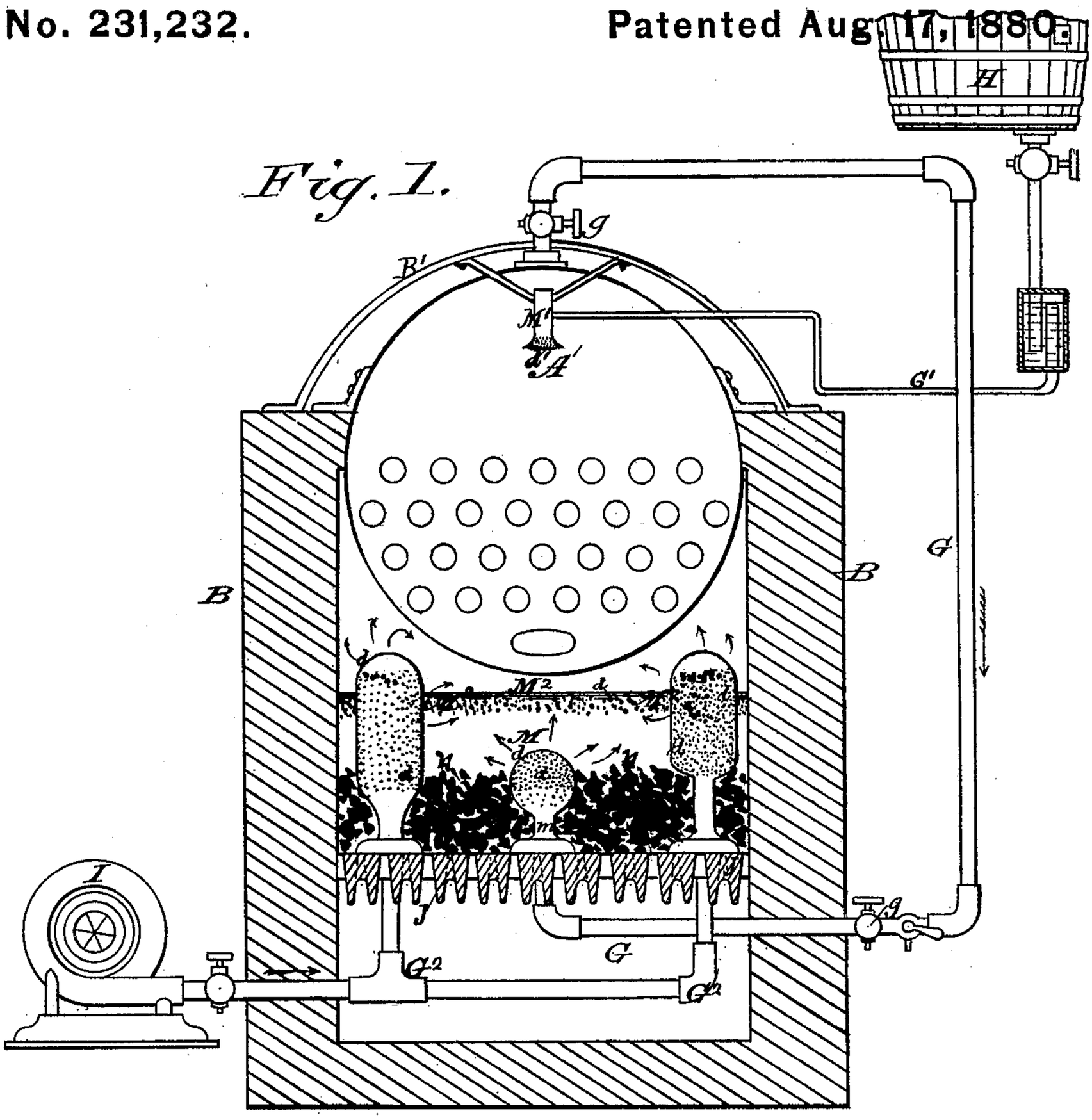
2 Sheets—Sheet 1.

J. MAHONY.

Apparatus for Promoting Combustion in Furnaces.

No. 231,232. **Patented Aug. 17, 1880.**

Fig. 1.



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2 Sheets—Sheet 2.

J. MAHONY.

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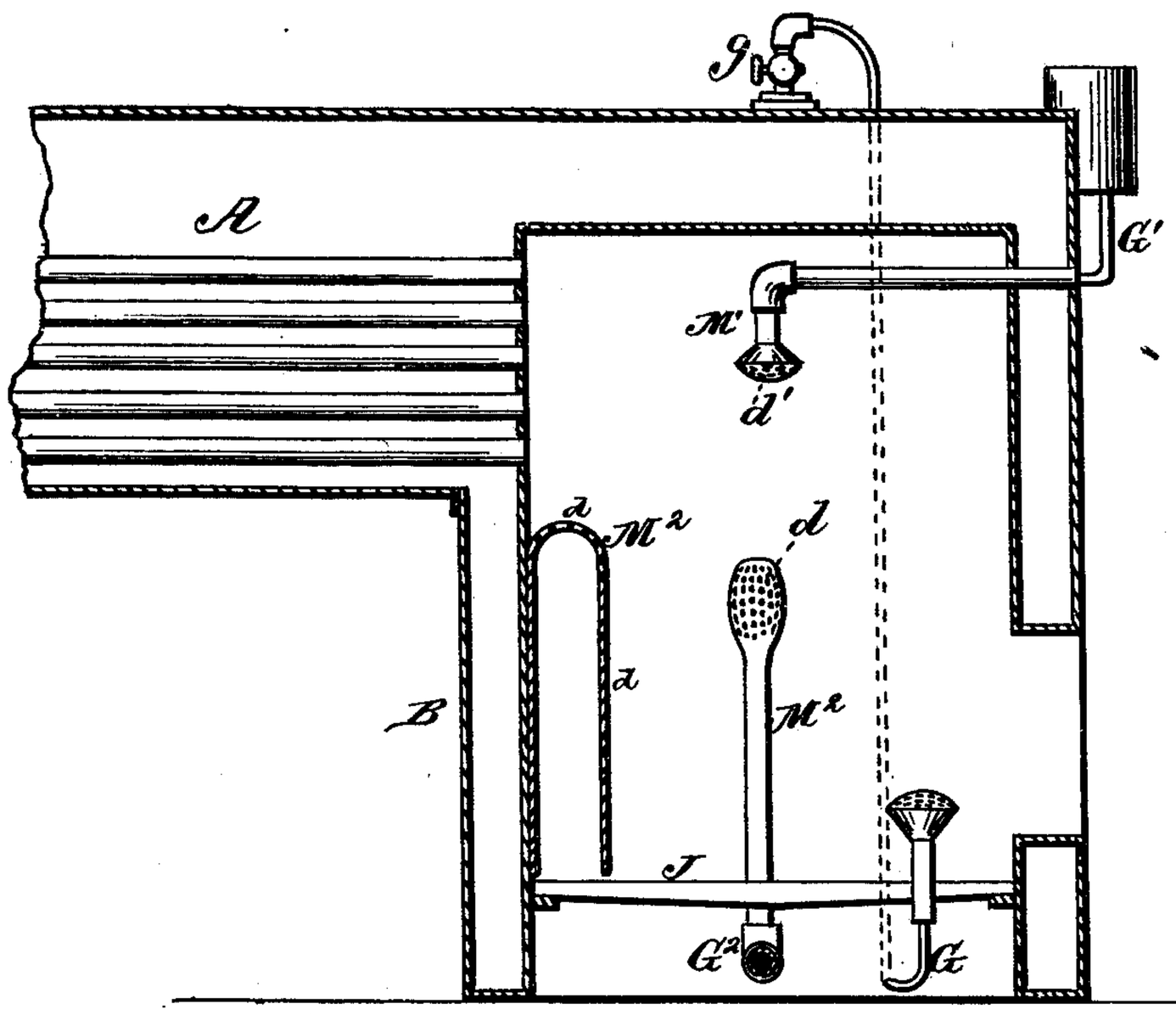
Fig. 2.



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UNITED STATES PATENT OFFICE.

JAMES MAHONY, OF NEWPORT, RHODE ISLAND.

APPARATUS FOR PROMOTING COMBUSTION IN FURNACES.

SPECIFICATION forming part of Letters Patent No. 231,232, dated August 17, 1880.

Application filed July 18, 1879.

To all whom it may concern:

Be it known that I, JAMES MAHONY, of Newport, in the State of Rhode Island, have invented certain new and useful Improvements relating to Furnaces, of which the following is a specification.

My invention is intended more particularly for the furnaces of steam-boilers; but I believe it may be applied with success in furnaces generally.

I have devised novel means for introducing the vapor of hydrocarbons, steam, or air, separately or together.

The fact that the gases rising from coal-fires contain much matter which is combustible has been long known, and the further fact that air and steam can be introduced into the gases with advantage has been demonstrated by many experiments; but the apparatus heretofore employed has involved difficulties which my invention is intended to avoid.

Certain hydrocarbons—eminently the natural product known as "petroleum" (either the crude or refined)—are available for fuel, and are capable of producing more heat than coal at a given cost; but the means of working such have been heretofore imperfect.

I propose to burn both coal and petroleum, diffusing the petroleum in the gases rising from the coal. The coal forms a substratum upon which the petroleum may fall if it is injected as a fluid; but ordinarily the conditions insure that the hydrocarbon shall become a vapor and mingle with the gases arising from the solid fuel. In combination therewith I provide means for introducing air and steam at a high temperature in small streams. The result is a steady and eminently practicable fire at small cost and absolutely complete combustion of all the fuel.

I will proceed to describe what I consider the best means of carrying out the invention.

The accompanying drawings form part of this specification, in which Figure 1 represents an elevation, partly in section, and Fig. 2 a longitudinal vertical section.

J is the grate, B the sides or walls, and B′ the top or crown, of the furnace. In some styles of boilers—as locomotive and marine—the side surfaces will be steam-generating surfaces; in others only the upper surface; and in some, perhaps, none of these will be directly employed, but the heat of the gases will be utilized in flues and other devices, of whatever name, after the combustion is completed in the furnace. My invention may be applied with any style in this respect.

A is the body of the boiler. G is a pipe leading from the steam-space thereof down to a point below the grate, where it bends inward and communicates with a peculiarly-formed chamber, M, from which the steam is distributed through small openings *d*, thickly dispersed through this upper portion. The upper portion of the body of the chamber M is spheroidal. For general purposes it may be an almost absolute sphere, with the apertures *d* thickly distributed on its upper half and a few more sparsely distributed on its lower half. The neck *m*, which connects it with the grate and the pipe G, may be cast in one with a section of the grate, so as to be introduced and removed therewith.

The exterior of the chamber M may be defended by a coat of fire-clay, or the whole chamber may be made of well selected and skillfully-wrought fire-brick material, attached in any suitable way to the grate.

The steam, controlled by cocks *g*, is allowed to flow into the chamber M, and thence to escape in finely-divided streams through the apertures *d*, to mingle with the products of combustion. The steam enters intensely superheated. I have satisfied myself that the effect is highly beneficial. It may not be essential to indicate now thoroughly whether the good effect be attained by the decomposition and burning of hydrogen in the steam, or simply by the mechanical agitation of the gases from the coal, or both. The surrounding of the chamber M and neck *m* with burning anthracite tends to insure that the steam shall enter at a very high temperature; but I can obtain a good degree of the same effect by introducing the same or a somewhat smaller chamber, M, in either of the vertical walls or in the crown-sheet.

I propose to use the chamber M with steam in any of these positions. In any of the positions indicated it becomes highly heated and introduces the steam in a dry and superheated condition, ready to be easily decomposed.

H is a reservoir of petroleum having a provision (not shown) for supplying fresh material in the liquid form, and a pipe, G′, leading from the bottom to a chamber, M′, favorably situated to distribute the gaseous fuel through the apertures *d′*.

In what I esteem the best mode of working, one chamber, M, is connected to a pipe, G, and supplies steam, while another is connected by a pipe, G′, and supplies hydrocarbon fuel. Preferably the steam-jets are through the grate or through the sides near the bottom, and the hydrocarbon is through the crown or through the sides near the top; but these positions may be reversed, or both may be in the bottom or top.

The letter M^2 indicates a series of chambers open below, and adapted to convey fresh air received at a low point, and discharge it intensely heated into the gases generated in the combustion-chamber of the furnace in small streams through thickly-distributed apertures *d*. I have represented three of these chambers. Two are cylindrical in their general configuration, closed at the top, and one is in the form of a rectangular box with an arched top, in which the perforations *d* are formed. All of said chambers are formed of or coated with fire-clay or other refractory material to promote their durability.

In operation, coal is supplied in a stratum, perfect and complete as possible, on the grate J, and is fed with air controlled by an ordinary damper, (not represented,) so as to burn at a moderate rate, which may be increased or diminished, as the working of the apparatus shall require, the solid fuel *n* burning on the grate J, as usual.

The hydrocarbon fluid introduced through the pipe G′ is vaporized in the connected chamber M′ and issues in the form of vaporous fuel through the holes *d′*.

The air is forced by a blower, I, or is inducted freely through the passages G^2, and discharged at a high temperature through the apertures *d*. The steam is received through the pipe G, which is under control by stop-cock *g*, and being intensely rarefied, contributes to the completeness of the combustion by a mechanical agitation, also by its decomposition and burning.

In combination all these devices are important. The grate J and the stratum of combustible fuel lying thereon give a uniformity and stability to the fire, supply a large quantity of heated gases, and form a bed to receive and burn any petroleum which may fall on it.

The combination of the pipe G′ and its connections adds cheap volatile fuel and increases the heating effect at little cost. The combination of the air-passages G^2, chambers M^2, and the apertures *d*, for finely distributing the hot air, supplies the necessary oxygen under peculiarly favorable conditions; and the combination of the steam-pipe G and its connections provides an efficient agitator and mixer with, I believe, a valuable addition to the fuel.

I propose to employ hydrocarbon fuel in any convenient form, according to the uses of the liquid, as refined petroleum of any grade, crude petroleum, coal-tar, or bitumen.

The reservoir H should be always at a higher level than the furnace, and care should be taken to keep it at a sufficient distance and properly cooled by enveloping it in a tank of water, or otherwise, as a protection against fire.

Various modifications may be made. I can mix steam with the gaseous fuel in the pipe G′. I can employ a jet of steam to give force to the current through the pipes G′ or G^2, using for this purpose a Giffard injector, or a simple device analogous in principle thereto.

The steam, hydrocarbon vapor, and air may be heated in a separate retort or pipe before being discharged into the combustion-chamber, if preferred.

I am aware that apparatus have been used having an air-blast passed through a perforated chamber, a hydrocarbon and a steam-distributer throwing their respective contents into and over the solid fuel; but mine possesses marked features of difference therefrom, as set forth in the following claims.

I claim as my invention—

1. In combination with a furnace and its grate, the air-passages G^2, chambers M^2, provided with distributing-orifices *d*, the air-blast apparatus I, the hydrocarbon-distributer A′, with its supply-pipe G′ and reservoir H, and the steam-distributer M *d*, and supply-pipe G, all arranged in respect to each other substantially as specified.

2. In combination with a furnace having the ordinary grate for containing solid fuel, an air-blast apparatus leading into and discharging the blast through the perforated chambers M^2, a hydrocarbon-distributer, A′, for discharging the hydrocarbon over the grate, formed and located as described, and a steam-distributer provided with perforations for ejecting the steam in a series of jets into and over the fuel, as shown and described, and for the purpose set forth.

In testimony whereof I have hereunto set my hand this 9th day of April, 1879, in the presence of two subscribing witnesses.

JAMES MAHONY.

Witnesses:

CHARLES C. STETSON,

E. B. BOLTON.