(No Model.) 3 Sheets—Sheet 1.

W. A. MORSE.

COMBINED STEAM BOILER AND WATER HEATER AND FILTER.

No. 465,533. Patented Dec. 22, 1891.

Fig. I.

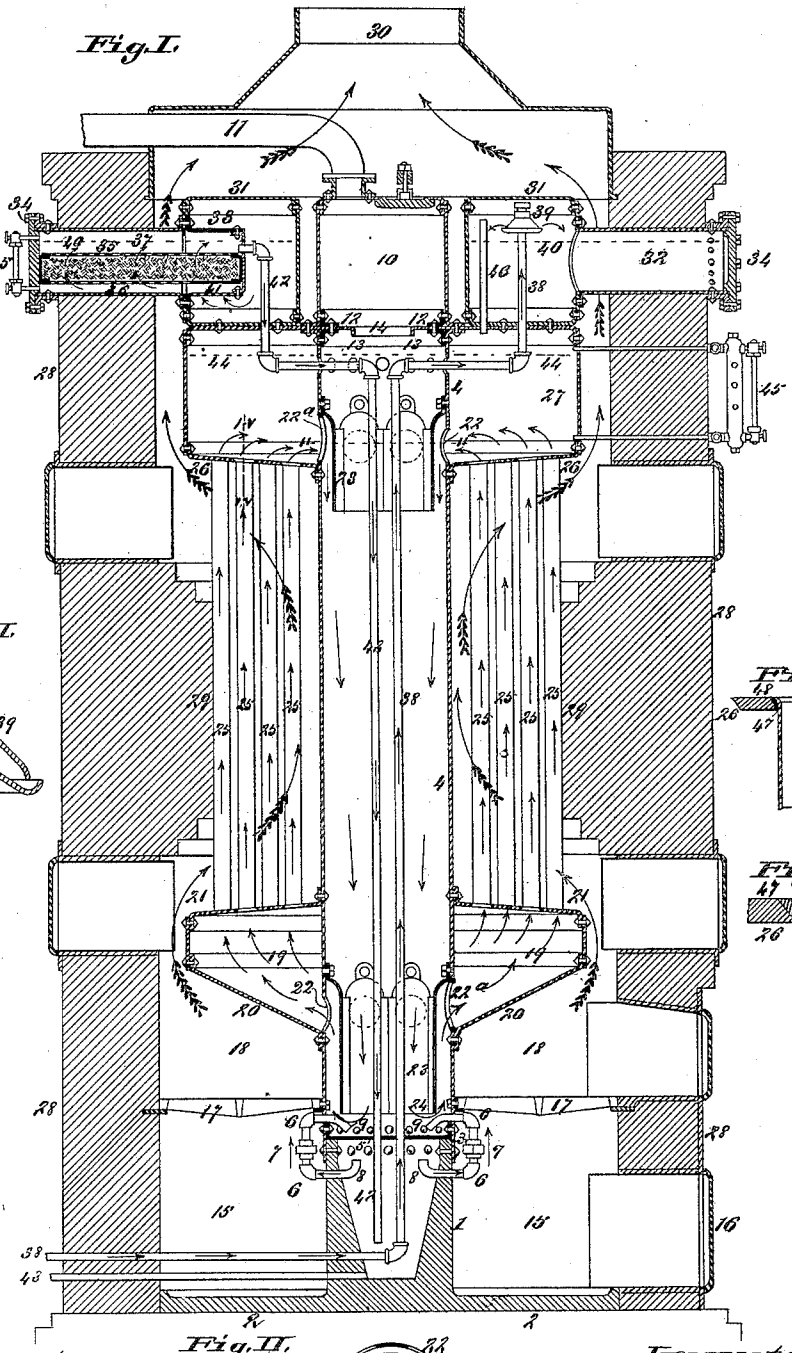


Fig. III.

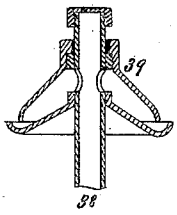


Fig. IV.

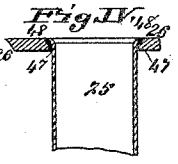


Fig. V.

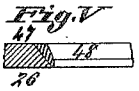
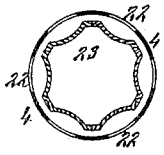


Fig. II.



Attest;

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S. Cotton

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(No Model.) 3 Sheets—Sheet 2.

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Fig. VI.

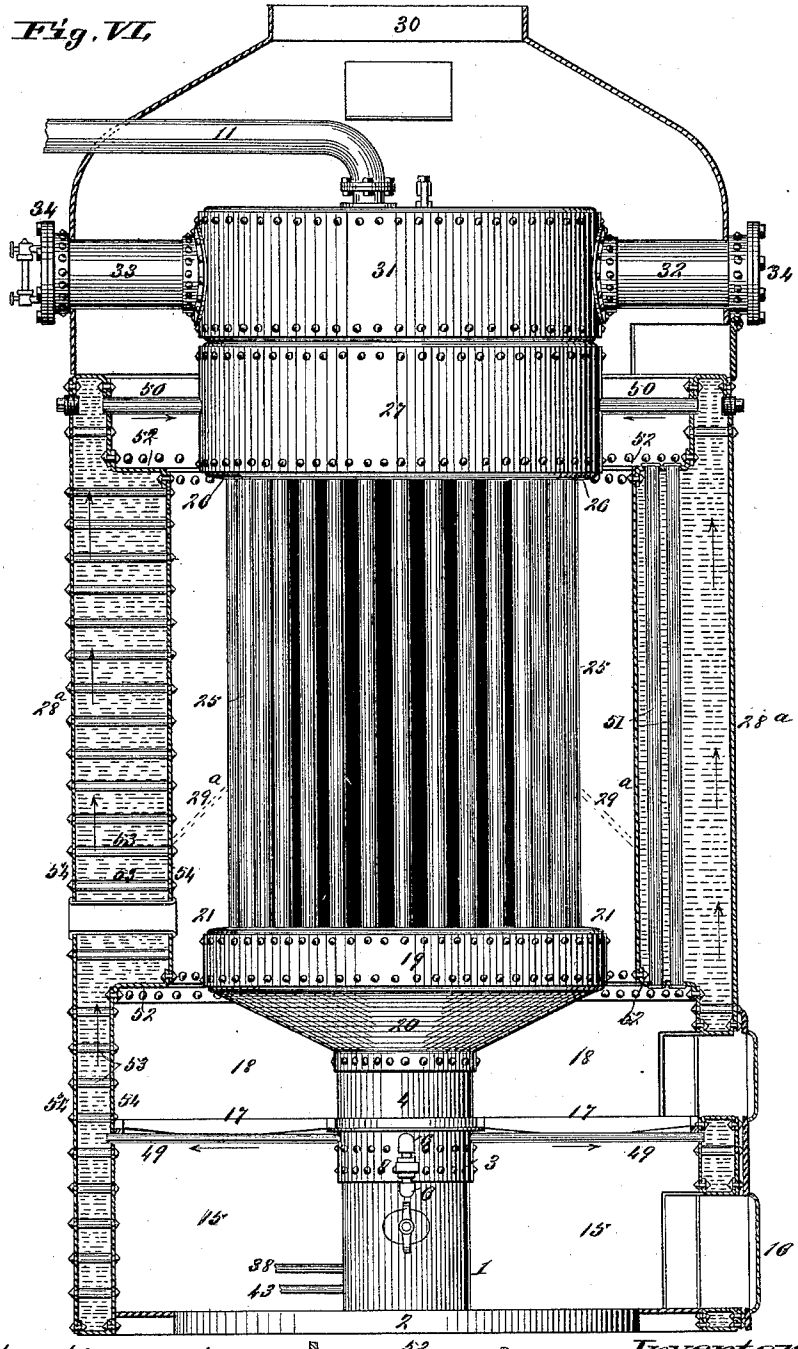

Fig. VII

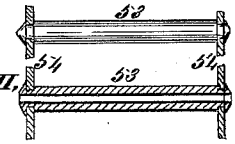

Fig. VIII.

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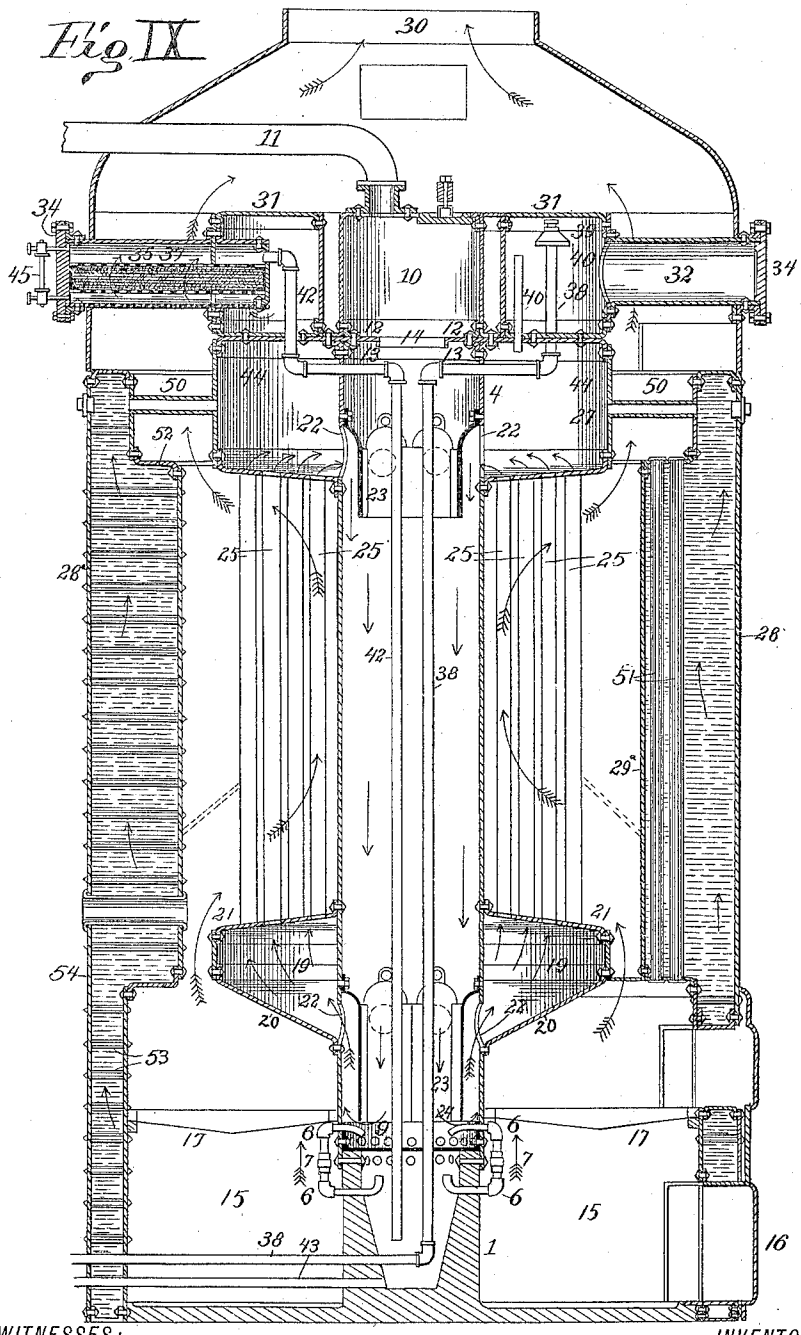
Fig. IX.



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UNITED STATES PATENT OFFICE.

WALLACE A. MORSE, OF ST. LOUIS, MISSOURI.

COMBINED STEAM-BOILER AND WATER HEATER AND FILTER.

SPECIFICATION forming part of Letters Patent No. 465,533, dated December 22, 1891.

Application filed December 19, 1890. Serial No. 375,244. (No model.)

To all whom it may concern:

Be it known that I, WALLACE A. MORSE, of the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in a Combined Steam-Boiler and Water Heater and Filter, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

This invention relates to the combination of a steam-boiler and water heater and filter having the novel construction hereinafter described, and set forth in the claims.

Figure I is an axial section of the apparatus in its more simple form, the section being taken on the plane of the fire-door. Fig. II is a horizontal section at II II, Fig. I. Fig. III is a vertical section of a spray-nozzle. Fig. IV is an enlarged detail horizontal section taken at IV IV, Fig. I. Fig. V is an enlarged detail vertical section showing the filling-ring which is interposed between the head-sheet of the water-drum and the expanded end of the tube. Fig. VI is an elevation of the boiler, &c., showing the water walls or jacket in vertical section. Fig. VII is a side view of a solid stay-bolt. Fig. VIII is an axial section of a tubular stay-bolt, both being shown in position; and Fig. IX is a view similar to Fig. VI, the interior structure being shown in vertical section, as in Fig. I.

The apparatus will first be described as shown in Figs. I to V.

1 is the mud-chamber, which is shown as made of heavy cast-iron and integral with the base-plate 2. The upper edge of the chamber 1 fits within or without the lower edge 3 of the vertical water-cylinder 4 of the boiler, and is secured thereto by rivets. The cylinder 4 has a bottom 5, which forms the top of the mud-chamber and closes the communication between the mud-chamber and cylinder 4 at that place. Said chamber and cylinder have communication, however, by pipes 6, having in them union-couplings 7. The ends 8 of the pipes within the mud-chambers are curved upward, so as to take the water from the upper part of the mud-chamber, and the ends 9 of the pipes within the cylinder 4 are bent downward, so as to discharge the water in a downward direction into the bottom of the cylinder 4. The cylinder ends at top in a steam-dome 10, from which the steam escapes by a steam-pipe 11. At the bottom of the steam-dome is an annular plate 12, having a downturned flange 13, surrounding the central orifice 14. The purpose of the flange 13 is to prevent the water being carried up with the steam into the steam-dome. Any water adhering to the under side of the sheet or plate 12 by capillary attraction and moving toward the orifice 14 would be broken by the downturned flange 13 and would drip from its edge. The ash-pit 15 surrounds the mud-chamber.

16 is the ash-door.

17 are the grate-bars.

The fire-chamber 18 surrounds the lower part of the water-cylinder 4.

19 is the lower annular water-drum, whose lower sheet 20 forms the top of the fire-chamber. The drum 19 is riveted to the cylinder 4 at the inner edges of the lower sheet 20 and tube-sheet 21. The interiors of the cylinder 4 and drum 19 communicate by ports 22 and 22^a, made in the sides of the cylinder. The ports 22^a are much larger than the ports 22 in order that they may be used as man-holes to give access from the cylinder 4 to the drums 19 and 27 for purposes of cleaning and repairs.

23 is an annular deflector bolted at the upper edge to the cylinder above the holes 22, having a tight connection therewith at that point, but being open all around the bottom edge 24, which is in proximity to the bottom of the cylinder, so that the water will be taken from that point to supply the upward current of water between the deflector 23 and the wall of the cylinder. This upward current will be rapid, owing to great heat of this part of the cylinder, which is in direct contact with the fire.

25 are vertical water-tubes whose ends are expanded in the tube-holes of the tube-sheet 20 and in a similar sheet 26, forming the bottom sheet of the upper annular water-drum 27, whose connection and communication with the cylinder 4 are similar to the lower drum 19, the same reference-numbers being used. Through the tubes 25 the water ascends from the lower drum 19 to the upper drum 27. The tube-sheets 21 and 26 are not horizontal, but are inclined, as shown, the sheet 20 sloping downward from the cylinder 4 and the sheet

26 upward from the cylinder. This is for the purpose of more easily removing or replacing the tubes should occasion demand it, as well as to favor the passage of the products of combustion as they pass first inward and then outward among the tubes 25.

In order to insure the circulation of the products of combustion among the tubes 25, the surrounding furnace-walls 28 are in contact with the outer series of the tubes, as seen at 29, so that the said current is forced to follow the line indicated by the feathered arrows in Fig. I, passing from the fire-chamber around the periphery of the lower drum, then first inward and then outward among the tubes 25, then around the periphery of the upper drum and what I term the "economizer" above it, and so to the chimney or smoke-flue 30. The economizer 31 is an annular chamber set directly on the top sheet of the upper drum 27 and surrounding the steam-dome.

32 and 33 are man-hole extensions which extend outwardly from the economizer, traversing the inclosing wall or casing 28 and fitted with man-heads 34. The extension 32 gives means of access to the economizer-chamber. The extension 33 contains the filter 35, which extends horizontally across the extension and separates it into two chambers, the receiving-chamber 36 below and the discharging-chamber 37 above. The filter has perforate plates, between which is any suitable filtering material. 38 is the water-supply pipe, leading from the pump and passing without opening through the mud-chamber and with a tight joint through the plate 5. The pipe 38 extends up near the center of the cylinder 4 to near its upper end, where it is bent outward and passes through the side of the cylinder into the drum 27, and then upwardly into the economizer through a tight joint in the top of the drum and bottom of the economizer. The pipe carries at its upper end a spray device 39, of any suitable construction, through which the water is sprayed into the economizer. The spray is above the surface of the water, which surface is indicated by broken lines at 40. The water escapes from the economizer into the filter-extension 33, which extends into the body of the economizer at the inner end and is perforated at 41 for the passage of water from the economizer into the chamber 36. The water passes upwardly through the filter into the chamber 37 and escapes through a pipe 42, which extends downwardly through the bottom of the economizer and top of the drum 27 with a tight joint, and through the wall of the cylinder 4 into the cylinder, and downwardly through the central part of the cylinder, and through the bottom 5 of the same into the mud-chamber 1, into which the lower end of the pipe discharges. The water, which has become heated in the pipes 38 and 42 and in the economizer, deposits its impurities in the mud-chamber 1, from which they are blown off through a pipe 43. The clear water passes through the pipes 6 into the cylinder 4, and, mixing with the descending water in the cylinder, flows upward between the deflector 23 and the side of the cylinder and through the holes 22 into the drum 19 and upward through the tubes 25 to the drum 27, from which it escapes through the holes 22 into the cylinder and is turned downward by the deflector 23 and descends within the cylinder to its bottom, as shown by the featherless arrows in Fig. I. The surface of the water in the drum 27 is indicated by broken line 44.

45 are water-gage glasses indicating the surface levels in the drum 27 and the economizer. The steam-spaces of the drum 27 and economizer 31 are in communication by pipes, one of which is shown at 46, Fig. I. These pipes extend in a circle entirely around the economizer. These pipes insure an equal steam-pressure in the economizer and drum, and also bring the water in economizer up to same temperature as water in main part of boiler, thus helping to free it from impurities.

It has been said that the tube-sheets 21 and 26 are not horizontal and not parallel with each other, so that they will be oblique to the tubes 25, and in order to allow the easy introduction of the ends of the tubes into the holes 47 and the making of a tight joint I prefer to place a filling-ring 48 between the tube and the edge of the hole, the ring being made flaring at both its outside and inside circumference to fit the beveled or countersunk edge of the hole and the flaring end of the tube after it has been expanded. (See Figs. IV and V.)

I am aware that the matter shown in these Figs. IV and V is old; but I have described the same so as to show the best manner of attaching these parts.

In the modification shown in Figs. VI and IX the construction and arrangement is just the same as that already described, excepting that a water wall or jacket 28[a] takes the place of the brick wall or casing 28, (shown in Fig. I,) the water-wall extending from the base-plate to about the top of the drum 27. The interior of the water-wall communicates with the lower part of the cylinder 4 by pipes 49 and with the interior of the drum 27 by pipes 50. There will be an upward movement of water in the water-wall.

51 are tubes extending through the interior of the water-wall from the fire-chamber 18 to the smoke-space above. These tubes pass through the annular offset-sheets 52, and their ends are expanded to make a tight joint therewith, as usual. The sides of the water-wall are stayed by bolts 53, which may be solid, as seen in Fig. VII, or tubular, as seen in Fig. VIII. In either case the ends are reduced to pass through holes in the sheets 54, leaving a shoulder bearing against the inner side of the sheet, the ends of the bolts being riveted on the outside.

An annular deflector is shown by broken lines at 29ª, Fig. VI, said deflector extending all around from the water-wall to the outer annular series of tubes 25 and performing the same office as the annular projections 29 of the brick casing—that is, deflecting the ascending products of combustion inward, so as to cause them to circulate among the tubes 25. This deflector may be dispensed with, if preferred.

It will be noticed that the cylinder 4 extends from the mud-chamber to the economizer and is firmly secured to them and to the drums 19 and 27, so that there is no possibility of the parts getting out of their relative positions, and also that the base-plate, when made integral with the mud-chamber, will give great stability to the whole apparatus.

I claim as my invention—

1. The combination, in a steam-boiler, of a central water-cylinder 4, lower and upper water-drums secured to and communicating with the cylinder by ports 22 and having conical tube-sheets 21 and 26, respectively, and the water-tubes 25, connecting the interiors of the water-drums, substantially as set forth.

2. The combination, in a steam-boiler, of the central water-cylinder 4, lower and upper water-drums secured to and communicating with the cylinder by ports 22 and enlarged ports 22ª, and tubes 25, connecting the drums, substantially as and for the purposes set forth.

3. The combination, in a steam-boiler, of a central water-cylinder 4 and lower and upper water-drums 19 27, whose interiors communicate with the interior of the cylinder and whose lower sheets 20 and 26 are conical, and tubes 25, extending from drum to drum and open at the ends to the interiors of the drums, substantially as set forth.

4. A steam-boiler having water and steam drum or chamber 27, an economizer 31 above said drum or chamber, a water-supply pipe with a jet device discharging into the economizer, and a discharge-pipe leading from the economizer to a mud-chamber in communication with the interior of the boiler, substantially as set forth.

5. The combination, in a steam-boiler, of the cylinder 4, the mud-chamber 1, integral with the base-plate 2 and secured to the lower end of the cylinder, the lower and upper drums secured to and communicating with the cylinder, and the tubes 25, extending from drum to drum, substantially as set forth.

6. The combination, in a steam-boiler, of the cylinder 4, the mud-chamber 1, secured to the lower end of the cylinder, a plate 5, separating the inside of the cylinder from the inside of the mud-chamber, and bent pipes 6, forming means of communication between the mud-chamber and the cylinder, substantially as set forth.

7. The combination, in a steam-boiler, of the mud-chamber 1, the cylinder 4, with water-drums 19 27, tubes 25, connecting the drums, water-supply pipe 38, extending up centrally in the cylinder 4, an economizer 31 at the upper part of the boiler, a water-supply pipe extending upward through the cylinder 4 into the economizer, a spray device at the end of the water-pipe discharging into the economizer, a filter receiving water from the economizer, and a pipe connecting the filter with the mud-chamber, substantially as set forth.

8. The combination, in a steam-boiler, of the central cylinder 4, the drums 19 and 27 upon the cylinder and communicating therewith by holes 22, the deflectors 23, and the tubes 25, forming communication between the drums, all constructed and adapted to operate substantially as set forth.

9. The combination, in a steam-boiler, of the water-drums 19 and 27, with conical tube-sheets 21 and 26, and the tubes 25, which form communication between the drums set in concentric series, substantially as shown and described.

10. The combination, in a steam-boiler, of the central cylinder 4, the lower and upper drums upon the cylinder and in communication therewith, the tubes 25, extending from drum to drum, and an inclosing case having a part in contact with the outer series of tubes 25 at about their mid-height, substantially as set forth.

11. The combination of a steam-boiler, the economizer 31 at the top of the boiler, a filter 35 in connection with the economizer, and water-pipes respectively discharging into the economizer and carrying water from the discharge-chamber of the filter, substantially as set forth.

12. The combination, in a steam-boiler, of the annular plate or sheet 12 between the main chamber of the boiler and the steam-dome, said sheet having a downturned flange 13, surrounding its central orifice 14, substantially as and for the purpose set forth.

13. The combination, in a steam-boiler, of the cylinder 4, the mud-chamber secured to the lower end of the cylinder and whose top is formed by the bottom of said cylinder, economizer, and steam-dome secured to the upper end of the cylinder, and water-drums secured to the cylinder, substantially as set forth.

14. The combination, in a steam-boiler, of the central cylinder 4, the drums 19 and 27, the water-tubes 25, and the water-case inclosing said parts and having communication by pipes 49 and 50 with the lower part of the cylinder and the upper drum, substantially as set forth.

15. The combination, in a steam-boiler, of the cylinder 4, drums 19 27, tubes 25, water-case surrounding the above parts, pipes 49 and 50, and tubes 51, all constructed and arranged to operate substantially as set forth.

WALLACE A. MORSE.

In presence of—
SAML. KNIGHT,
E. S. KNIGHT.