

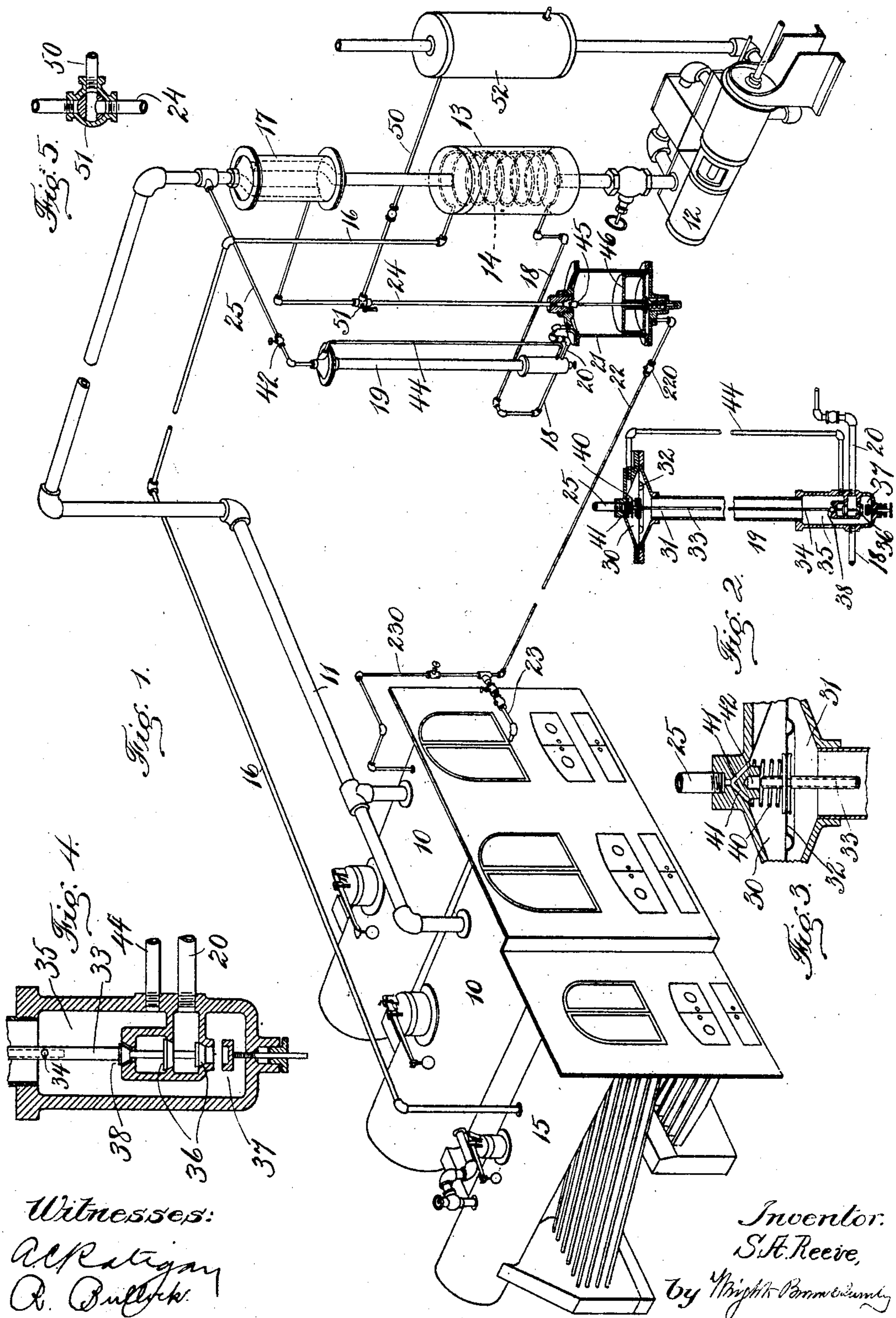
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S. A. REEVE.

APPARATUS FOR INTRODUCING WATER TO PRESSURE RECEPTACLES.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR INTRODUCING WATER TO PRESSURE-RECEPTACLES.

No. 803,712.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, SIDNEY A. REEVE, of Worcester, in the county of Worcester and State of Massachusetts, have invented certain
5 new and useful Improvements in Apparatus for Introducing Water to Pressure-Receptacles, of which the following is a specification.

This invention relates in general to the art
10 of introducing water into pressure or other receptacles by the force of a body of steam; and it applies particularly to the art of superheating steam by the communication through conducting-walls to the working steam of the
15 heat of a body of steam at a superior pressure and temperature—as disclosed, for example, in my prior patents, Nos. 753,433 and 753,738.

The main object of the invention is to provide means whereby the water of condensation from a body or bodies of steam, such as the superheating agent and the working steam in the above-mentioned system or other water, may be introduced into a receptacle, such
25 as the low-pressure boiler, for furnishing working steam in said system and the heat of said water in a large measure conserved, all without resorting to the more or less objectionable expedient of pumping these fluids into
30 the designed receptacle.

The above object is accomplished in accordance with the present invention by allowing an accumulation of the water of condensation from the body of superheating steam and
35 periodically forcing this collected water, and also preferably the water of condensation, from the working steam into the low-pressure generator which supplies said working steam. The condensation from the high-pressure
40 steam is controlled by a trap in such manner that the pressure of the steam acts on the surface of the water of condensation to force it into the low-pressure receptacle. In this way the operation of the system is made independent of relative levels between the generators and the superheater or other producer of condensation. One of the attendant phenomena is the formation of a body of steam from the high-pressure water of condensation
45 when released to a lower pressure, which steam assists or effects the propulsion of the body or bodies of water into the selected receptacle. A novel apparatus is provided for bringing the higher pressure of the super-

heating steam periodically to bear upon the
55 low-pressure water of condensation.

Of the accompanying drawings, Figure 1 represents a perspective view, partly in section, of an apparatus for superheating steam and returning the condensation products to
60 the low-pressure generator. Fig. 2 represents a vertical section, partly broken away, of the return-trap. Figs. 3 and 4 represent sections, enlarged, of the upper and lower ends of said trap. Fig. 5 represents an enlarged
65 section of the three-way valve controlling entrance of feed-water or low-pressure condensation to the float-chamber.

The same reference characters indicate the same parts in all the figures.

In the drawings, 10 10 are boilers which furnish the lower pressure or working steam through a pipe 11 to the apparatus for using it, which here takes the form of a steam-engine 12. At 13 the steam-conduit is enlarged
75 into a drum forming one chamber of a superheater of which the other chamber is a coil 14, inclosed in said drum and communicating with the superheating-boiler 15 through a pipe 16. This boiler 15 carries steam at a
80 higher pressure and temperature than the working steam furnished by the boilers 10, which steam loses a portion of its heat to the working steam in the drum 13 by conduction through the walls of the coil 14, thereby be-
85 coming partially condensed and serving to superheat the working steam, as more fully described in my aforesaid patents. At 17 in the steam-pipe 11 is a separator to collect the water of condensation from the steam-pipe
90 11, which may be of considerable length.

The outlet from superheating-coil 14 is by a pipe 18, entering an automatic return-trap 19, which is primarily the means provided for controlling the entrance of water of con-
95 densation to one of the low-pressure boilers 10. The discharge is effected from a collecting-chamber 21, through a pipe 22, having branches 23 230, whereby the discharge is to either the water-space or the steam-space of
100 the generator. Pipe 22 contains a check-valve 220. Chamber 21 receives the high-pressure water of condensation from the trap 19 through a pipe 20 and the low-pressure water of condensation from separator 17 through a
105 pipe 24. The inlet from pipe 24 is controlled by a check-valve 45, adapted to seat upwardly by pressure in the collecting-chamber when

allowed to do so by a float 46. The latter slides freely on the stem of valve 45 and when at its lowest limit of movement engages a shoulder on said stem and opens the valve.

5 The trap 19 embodies in its construction a collecting-chamber 35 for the high-pressure water of condensation, a valve 36, controlling the outlet from said chamber to pipe 20, and a diaphragm 32, connecting by tubular stem
10 33 with valve 36. On the under side of said diaphragm is a chamber 31, open to the chamber 35, and on the upper side a chamber 30, open to chamber 35 at the desired minimum water-level by a fixed pipe 44. Upper cham-
15 ber 30 is also adapted to communicate with chamber 35 through the interior of tubular stem 33, the latter being open at its upper end and having a hole 34 in its lower portion at the desired maximum water-level. A spring
20 40 tends to depress and close the valve 36. Provision is made for decreasing the pressure in chamber 30 when the latter is cut off by a pipe 25, communicating at one end with chamber 30 by ducts 41 and at the other end
25 with the low-pressure steam-line 11, said pipe containing a valve 420, which is adjusted to a slight leakage-opening. 37 and 38 are members on the casing and valve-stem, respectively, anterior to the valve 36 and forming
30 contracted openings which relieve the valve-seat of the velocity and consequent cutting due to the outflow of hot water and steam. The upper end of tubular stem 33 acts as a valve in conjunction with a fixed seat 42 for
35 a purpose hereinafter described.

The operation is as follows: Water of condensation from the separator 17 in the low-pressure line flows past the open valve 45 and collects in chamber 21 until the trap 19
40 operates, or if the collecting-chamber 21 should be above the level of the low-pressure boiler this collected water might flow by gravity into said boiler. The high-pressure water of condensation from coil 14 and other
45 parts of the high-pressure line accumulates in chamber 35 of the trap 19 and rises above the lower end of pipe 44 without creating a difference of fluid-pressure above and below the diaphragm 32, since upper chamber 30 is
50 still open to chamber 35 through tubular stem 33 and its hole 34. When the water reaches and closes the hole 34, the upper chamber is sealed and its pressure reduced by leakage through pipe 25 past valve 420 into the low-
55 pressure line. This unbalances diaphragm 32, which rises and opens valve 36, thereby admitting the accumulated water from chamber 35 into the collecting-chamber 21. The trap-valve 36, for the reason that the stem 33 is
60 sealed by coöperation of its upper end with seat 42, will not again close until the water has unsealed the lower end of pipe 44 and allowed the diaphragm to become balanced. The superior pressure thus created in chamber
65 21 closes the check-valve 45, and the water of

condensation from both high and low pressure lines is forced by the high-pressure through pipe 22 into the low-pressure generator 10. As the high-pressure water of condensation is released into a region of lower pressure in the
70 chamber 21 its contained heat vaporizes a portion of the water, and the pressure of this vapor becomes a factor in forcing the water into generator 10. When chamber 21 has become exhausted of water, the descending float
75 36 serves to open the check-valve 45 against the superior pressure in chamber 21, and thereby reestablishes communication with pipe 24 for the inlet of low-pressure water of condensation. Any small quantity of high-pres-
80 sure steam which thereupon escapes through pipe 24 passes on into the low-pressure line and does work with the low-pressure steam.

I do not herein claim the particular construction of trap 19 except as it enters into
85 combination with the rest of the invention, this trap being described and claimed in a copending joint application of myself and E. P. Noyes, Serial No. 204,592. Any other suitable form of trap may be substituted for the
90 one described, it being desirable, however, that the trap should be so constructed as to discharge the whole of its contents or a predetermined content at one period of operation.
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When the water in chamber 35 has been so far discharged as to unseal pipe 44, the momentum of the outgoing water and the short period required to empty the pipe 44 may suffice to establish the full pressure of
100 the boiler 15 in chamber 21 for a short time. Depression of the inlet to pipe 44 with respect to the pipe 20 prolongs this period and raising of said inlet shortens it.

The chamber 21, with its automatic mechanism and connections with the high-pressure line, may also be employed to introduce water other than or in addition to the low-pressure condensation into the low-pressure boiler. For this purpose I have shown a feed-pipe 50,
110 connected with pipe 24, a three-way valve 51 at the junction of said pipes, whereby either feed-water or low-pressure condensation reaches the chamber, and an exhaust-heater 52, in which the feed-water receives a preliminary heating. This is one of several arrangements whereby the desired object may be accomplished.

I claim—

1. The combination of a boiler, a source furnishing elastic fluid at a pressure higher than that of the boiler, means for accumulating feed-water, and means controlled by the level of the accumulated water for automatically and periodically admitting the higher pressure to the surface of the feed-water to force the latter into the boiler.
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2. In an apparatus of the character described, a steam-generator, a receptacle, means for accumulating a body of water of
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condensation from the steam supplied by said generator, and means controlled by the accumulation of said water for automatically introducing the same at intervals into said receptacle.

3. In an apparatus of the character described, a high-pressure steam-generator, a low-pressure steam-generator, a return-conduit connecting said generators, and an automatic return-trap in said conduit.

4. In an apparatus of the character described, high and low pressure generators for supplying superheating and working steam respectively, a superheater having chambers in connection with the respective generators, a return-conduit connecting the high-pressure chamber with the low-pressure generator, and an automatic return-trap in said conduit.

5. In an apparatus of the character described, high-pressure and low-pressure steam-generators, a chamber for collecting water of condensation from the low-pressure steam-supply, and means to automatically place said chamber periodically into connection with the high-pressure generator.

6. In an apparatus of the character described, high-pressure and low-pressure steam-generators, a chamber for collecting water of condensation from the low-pressure supply and having a return connection with the low-pressure generator, a conduit connecting said chamber with the high-pressure generator, and an automatic trap in said conduit.

7. In an apparatus of the character described, high-pressure and low-pressure generators, a chamber having an outlet to the low-pressure generator and a water-supplying inlet, a conduit independent of said inlet connecting the high-pressure generator with said chamber, and an automatic trap in said conduit.

8. In an apparatus of the character described, a steam-generator, a receptacle, a chamber connected with the latter and having an inlet, an automatic check-valve controlling said inlet, and means to automatically place said chamber periodically in connection with said generator.

9. In an apparatus of the character described, a chamber having an inlet, a pressure-controlled check-valve controlling said inlet, a float whose descent opens said valve, an outlet from the chamber, a second inlet thereto, and an automatic steam-trap controlling the inflow through said second inlet.

10. In an apparatus of the character described, high-pressure and low-pressure steam-generators, a collecting-chamber having inlets from the steam-lines of both generators and an outlet to the low-pressure generator, an automatic steam-trap controlling the high-pressure inlet, a pressure-controlled check-valve controlling the low-pressure inlet, and a float in said chamber whose descent opens said valve.

11. In an apparatus of the character described, high-pressure and low-pressure generators, a superheater having chambers in respective connection with the steam-lines from said generators, a collecting-chamber having an inlet from the low-pressure steam-line and a second inlet from the high-pressure superheater-chamber, a return-outlet from said collecting-chamber to the low-pressure generator, and an automatic trap in the second inlet connection.

12. In an apparatus of the character described, high-pressure and low-pressure steam-generators, a superheater having chambers in respective connection with the steam-lines of said generators, a condensation-return line from the low-pressure steam-line to the low-pressure generator, a collecting-chamber in said return-line, and means to automatically and periodically place the high-pressure steam-line in connection with said collecting-chamber.

13. In an apparatus of the character described, high-pressure and low-pressure steam-generators, a superheater having chambers in respective connection with the steam-lines of said generators, a condensation-return line from the low-pressure steam-line to the low-pressure generator, a collecting-chamber in said return-line, means to automatically and periodically place the high-pressure steam-line in connection with said collecting-chamber, and a pressure and level-controlled valve controlling the inlet to said collecting-chamber from the low-pressure steam-line.

14. In an apparatus of the character described, high-pressure and low-pressure steam-generators, a superheater having chambers in the steam-lines from the respective generators, a condensation-separator in the low-pressure steam-line between the generator and superheater, a condensation-return line connecting said separator with the low-pressure generator, a collecting-chamber in said return-line, a second collecting-chamber for the condensation from the high-pressure superheater-chamber, and means to automatically and periodically connect said collecting-chambers.

15. In an apparatus of the character described, high-pressure and low-pressure steam-generators, a collecting-chamber for the high-pressure and low-pressure waters of condensation having an outlet to the low-pressure generator, level-actuated means in said chamber for controlling the inlet thereto for low-pressure condensation, a second collecting-chamber for high-pressure condensation anterior to the first said collecting-chamber, and level-controlled means for periodically exhausting said second chamber between predetermined maximum and minimum levels.

16. In an apparatus of the character described, high-pressure and low-pressure

steam-lines, an automatic return-trap in the high-pressure line having a controlling-chamber, means for alternately sealing and unsealing said chamber by fluctuation in the quantity of high-pressure condensation, and a leakage-outlet from said chamber to the low-pressure steam-line.

In testimony whereof I have affixed my signature in presence of two witnesses.

SIDNEY A. REEVE.

Witnesses:

R. M. PIERSON,
A. C. RATIGAN.