 25 and pipes 24 and 29 to cut off communication therebetween, so that the terminal at one side can be used for refilling, while the terminal at the other side can be used for washing. By manipulation of valves 27, 28, 32, and 28' either or both of the terminals of branch 25 can be used for supplying water to a wash-out connection.

Blow-off main 10 conducts the contents of the locomotive-boiler (steam and water) to a pipe 10', connected to a separator 37, Fig. 4, whereby the blow-off steam is separated from the blow-off water. The steam passes by a pipe 38 to a feed-water reservoir and heater A, and the blow-off water and impurities therein pass through a pipe 39 to a reservoir B for the washing-water. It will thus be seen that the blow-off steam and blow-off water can be simultaneously discharged from the locomotive-boiler through a common

pipe and then separated, so that the steam can be used to heat the feed-water and the impure blow-off water sent to the reservoir for the washing-water.

Reservoir B for containing the washing-water is provided near one end with a strainer or filter C, Fig. 2, at one side of which is arranged a chamber *b'* for the purified blow-off water, and at the other side of which is arranged a receiving-chamber *b* for the blow-off water as it comes from the boiler and to which pipe 39 is connected. The blow-off water passes from the receiving-chamber *b* through filter C into the storage-chamber *b'*. The strainer purifies the blow-off water sufficiently so it can be used to advantage in washing out the boiler. This strainer or filter is preferably mounted in a removable frame *c*, which can be withdrawn and replaced through an opening in the top of the reservoir. The heavier portions or foul contents of the boiler settle in chamber *b* and may be withdrawn, when desired, through a discharge-pipe 40, controlled by a valve 41 and leading to a sludge-tank 42. An overflow-pipe 43 terminates near the lower portion of chamber *b* and conducts the excess blow-off water to the sewer. On account of such construction the coldest portion of the water in the reception-chamber passes to the sewer.

The washing-water should be used at a temperature ranging from 100° to 130° Fahrenheit, and the blow-off water as it enters reservoir B is usually of a much higher temperature. Resultantly it frequently occurs that the filtered water in reservoir B is too hot for washing. A pipe 45, usually connected to the water-supply main, supplies cold water which is mixed with the purified blow-off water, to temper the water supplied to washing-main 12. A pipe 80 is connected to the bottom of reservoir B and conducts the purified blow-off water to a reservoir 81. A valve 82 is included in said pipe and is automatically operated by a float 83, so that reservoir 81 will always contain a supply of water at suitable temperature for washing. Cold-water pipe 45 is connected to a tank 84, and a valve 85, which is controlled by a float 86 in said tank, automatically regulates the supply of cold water to said tank. A thermostatically-controlled butterfly-valve 46 is included in a pipe 87, which connects pipe 80 and tank 84 and controls the supply of cold water to reservoir 81. Purified blow-off water in reservoir B is not under pressure, and the purpose of tank 84 is to reduce the pressure under which the cold water is usually supplied in main 45, so that the pressure of the cold water and the hot water passing to reservoir 81 will be substantially equalized. This feature is important, because unless the pressures are equalized the water under greater pressure will preponderate and effect

a sudden change of temperature of the washing-water in the mixing-tank. By thus substantially equalizing the pressure of the water in pipes 80 and 87 the temperature of the water in reservoir 81 can be regulated to a nicety. Valve 46 is normally spring-pressed into closed position and is opened by fluid under pressure supplied through a pipe 88 into a chamber 89, formed in the valve-casing. Fluid in chamber 89 acts upon a diaphragm 90, which operates a lever 91, connected by a rod 92 to an arm 93, secured to the stem of the butterfly-valve. Springs 94 restore the valve to closed position and hold said valve normally closed.

A thermostatic regulator N, Fig. 8, controls the supply of fluid under pressure to pipe 88 and butterfly-valve 46. A pipe 100 for fluid under pressure—*e. g.*, water or air—is connected to a suitable source of supply and conducts said fluid to the regulator. A filter 101 and a pressure-reducing valve 102 of usual construction are included in said pipe 100, and the pressure-reducing valve 102, of usual construction, is adapted to supply fluid under desired pressure to a fluid-port 99 in the casing of the thermostatic regulator. The regulator comprises a tube 95, located in reservoir 81 and containing an expansible fluid 96, such as mercury, which acts upon a diaphragm 97 against the force of a restraining-spring 98. A valve 103 controls the passage of fluid under pressure through port 99 to a port 99', connected to pipe 88 and the butterfly-valve. Valve 103 is normally held in closed position by a spring 109 and is provided at its inner end with a valve 104 for controlling the passage of fluid to outlet 105 after the butterfly-valve has been operated. Restraining-spring 98 acts on a stem 106, which has its outer end connected to diaphragms 107 and 108. A spring 109 is interposed between the outer end of stem 106 and the exhaust-valve 104 and presses the seat of said valve away from said valve when said stem is moved inwardly as a result of the contraction of the medium 96 in pipe 95. An adjusting-nut 110 for regulating the operation of valve 103 is provided, and a relief-spring 111 is interposed between the restraining-spring 98 and the valve-stem. When the parts are in normal position (shown in Figs. 8 and 9) and the water supplied to reservoir 81 by pipe 80 is too hot for washing out a boiler, medium 96 will expand, and thereupon stem 106 will be operated to open admission-valve 103 and to close exhaust-valve 104. Thereupon fluid under pressure from pipe 100 will pass through port 99' in the regulator to pipe 88 to operate the butterfly-valve 46 against the force of its retaining-springs 94 to open said valve, whereupon cold water from tank 84 will flow to reservoir 81 and temper the water. When the temperature has been lowered to the desired point,

the medium 96 will contract, and thereupon admission-valve 103 will be closed and exhaust-valve 104 will be opened, so the fluid in pipe 88 can escape, via a port 113, to a chamber 112 and outlet 115.

A steam-pump D serves to force the water in reservoir 81 to the wash-out main. The inlet of said pump is connected to reservoir 81 by a pipe *d*, and the discharge of the pump is connected by a pipe *d'* to wash-out main 12. A valve 49 is also provided for cutting off the supply of water from reservoir B to the pump when desired. Pump D is of usual construction and operated by steam conducted thereto by a pipe 50, and its operation is controlled by a suitable governor *d*—*e. g.*, such as is commonly known as a "Fisher" governor—which is operated by the pressure of the water in pipe *d'* to automatically start and stop the pump and maintain desired pressure in main 12. A small circulating-pipe *d*² is connected to one end of main 12 and to the reservoir. It is important to keep the washing-water in the main at the proper temperature. If it should cool, there is likelihood of injury to the boiler at the outset of a washing-out operation, when the cool water comes in contact with the hot walls of the boiler or crown sheet. By maintaining at least a slow circulation of washing-water when the washing-out system is not being used all likelihood of such injury is avoided. Manifestly this apparatus utilizes the blow-off water for washing out the locomotive-boiler and, furthermore, saves to the fullest extent the heat units in the blow-off water and in the sediment blown off from the boiler and renders operation of the plant extremely economical, because both the water and the heat units of the blow-off water are utilized. Furthermore, the water for washing is supplied to the roundhouse-main at the proper temperature for washing without the necessity of mixing hot and cold water at the discharge connection. The temperature of the washing-water is automatically and thermostatically regulated, and thus always at the proper temperature to avoid injury to the boiler. The workman employed for washing out need not mix cold and warm water to obtain water of the proper temperature for washing out the locomotive-boiler. Furthermore, the workman at the roundhouse cannot change the temperature of the water used for washing, which always arrives at the wash-out connection at the proper temperature. The disposition of some workmen is to use washing-water at too low a temperature, since that is easier to wash out with; but with the improved apparatus the workman is obliged to use at all times washing-water at the proper temperature, and therefore fracture of the boiler or crown sheet cannot occur as a result of the use of water which is too cold for washing.

In blowing off a locomotive steam is conducted with the blow-off water to separator 37. Said separator is provided with a baffle 37' for checking the passage of steam through the separator with the blow-off water. The steam passes from separator 37, through pipe 38, to feed-water reservoir A. This heater is provided with a steam-chamber *a* at each end and circulating-pipes *a'* in desired number, wherethrough the steam will pass from the chamber at one end of the reservoir to the chamber at the other end. Around the pipes and between heads *a''* is formed a chamber for the feed-water used for recharging a boiler. A small pipe *a'''* is connected to the chamber *a* at one end of heater A to permit the steam to slowly escape. A trap *a''''* is provided for the water of condensation in the heater. Fresh water is supplied to reservoir A by a pipe 54, which is connected to the cold-water-supply pipe 45. A float 55, Fig. 6, automatically controls a valve 56, which controls the supply of fresh water to the feed-water reservoir, so that a body of fresh water will at all times be within the heater. The blow-off steam passing through heater A materially raises the temperature of the feed-water. A valve 57 is provided in pipe 38, through which the blow-off steam enters heater A, so the blow-off steam can be discharged in reservoir B, if desired. The blowing-off operation with the improved apparatus consumes a very short period because the steam and water can be simultaneously discharged from the locomotive-boiler, and by using a large blow-off main through which both the steam and water are blown off the blowing-off operation can ordinarily be effected in about four to eight minutes. Furthermore, by cutting off the blow-off steam at the dome connection the steam can be used to force the water from the boiler into reservoir B.

The feed-water for recharging the boiler is forced into the boiler at a pressure of about one hundred pounds and at a temperature of about 300° Fahrenheit. The superheated water discharged into the boiler results in rapid diffusion of sufficient steam, so the locomotive will when charged be immediately put into condition for service.

A superheater E, Fig. 5, is provided for raising the temperature of the feed-water before it is supplied to the locomotive-boiler. The superheater is preferably a fuel-heater, comprising a fire-pot *e''* and a boiler *e'''*, which contains feed-water from heater A. In this superheater the temperature of the water from heater A is raised to supply the deficiency in temperature necessary in charging in such manner that the locomotive will be quickly restored to serviceable condition. A fuel-heater as distinguished from other heaters, such as steam, is of importance, because it is more economical in operation and, fur-

thermore, because it is possible thereby to quickly raise the temperature of the hot water from reservoir A to the desired temperature of the feed-water (approximately 300°) for introduction into the locomotive-boiler and so as to permit the quick-filling operation herein set forth and without retarding the filling operation. Furthermore, in many roundhouse equipments the use of steam is to be avoided for this purpose, so the steam-supply usually provided is not overtaxed, and because it would be impossible to generate the desired amount necessary for the purpose as quickly as desired. By banking the fire when the apparatus is not in use a material saving of fuel will be effected. For these reasons a fuel heater or boiler operated directly by the heat generated by fuel is of advantage in the practice of the invention. Manifestly the feed-water is raised to the desired temperature in an economical manner, because the blow-off steam is utilized to raise the temperature of the feed-water (sometimes as high as 200° to 205°) and only a small amount of fuel is necessary to superheat the water for refilling a locomotive-boiler. A pipe 60 conducts water from the feed-water heater and reservoir A to a steam-pump F, from which said water passes by pipe 61 to the superheater E. A pipe 62 conducts the superheated water from heater E to feed-water main 11 in the roundhouse. A check-valve 63 in pipe 61 prevents backflow of the water under pressure in the feed-water main. The supply of water from heater and reservoir A to the superheater and the feed-water main 11 is automatically controlled by a Fisher governor 64, which controls the operation of force-pump F, so that the desired pressure in the feed-water-supply line will always be maintained. Steam for the operation of pump F is supplied by a pipe 65. A small circulating-pipe 66 is connected to the feed-water main 11 and to pipe 60 to maintain circulation in the feed-water line, and thereby the feed-water throughout the supply-line will always be kept at the desired temperature, so as to avoid a fracture likely to result on injection of cool water. Pipe 45 has direct connection, as at 45', with pipe 38, so that if there is no supply of hot water in reservoir A fresh water can be pumped directly from the supply-main 45 to the superheater.

The operation of the improved apparatus will be as follows: The locomotive to be washed is run into one of the stalls and usually arrives there with about seventy-five to one hundred and fifty pounds of steam-pressure. If the boiler is in condition that it needs washing, a flexible pipe 17 is connected to the adjacent blow-off cock 18, and, if desired, when the locomotive is equipped with a blow-off cock at each side like connections can be made at both cocks of the boiler to ex-

pedite the blowing-off operation. Pipe 22 will also be connected to the dome-cock 23. Blow-off cocks 18 and the proper valves 16 and valves 23 and 19 of the dome connection will then be opened. Under the pressure within the boiler the water and steam will be quickly blown off and into the blow-off main 10. If desired, cock 23 can be left closed until the water has been blown off and then opened to provide exit for the blow-off steam. Obviously by blowing off the water through the cocks at the sides of the boiler and the steam through the dome connection the blowing-off operation will be completed in a very short period. From the blow-off main 10 the blow-off steam and water pass by pipe 10' to separator 37, and thence the blow-off steam passes to the feed-water heater and reservoir A to raise the temperature of the fresh feed-water. The blow-off water passes from separator 37, through pipe 39, to reservoir B, where it is purified and passes in the chamber *b'* for the water used for washing out the boiler. The solids blown off from the boiler are deposited in chamber *b* of reservoir B. In this manner sufficient hot water for washing out the boiler is provided, since the amount of blow-off water in a locomotive-boiler is usually more than sufficient for washing out a boiler.

When the blowing-off operation is completed, cocks 23 and 16 are closed. A hose for washing out the boiler is then connected to pipe-terminal 25. Valves 28 or 28' and 31' are then opened, when water supplied from tank 81 by force-pump D will pass from main 12, through pipe 29 and the branch 25, to the hose used for washing out the boiler. If desired, such a connection can be made at each side of the boiler, so two workmen can simultaneously wash out a boiler, which is desirable when a locomotive is to be kept out of service as little as possible.

Manifestly the washing-out connection can be performed by the workman without any regulation on his part because of the apparatus employed for automatically regulating the temperature of the wash-out water and by which it is always maintained at the desired temperature in the mixing-tank 81.

When the boiler has been washed out, a hose connection 17 is connected to each of the branch pipes 25 on opposite sides of the locomotive, and the necessary valves are opened (27 and 28 on one side and 32 and 28' on the other) and conduct water from main 11, through pipes 24, hose connections 17, and the blow-off cocks 18 to the boiler. At the same time the filling operation can be expedited by opening valve 23', Fig. 7, so that water from main 11 will also pass to the boiler by the dome connection, (valve 23', coupling 20, pipes 21 22, and cock 23.) The water for refilling, as already described, is kept under sufficient pressure and at such

temperature that when the boiler is filled there will be sufficient steam and pressure in the boiler to render the locomotive serviceable and in condition to leave the round-house under its own steam without waiting to build up the fire in the fire-box until the steam necessary to charge the boiler has been generated in the boiler.

When the boiler has been filled, dome-cock 23 and the blow-off cock 18 will be closed and the dome connection and hose connection 17 will be disconnected from the boiler, whereupon the locomotive will be in condition for service. Manifestly, if desired, the boiler can be filled not only from the dome and one side of the boiler, but connection can also be made of a hose 17 at each side of the boiler, so the superheated water will enter the boiler at three places. Such construction not only saves considerable time, but is of material advantage, because the superheated water and steam evolved on entry of the water into the boiler are distributed throughout different portions of the boiler and the temperature of all portions of the boiler is evenly raised, so that fractures resulting from uneven expansion of the boiler-walls and crown-sheet are entirely avoided.

In railroad practice treated water is sometimes used—i. e., water treated with incrustation preventives or compounds—and then it is not necessary to wash out the boiler, or at least not frequently. In that practice, however, it is frequently desired to discharge the impure water containing the accumulated compounds in suspension and to replace the same by fresh water. With the improved apparatus described it is possible to simultaneously blow off and replace the water in the boiler by pure water without putting out, distributing, or banking the fire in the fire-box of the locomotive. That can be done in the following manner, viz:

Hose connection 17 is coupled to the blow-off cock at the side of the boiler, and pipe 22 is connected to the dome-cock 23. Valves 18 and 16 are then opened to discharge the water containing the accumulated solids in suspension, so the solids and the water of the lowest temperature in the boiler will be blown off into main 10 to the reservoir for washing-water. Simultaneously superheated water under necessary pressure and greater than that in the boiler will be supplied through the dome connection into the boiler. The difference in temperature between the superheated feed-water and the water in the boiler will cause the fresh feed-water to remain near the top of the boiler, so that it will not commingle with the impure water and solids near the bottom of the boiler, which will be blown off. To prevent agitation of the water in the boiler to such extent that the impure water will commingle with the hot fresh water, a divider or sprayer *o*, Fig. 7,

may be connected to the dome-cock 23, so that the stream of fresh feed-water entering the boiler will be divided or distributed. Manifestly, then the impure water, with the solids in suspension at the bottom of the boiler, will be replaced by fresh water as the impure water leaves the boiler. For this purpose it is not necessary to bank or put out the fire. The locomotive remains hot during the entire recharging operation, thus avoiding the material change of temperature and resultant expansion and contraction which strain the boiler. By this improved apparatus impure water can be frequently replaced in a very short period, and by occasional replacement the life of a locomotive is materially lengthened without washing out the locomotive-boiler.

By the improved apparatus many of the difficulties heretofore encountered in the use of equipment for washing out and refilling locomotive-boilers are overcome, because the plant can be operated at a low cost of maintenance, and it becomes possible and practical to frequently wash out or refill boilers without lengthy interruption of the service.

Manifestly, the invention is not to be understood as restricted to the particular construction set forth, but may be modified within wide limits without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In apparatus for washing out locomotives, the combination of a reservoir for containing the blow-off water, a blow-off pipe for conducting water from the locomotive-boiler to said reservoir, a pipe for conducting said water as washing-water from said reservoir to a wash-out connection whereby the blow-off water from a locomotive can be used for washing, and a pipe for supplying cold water to said washing-water for tempering the same.

2. In apparatus for washing out locomotives, the combination of a reservoir for containing the blow-off water, a blow-off pipe for conducting water from the locomotive-boiler to said reservoir, a pipe for conducting said water as washing-water from said reservoir to a wash-out connection whereby the blow-off water from a locomotive can be used for washing, a pipe for supplying cold water to said washing-water for tempering the same, and a pump for supplying the washing-water to said wash-out connection.

3. In apparatus for washing out locomotives, the combination of a reservoir for containing the blow-off water, a blow-off pipe for conducting water from the locomotive-boiler to said reservoir, a pipe for conducting said water as washing-water from said reservoir to a wash-out connection whereby the blow-off water from a locomotive can be used for

washing, and a pipe for maintaining circulation in the pipe leading to the wash-out connection.

4. In apparatus for washing out locomotives, the combination of a reservoir for containing the blow-off water, a blow-off pipe for conducting said water from the locomotive-boiler to said reservoir, a pipe for conducting said water as washing-water from said reservoir to a wash-out connection whereby the blow-off water from a locomotive can be used for washing, and a pipe for maintaining circulation in the pipe leading to the wash-out connection and connected to return water from said latter pipe to the reservoir.

5. In apparatus for washing out locomotives, the combination of a blow-off pipe, a reservoir for receiving blow-off water, a settling-chamber for the impurities in the blow-off water, a storage-chamber for the purified blow-off water, a pipe for conducting the purified blow-off water as washing-water to a wash-out connection, and a pipe for supplying fresh water to said washing-water to temper said water before it reaches the wash-out connection.

6. In apparatus for washing out locomotives, the combination of a reservoir for washing-water, a blow-off pipe for conducting water from the locomotive to said reservoir, a pipe for conducting water in said reservoir to a wash-out connection at the locomotive-boiler, a cold-water supply, and means for automatically regulating mixture of hot water from said reservoir and cold water so the washing-water will be at suitable temperature.

7. In apparatus for washing out locomotives, the combination of a reservoir for washing-water, a blow-off pipe for conducting water from the locomotive to said reservoir, a pipe for conducting washing-water to a wash-out connection at the locomotive-boiler, a pump for forcing water to said connection, a cold-water supply, and means for controlling mixture of hot water from said reservoir and cold water so the water pumped to said connection will be at suitable temperature for washing.

8. In apparatus for washing out locomotives, the combination of a reservoir for washing-water, a blow-off pipe for conducting water from the locomotive to said reservoir, a pipe for conducting washing-water to a wash-out connection at the locomotive-boiler, a pump for forcing water to said connection, a cold-water-supply pipe connected to said washing-water, and means for automatically controlling the operation of the pump to maintain pressure in the pipe leading to the washing-out connection.

9. In apparatus for washing out locomotives, the combination of a reservoir for washing-water, a blow-off pipe for conducting water from the locomotive to said reser-

voir, a pipe for conducting washing-water to a wash-out connection at the locomotive-boiler, a pump for forcing water to said connection, a cold-water-supply pipe connected to said washing-water, and a thermostatic valve for controlling mixture of hot and cold water.

10. In apparatus for washing-out locomotive-boilers, the combination of a blow-off pipe, a reservoir for containing washing-water, a strainer for the blow-off water through which the blow-off water passes to said reservoir, a pipe connected to the reservoir for conducting purified blow-off water to a wash-out connection near the locomotive-boiler, a cold-water supply, and means automatically controlling mixture of hot and cold water for the wash-out connection.

11. In apparatus for washing out and recharging locomotive-boilers, the combination of a reservoir for feed-water, a reservoir for washing-water, means for transferring the heat units of the blow-off steam to the water in the feed-water reservoir, means for conducting the blow-off water to the reservoir for washing-water, and a pipe for conducting the washing-water to a wash-out connection.

12. In apparatus for washing out and recharging locomotive-boilers, the combination of a reservoir for feed-water, a reservoir for washing-water, means for transferring the heat units of the blow-off steam to the water in the feed-water reservoir, a strainer for the blow-off water through which the blow-off water passes, means for conducting the blow-off water to the reservoir for washing-water, and a pipe for conducting the washing-water to a wash-out connection.

13. In apparatus for washing and refilling locomotive-boilers, the combination of a reservoir for feed-water, a reservoir for washing-water, means for transferring the heat units of the blow-off steam to the water in the feed-water reservoir, a strainer for the blow-off water in the washing-water reservoir from which said water passes to the chamber for washing-water in said reservoir, a pipe for conducting the washing-water to a wash-out connection, a cold-water supply, and means for automatically regulating mixture of the cold and hot water so the washing-water passing to the wash-out connection will be at suitable temperature for washing.

14. In apparatus for washing and recharging locomotive-boilers, the combination of a blow-off pipe, connections whereby the steam and water in a boiler can be blown off into said pipe, a separator, a reservoir for feed-water connected to receive blow-off steam from the separator, a reservoir for washing-water connected to receive blow-off water from the separator, a wash-out connection, and a pipe for conducting the blow-

off water from its reservoir to said wash-out connection.

15. In apparatus of the character described, the combination of a main for washing-water, a feed-water main, a plurality of pipe-terminals each of which is connected to the feed-water main and to the washing-water main, and valves whereby said connections can be used to supply feed-water and washing-water simultaneously to different boilers from a single series of terminals.

16. In apparatus of the character described, the combination of a feed-water supply, a feed-water main, and means connected to said main whereby circulation of the feed-water in the main will be maintained.

17. In apparatus of the character described, the combination of a reservoir for feed-water, a superheater, a feed-water main connected to the superheater, a plurality of branch pipes connected to the main having terminals for connection to a boiler, an automatically-controlled pump for forcing the feed-water through said main, and a circulating-pipe connected to the main whereby circulation of the feed-water in the main will be maintained.

18. In apparatus of the character described, the combination of a fresh-water supply, a superheater, a feed-water main in the round-house, a filling connection, a pump for forcing the feed-water to said main, and a circulating-pipe connected to said main and to the pump.

19. In apparatus for washing-out locomotive-boilers, the combination of a hot-water supply, a cold-water supply, a wash-out connection for the locomotive-boiler, means at the connection for controlling the discharge of washing-water, and means remote from said connection whereby the relative supply of hot and cold water will be automatically regulated so that the water passing to said connection will be at suitable temperature for washing and whereby the connection will be used for washing without regulation of the temperature at the wash-out connection.

20. In apparatus for washing out locomotive-boilers, the combination of a hot-water supply, a cold-water supply, a wash-out connection for the locomotive-boiler, means at the connection for controlling the discharge of washing-water, and a thermostatic regulator remote from said connection whereby the relative supply of hot and cold water will be automatically regulated so that the water passing to said connection will be at suitable temperature for washing and whereby the connection will be used for washing without regulation of the temperature at the wash-out connection.

21. In apparatus for washing out locomotive-boilers, the combination of a hot-water supply, a cold-water supply, a wash-out connection for the locomotive-boiler, means

at the connection for controlling discharge of washing-water at the connection, means remote from said connection whereby the relative supply of hot and cold water will be automatically regulated so that the water passing to said connection will be at suitable temperature for washing and whereby the connection can be used for washing out without regulation of the temperature at the wash-out connection, and a pump for forcing water of regulated temperature to the wash-out connection.

22. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a plurality of wash-out connections, a main for washing-water to which said connections are connected, and means whereby the relative supply of hot and cold water will be regulated so that the water passing to said main will be at suitable temperature for washing, and whereby the connections can be used for washing without regulation of the temperature at the wash-out connections.

23. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a plurality of wash-out connections, a main to which said connections are connected, means at each of the connections for manually controlling discharge of washing-water, and a thermostatic regulator whereby the relative supply of hot and cold water will be automatically regulated so that the water passing to said main will be at suitable temperature for washing and whereby the connections can be used for washing without regulation of the temperature at the wash-out connections.

24. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a plurality of wash-out connections, means at each of the connections for controlling discharge of washing-water, a main for washing-water to which said connections are connected, an automatically-controlled pump for forcing water to said main, and means whereby the relative supply of hot and cold water will be automatically regulated so that the water passing to said pump will be at suitable temperature for washing, and whereby the connections can be used for washing without regulation of the temperature at said connections.

25. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection for the locomotive-boiler, a reservoir to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, and means for automatically regulating the temperature of the water supplied to the reservoir so the water for washing will be supplied to said connection at suitable temperature for washing out a boiler.

26. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection for the locomotive-boiler, a reservoir to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, means for automatically regulating the temperature of the washing-water supplied to the reservoir so the water will be supplied to said connection at suitable temperature for washing, and means for manually controlling the discharge at the wash-out connection.

27. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir remote from said connection to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, a valve controlling the supply of cold water to the reservoir, and a thermostatic regulator for controlling the operation of said valve so the water supplied to said connection from said reservoir will be at suitable temperature for washing out a boiler.

28. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir remote from said connection to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, a valve controlling the supply of cold water to the reservoir, a thermostatic regulator for controlling the operation of said valve so the water in said reservoir will be supplied to said pipe at suitable temperature for washing out a boiler, and means for manually controlling the discharge at the wash-out connection.

29. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, an automatically-operated valve for controlling the supply of water to the reservoir, a valve for the cold-water supply, and means for automatically controlling the operation of one of said valves so that water in the reservoir will be maintained at the desired temperature for washing out.

30. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, an automatically-operated valve controlling supply of water to said reservoir, a valve for the cold-water supply, means for automatically controlling the operation of one of said valves, so that

water in the reservoir will be supplied therefrom at the desired temperature for washing out, and means for manually controlling the discharge at the wash-out connection.

31. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, means for reducing the pressure of the water supplied to the reservoir and means for automatically regulating the supply of water to said reservoir so that the water will be supplied therefrom at the desired temperature for washing out a boiler.

32. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, a tank to which the cold-water supply is connected, an automatically-operated valve for controlling the supply of water to said tank, and means for automatically regulating the mixture of hot and cold water so the temperature of the water supplied to said connections from said reservoir will be at suitable temperature for washing out a boiler.

33. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, a tank to which the cold-water supply is connected, an automatically-operated valve controlling the supply of cold water to said tank, a valve controlling the passage of cold water to said reservoir, and a thermostatic regulator for controlling the operation of the latter valve so the water in the reservoir will be supplied at the desired temperature for washing out a boiler.

34. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir to which both of said supplies are connected, a pipe for conducting water from said reservoir to said connection, a tank to which the cold-water supply is connected, an automatically-operated valve controlling the supply of cold water to said tank, a valve controlling the passage of cold water to said reservoir, a thermostatic regulator for controlling the operation of the latter valve so the water in the reservoir will be supplied therefrom at the desired temperature for washing out a

boiler, and means for manually controlling the discharge at the wash-out connection.

35. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir remote from said connection to which both of the supplies are connected, a pipe for conducting water from said reservoir to said connection, means for automatically regulating the temperature of the water so that the water supplied to said pipe from said reservoir will be at suitable temperature for washing, and a pump for forcing water from said reservoir to the wash-out connection.

36. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply under different pressure, means for substantially equalizing the pressure of the hot and cold water, a wash-out connection for the locomotive, a reservoir connected to the hot and cold water supplies, a pipe connecting the wash-out connection and said reservoir, and means for automatically regulating the relative supply of hot and cold water to the reservoir so the water will be supplied to the wash-out connection from the reservoir at the desired temperature for washing out a boiler.

37. In apparatus for washing out locomotives, the combination of a hot-water supply, a cold-water supply under different pressure, means for substantially equalizing the pressure of the hot and cold water, a wash-out connection for the locomotives, a reservoir connected to the hot and cold water supplies, a pipe connecting the wash-out connection and said reservoir, means for automatically regulating the relative supply of hot and cold water to the reservoir so the water will be supplied to the wash-out connection from the reservoir at the desired temperature for washing out a boiler, and a pump for forcing water from said reservoir to said connection.

38. In apparatus for washing out locomotives, the combination of a reservoir, a pipe for conducting blow-off water to said reservoir, a cold-water supply, a wash-out connection at the locomotive-boiler, a reservoir to which the cold-water supply and the blow-off reservoir are connected, a pipe for conducting water from the latter reservoir to said connection, and means for automatically regulating the relative supply of water from the blow-off reservoir and cold water so that the water for washing out will be at suitable temperature for washing out a boiler.

FREDERICK A. GALE.

Witnesses:

H. E. PARKER, JR.,
LEONE S. RUSSELL.