(No Model.)

H. R. WALKER.

SMOKE PREVENTING FURNACE.

No. 435,532. Patented Sept. 2, 1890.

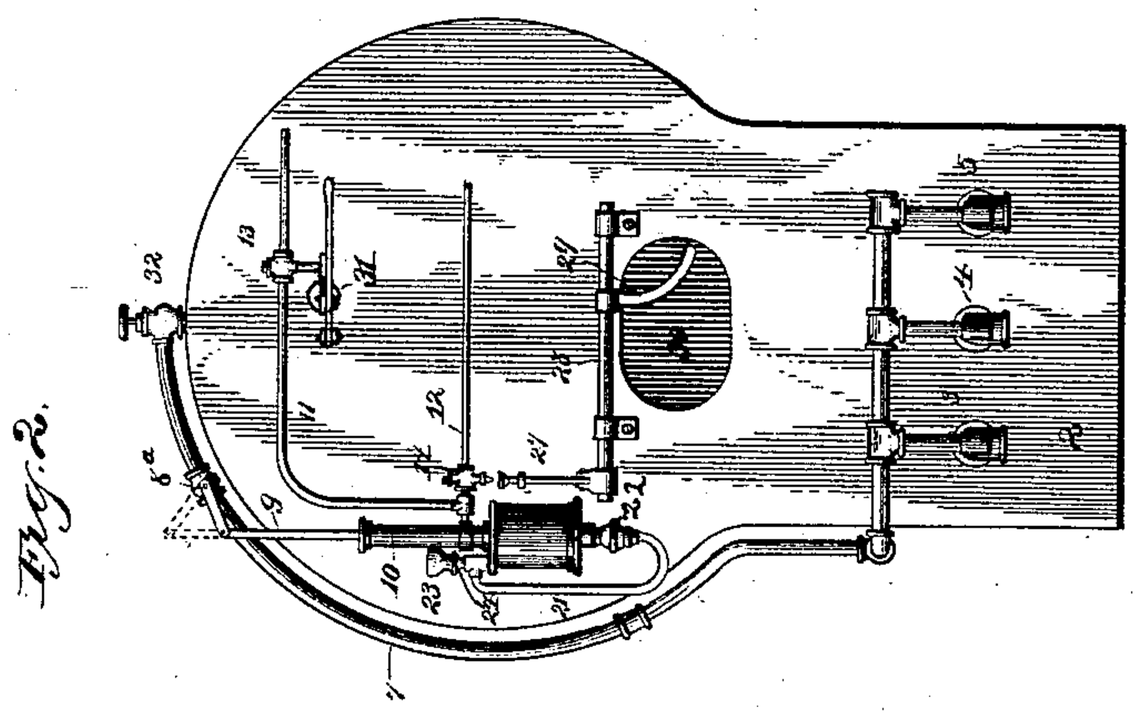

Fig. 2.

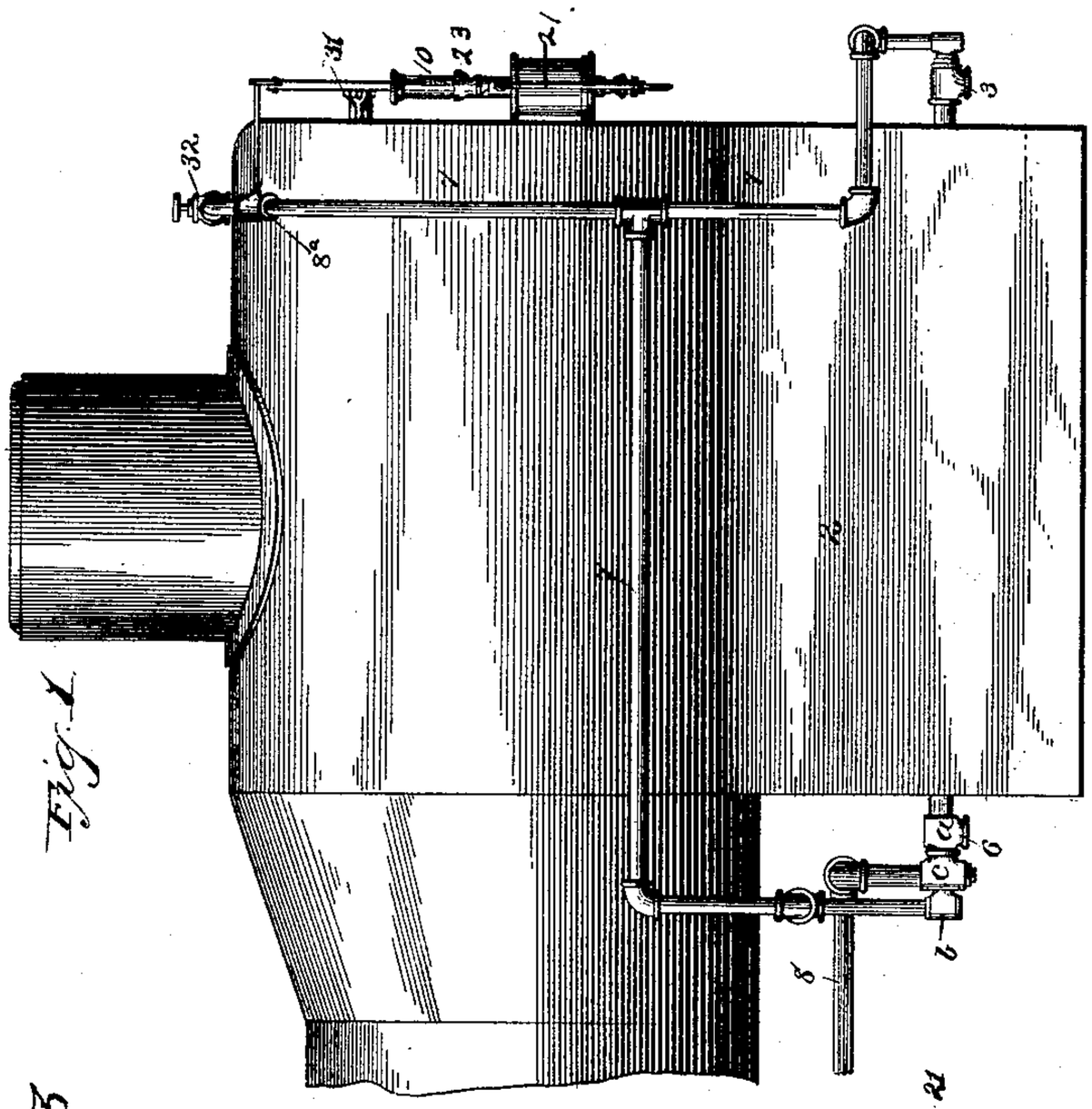

Fig. 1.

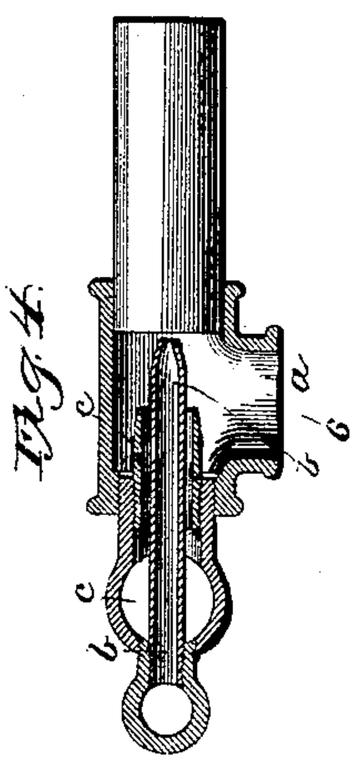

Fig. 4.

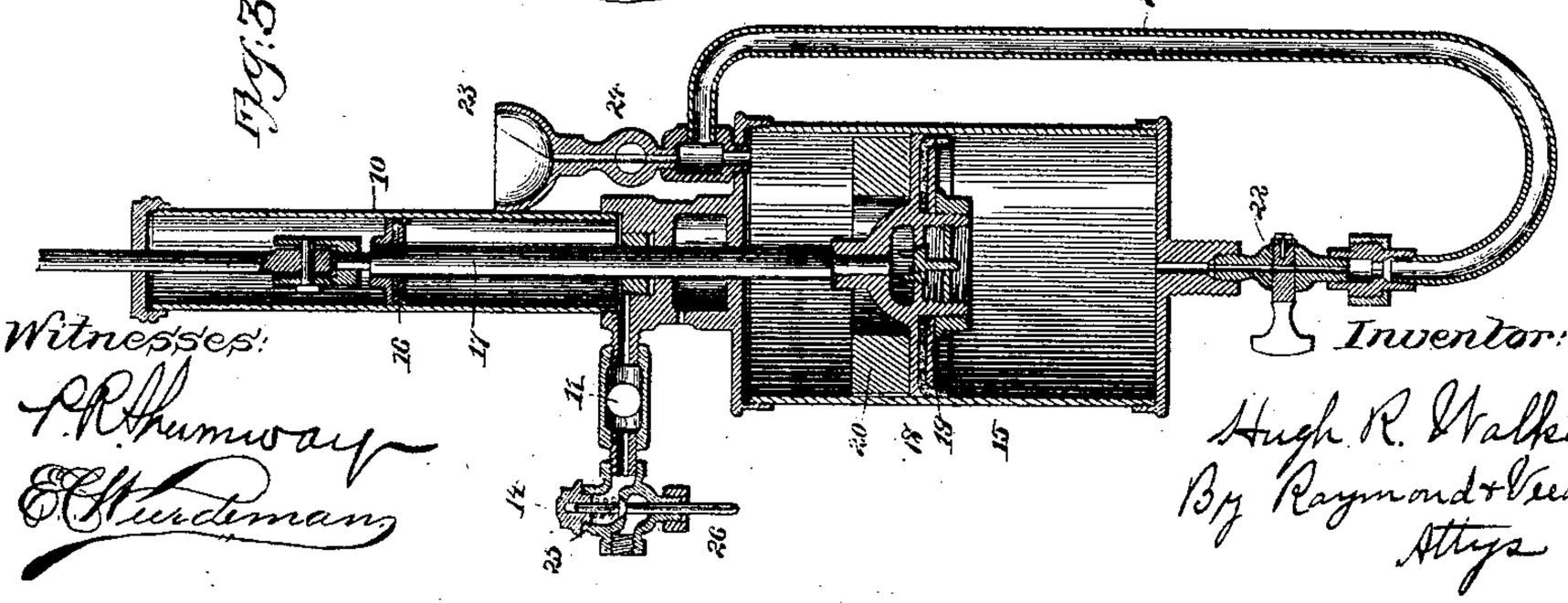

Fig. 3.

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UNITED STATES PATENT OFFICE.

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SMOKE-PREVENTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 435,532, dated September 2, 1890.

Application filed May 16, 1890. Serial No. 352,046. (No model.)

To all whom it may concern:

Be it known that I, HUGH R. WALKER, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Smoke-Preventing Furnaces, of which the following is a specification.

My invention is intended for furnaces in which the fuel is fed by successive charges in contradistinction to those into which the fuel is fed in a constant stream. It is for the most part only applicable to steam-boiler furnaces, as a blast of air or steam is requisite for its operation. It is well known that immediately after fresh fuel is put upon a fire a large volume of gases is disengaged, the quantity becoming much less than after a few minutes' burning, consequently the volume of air at first supplied must be correspondingly greater if the perfect combustion necessary to prevent smoke is to be secured. In some of its features it is specially adapted for use in a boiler-furnace whose fire is urged by the blast of the exhaust-steam from the engines, as locomotive fires universally are, and as stationary-boiler fires are occasionally driven. Such fires often smoke excessively when steam is shut off from the engine, as the volume of air passing is suddenly and greatly reduced.

My invention is adapted to prevent the formation of smoke at such times by providing for the automatic admission of air over the fire as soon as steam is shut off from the engine. No material amount of extra heat will be thus produced, but the formation of smoke will be much reduced, the annoyance arising from locomotives standing at stations being correspondingly lessened.

In the accompanying drawings, Fig. 1 is a side view of a portion of a boiler of the locomotive pattern to which my invention is attached. Fig. 2 is an end view of the same. Fig. 3 is a sectional view, on an enlarged scale, of the dash-pot and connected operating mechanism. Fig. 4 is a sectional view of one of the air-inlet tuyeres.

At one or both ends of the fire-box 2 of the boiler are placed tuyeres 3, 4, 5, and 6. These tuyeres, as shown in section in Fig. 4, are provided with air-inlets *a* and one or more steam inlets or nozzles *b c*. The steam-nozzle *b* communicates through a pipe 7 with the boiler, live steam being thereby supplied to the nozzle. The nozzle *c* communicates with a pipe 8, which is extended to the exhaust-nozzles of the engine, so that exhaust-steam will be drawn through nozzle *c* when live steam is admitted to nozzle *b*. The use of the nozzle *c* is optional, as in most cases sufficient steam will be supplied through the nozzle *b*. The steam passing through the nozzle *b* will create an inrush of air through the passage *a*, and the mingled steam and air will pass into the furnace above the fire.

Instead of steam, air under pressure may be supplied to the nozzle *b* with good results, as the main purpose is to introduce air over the fire, and not steam.

The flow of steam through the pipe 7 is regulated by a valve 8ª, (*vide* Fig. 2,) which is operated by a piston-rod 9 passing upward from the cylinder 10. The cylinder 10 communicates preferably with the air-brake reservoir, if there be one upon the engine; if not, then with the steam-boiler, through the pipes 11 and 12. The flow of air or steam through said pipes is governed by the valves 13 and 14, respectively.

The interior construction of the cylinder 10 and the dash-pot 15, connected thereto, is shown in Fig. 3.

Within the cylinder 10 is a piston 16, fitted closely to the cylinder, but not absolutely air-tight.

The piston-rod 17 extends downward into the dash-pot 15, and at its lower end is attached a piston 18, fitted tightly in the dash-pot 15. This piston is provided with a downwardly-opening valve 19, and to insure its descent at the proper time a weight 20 is placed upon it or made a part of the piston. A by-pass tube 21, passing outside of the dash-pot 15, connects the opposite ends thereof, and a cock 22, inserted in said by-pass pipe, controls the flow of fluid through said by-pass. At the upper end of the by-pass pipe is a funnel 23, provided with a plug-cock 24, so that any leakage of the liquid in the dash-pot may be replaced at pleasure. The valve 14 is seen in section at the left of Fig. 3. The valve is kept seated by a spring 25, surrounding the valve-spindle 26. The latter extends outside the case and is operated by a lifter 27, (*vide* Fig. 2,) attached to a rock-shaft 28. Said rock-shaft has an arm 29, which projects over

the furnace-door 30, so that when the latter is opened the rock-shaft is turned and the lifter 27 opens the valve 14. Air or steam is thus admitted below the piston 16, the latter being thereby raised. The piston 16 in rising opens the valve 8, thereby permitting the passage of steam through the pipe 7 and causing a blast of mingled air and steam to pass above the fire. The piston 16 carries with it in its rise the piston 18 of the dash-pot, the valve 19 opening to permit the piston to move rapidly. As soon as the furnace-door is shut the valve 14 closes, and air is thus cut off from the piston 16. The dash-pot piston 18 at once begins to descend, the speed of its descent being governed by the size of the opening through the by-pass pipe 21. The blast of air above the fire is thus cut off after an interval sufficiently great to permit the fire to become once more clear.

The valve 13, controlling the admission of air to the cylinder 10 through the pipe 11, is so situated with reference to the throttle-valve lever 31, or to some other moving part of the throttle-valve, as to be opened when the throttle-valve is closed. The opening of this valve puts the blast into operation in the same manner as the opening of the valve 14, and the blast is continued in operation so long as the throttle-valve is kept closed, thereby supplying an artificial draft over the fire, which does not urge the fire itself materially, so that the supply of steam is not increased to any inconvenient extent; but the smoke and gases evolved by the fire are consumed and the evolution of an annoying amount of smoke is prevented when the engine is standing still.

A valve 32 is provided in the pipe 7, which may be closed and the apparatus thrown out of action thereby whenever it is desired to do so.

By my construction I provide for an automatically-regulated blast over the fire immediately after a fresh charge of fuel has been thrown upon the fire, and also for a blast over the fire when the artificial blast produced by the exhaust-steam of the engine has been stopped, and this without interfering with the working of either the throttle-valve or the furnace-door, because the duty imposed upon the mechanism connecting the throttle-valve or the furnace-door in setting the blast-controlling mechanism at work is simply to open a small and very easily operated valve, the air-pressure or steam-pressure derived from the air-brake or boiler accomplishing the remainder of the work. By using an external by-pass pipe and a regulating valve or cock in the by-pass the speed of closing can be exactly regulated to suit any sort of fuel or mode of firing. Where a heavy charge of fuel is put in at once it is necessary to leave the blast on a longer time than where smaller charges are used, and the fireman can adjust the apparatus from time to time to suit his firing, or by closing the by-pass valve he can keep the blast on an indefinite length of time, if he so desires.

I am aware that other devices for supplying a blast over the fire for a limited time after the opening of the furnace-door have been heretofore invented, and I do not claim such as my invention; but

I claim—

1. The combination, with a boiler-furnace, of a blast-pipe adapted to carry air over the fire, a valve controlling the operation of said blast-pipe, mechanism connecting said valve and the furnace-door, and mechanism connecting said valve and the throttle-valve, a dash-pot having a piston provided with a valve and having an outside by-pass provided with a regulating-valve, said dash-pot controlling both said connecting mechanisms, whereby the first-named valve is opened by the opening of the furnace-door or the closure of the throttle-valve, and is gradually closed at a rate determined by the by-pass of the dash-pot, substantially as described.

2. The combination, with a boiler-furnace, of a blast-pipe adapted to inject air over the fire, a valve controlling the operation of said pipe, a dash-pot controlling the movement of said valve, a piston and cylinder connected to said valve and dash-pot and operated by fluid-pressure, and a valve controlling the admission of fluid to said piston and cylinder and operated by the opening of the furnace-door, substantially as described.

3. The combination, with a boiler-furnace, of a blast-pipe adapted to inject air over the fire, a valve controlling the operation of said pipe, a dash-pot controlling the movement of said valve, a piston and cylinder connected to said valve and dash-pot and operated by fluid-pressure, and valves controlling the admission of fluid to said piston and cylinder and adapted to be opened by the opening of the furnace-door or the closure of the throttle-valve, respectively, substantially as described.

4. The combination, with a boiler-furnace, of a tuyere having concentrically-arranged passages for air, live and exhaust steam, connections from the latter two passages in the boiler and to the exhaust-passages of the engine, respectively, and mechanism operated by the opening of the furnace-door controlling the flow from the boiler to the live-steam nozzle, substantially as described.

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