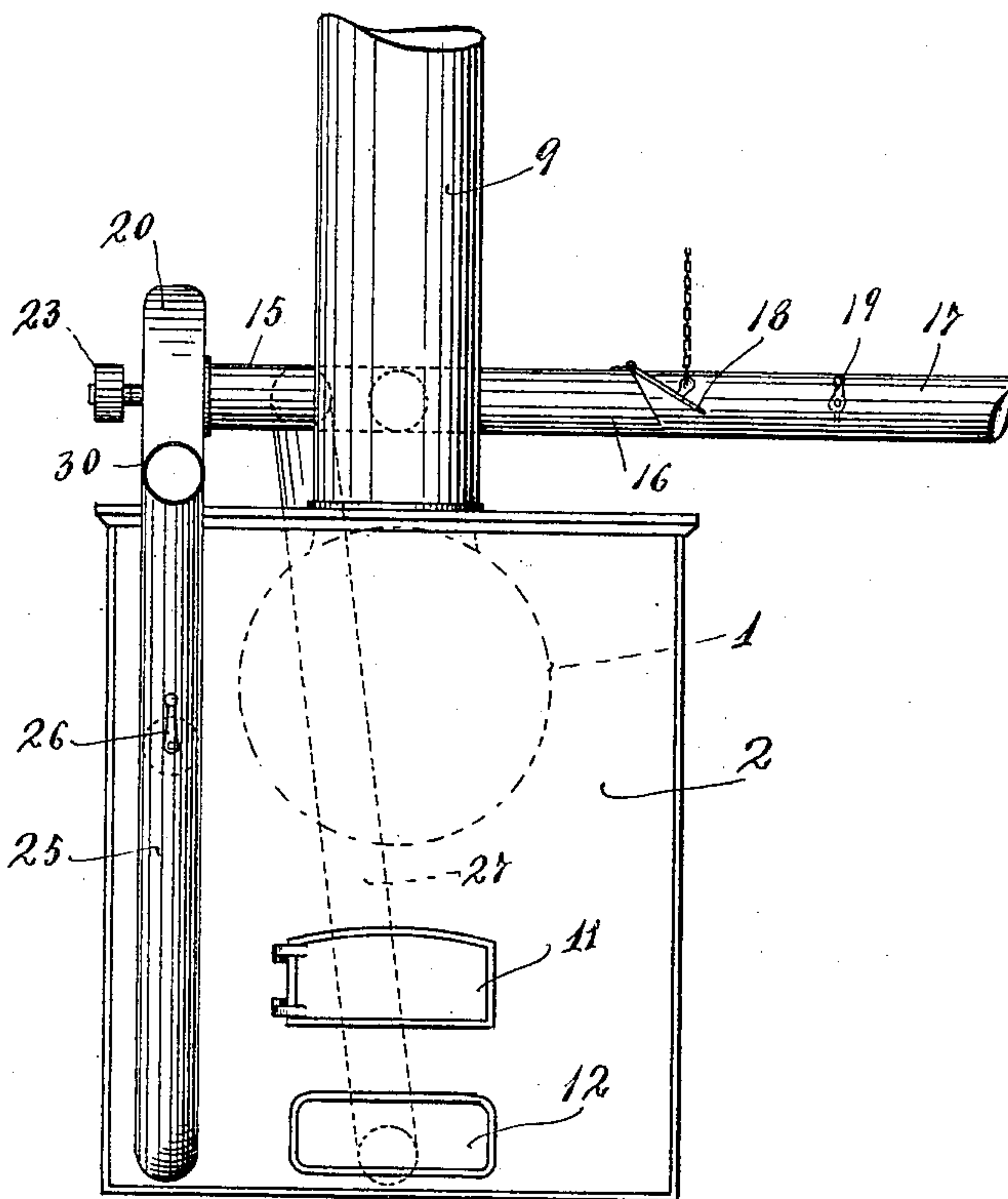


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Patented Sept. 6, 1910.
2 SHEETS—SHEET 1.

Fig. 1



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FURNACE.

969,279.

2 SHEETS—SHEET 2.

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969,279.

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To all whom it may concern:

Be it known that we, MERRITT D. HOFF and ANTHONY J. McCABE, citizens of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Furnaces; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to furnaces, and more particularly to furnaces used in connection with boilers.

The objects of the invention are, first, to provide improved means for effecting complete combustion of the fuel and the consequent economy and abatement of the smoke nuisance; and second, to provide means for rapidly removing fine dust or ashes which accumulate in the combustion chamber back of the fire box proper.

To the above ends, the invention consists of the novel devices and combination of devices hereinafter described and defined in the claims.

In the accompanying drawings which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings: Figure 1 is a view of the front elevation showing a boiler furnace with our invention applied thereto, some parts being broken away; Fig. 2 is a plan view of the same with some parts broken away and some parts sectioned; and Fig. 3 is a view partly in elevation and partly in vertical section on a line $x^3 x^3$ of Fig. 2.

The boiler 1, which is of the standard or any suitable horizontal type, is located in the customary manner within furnace 2, which latter is provided with the customary features to-wit: fire box 3, grates 4, ash pit 5, bridge wall 6, rear or secondary combustion chamber 7, smoke box 8, smoke stack 9 and fuel entrance passage 10, which latter is adapted to be closed by a door 11. The ash pit 5 is also shown as provided with a clean out door 12, which is tightly closed.

In applying our invention to this furnace, a short pipe 13 having a damper 14 is extended from the lower portion of smoke stack 9, and opens into a transversely extended draft pipe 15. This branch pipe 15

at one end has a relatively short branch 16 and a relatively long branch 17, the former of which is adapted to draw air from the boiler room and the latter of which extends to the exterior of the building and is adapted to draw in fresh air. The end of the short branch 16 is adapted to be opened and closed at will as shown by an ordinary gravity closed check damper 18, and the long branch 17 is adapted to be opened and closed by an ordinary pivoted damper 19. The other end of the draft pipe 15 opens into the eye of a fan case 20, shown as secured on top of the furnace, and provided with a tangential discharge pipe 21. A fan head 22 of ordinary construction, works in the fan case 20 and its shaft is provided with a pulley 23, over which a power driven belt, not shown, will be run to drive said fan head. The fan discharge pipe 21 is provided with a downward extension pipe 25, the lower end of which opens into the ash pit 5. This pipe 25 is provided with a normally open damper 26.

The mechanism, so far described, is all that is required for accomplishing the complete combustion of the fuel, but for the purpose of removing the light accumulated ashes or dust from the combustion chamber 7, the following features are added. The numeral 27 indicates a suction pipe, the lower end of which extends horizontally within the combustion chamber 7 and is located at the bottom thereof, and is provided with a multiplicity of ports or perforations 28. This draft pipe 27 is carried upward preferably at the rear of the furnace and then is carried over the top of the furnace and connected to the horizontal draft pipe 15. A normally closed damper 29 is placed in the pipe 27, preferably at a point close to the pipe 15. The discharge pipe 21 of the fan case 20 is provided with an extension pipe 30, that is normally closed by a damper 31, but extends to a suitable point for the discharge of ashes, such for instance as a dust collector.

Rotatively mounted within the horizontal lower portion of the clean-out draft pipe 27 is a tubular valve 32 having spirally arranged ports 33. The extreme lower end of the pipe 27 is closed, but the tubular valve 32 is open at both ends, and is provided at one end with a shaft 34 that extends through a bearing 35 in the lower elbow of the pipe 27, and is provided with

an operating crank 36 by means of which said valve 32 may be rotated.

Under normal conditions, the dampers 29 and 31 will be closed and the dampers 14 and 26 will be open. Either one or both of the dampers 18 and 19 will be open or both thereof may be opened to any desired extent, depending on whether or not it is desired to draw all of the air from the boiler room or all of the air from the exterior of the building or any part from the boiler room and any part from the exterior of the building. Sometimes, better results are obtained by using all fresh air from the exterior of the building, but it is usually desirable to draw at least part of the air from the boiler room, so as to keep the latter well ventilated.

When the dampers are set as above stated, and the fan is rotated while the fire is burning in the furnace, a large per cent. of the products of combustion which pass from the smoke box 8 into the smoke stack 9 will, by the fan, be drawn into the fan case and commingled with fresh air drawn into the fan case through one or both of the branch pipes 16—17 and thence commingled with incompletely burned gases together with the fresh air containing the required oxygen to support the complete combustion and will be forced into the ash pit 5 and thence upward through the grates and the fuel contained thereon. By this arrangement, the combustion of the gases and the smoke producing particles of the fuel is rendered complete. This complete combustion as is evident, results in a very great economy in the use of fuel and as is well known, complete combustion of the fuel means elimination of smoke. It will also be noticed by the above arrangement, the gases are returned directly from the smoke stack through the fan into the ash pit below the grates.

When it is desired to remove the accumulation of fine ashes, the dust which rapidly collects in the combustion chamber 7, the dampers 18, 19, 14 and 26 should be closed and the dampers 29 and 31 should be open. When this is done and the ports 28 in the horizontal lower end of the clean-out pipe 27 are open, the suction produced by the fan will draw these light ashes upward through

said pipe 27 into the fan case and from thence they will be discharged by the blasting fan through the discharge pipe 30 to the dust collector or through plates provided for the collection of ashes. With the ports 33 spirally arranged in the rotary valve 32, rotation or oscillation of the said valve will approximately open the ports 28 in a direction from front toward the rear or vice versa, so that the ashes will not be drawn at the same time through all of the said ports 28. In practice, great annoyance is caused by the accumulation of fine ashes in the rear combustion chamber and in boilers as hitherto constructed, considerable labor is required to remove these ashes. In fact, in many boilers, the removal of the ashes is accomplished with extreme difficulty. This important device for cleaning out the ashes effects its work very quickly and satisfactorily.

What we claim is:

1. The combination with a furnace having a combustion chamber, of a fan provided with a suction tube having damper equipped branches, one leading from the smoke stack of the furnace and the other leading from said combustion chamber, and the said fan having a discharge pipe with damper equipped branches, one leading back to the furnace, and the other leading to a distant point, substantially as described.

2. The combination with a furnace, having a fire box and a rear combustion chamber and provided with a boiler, of a fan having a suction tube provided with two damper equipped branch pipes, one extending from the smoke stack of said furnace, and the other extending from the rear combustion chamber thereof, and said fan having a discharge pipe with damper equipped branches, one extending back into the furnace and the other extending to a distant point, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

MERRITT D. HOFF.
ANTHONY J. McCABE.

Witnesses:

HARRY D. KILGORE,
F. D. MERCHANT.