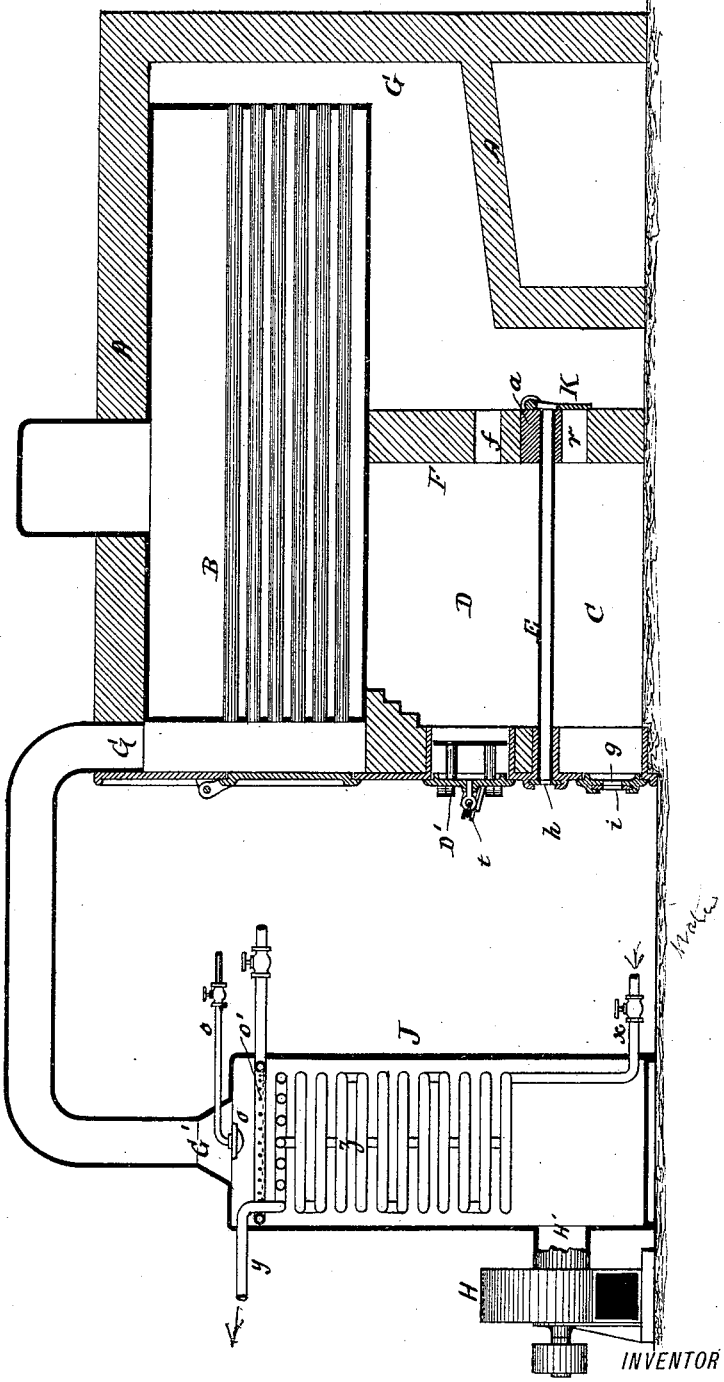
(No Model.) 2 Sheets—Sheet 1.

E. J. MALLETT, Jr.

BOILER OR OTHER FURNACE.

No. 262,072. Patented Aug. 1, 1882.

Fig. 1.



WITNESSES

Wm. A. Skinkle

Geo. W. Breck

INVENTOR

Edward J. Mallett, Jr.

By his Attorney

Marcellus Bailey

(No Model.) 2 Sheets—Sheet 2.

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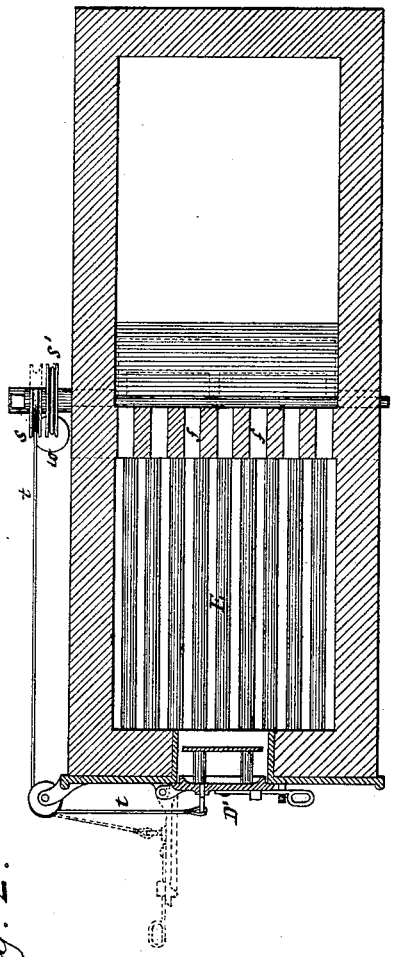

Fig. 2.

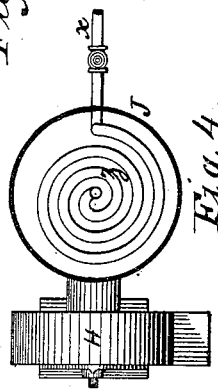

Fig. 4.

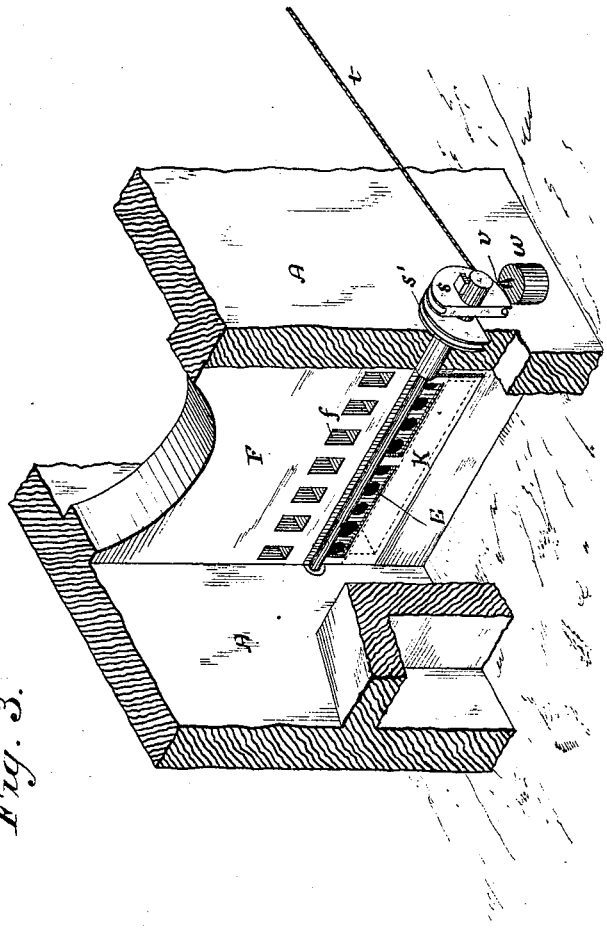

Fig. 3.

WITNESSES

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UNITED STATES PATENT OFFICE.

EDWARD J. MALLETT, JR., OF NEW YORK, N. Y.

BOILER OR OTHER FURNACE.

SPECIFICATION forming part of Letters Patent No. 262,072, dated August 1, 1882.

Application filed May 17, 1882. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. MALLETT, Jr., of the city, county, and State of New York, have invented certain new and useful Improvements in Boiler and other Furnaces, of which the following is a specification.

These improvements are the outgrowth of the system of promoting the combustion of fuel in boiler and other furnaces for which I have already applied for and am about to receive Letters Patent of the United States, said system being characterized mainly by the employment of distinct, separate, and controllable air-inlets, which introduce air in regulated quantities to the furnace, both through the ash-pit and also at a point where it will meet the fuel-gases, in conjunction with a suction-fan or other mechanical draft-inducing appliance—such, for instance, as the steam jet arrangement employed in the smoke stack or box of a locomotive, or a fan used to accelerate the draft of a chimney by revolving within it, or air injected into a chimney, or air admitted into tight stoke-holds of ships, or any other mechanical means of inducing the draft of a furnace. Although the combinations of the appliances above referred to are fully adequate to prevent the formation of smoke, still it happens that at times, when the fire-doors are opened to charge the furnace with fuel, the air necessary to produce complete combustion does not enter in sufficient quantity through those inlets (usually hollow grate-bars) which normally conduct it to the point where it will meet the fuel-gases, because it enters through the open furnace-doors. In order at this time to prevent the formation of smoke and insure continuance of complete combustion, I make use of a damper or draft-switch so placed that it may cover the opening in the septum or division wall through which the products of combustion pass from the fire, and I provide in the rear part of the ash-pit an exit opening or flue, which is exposed when the damper closes the septum-wall. The consequence of this is that the air which enters the open furnace-doors cannot pass through the usual flame-passage, which is closed by the switch or damper, but is drawn down through the fuel into the ash-pit, and thence out through the exit-opening in the rear part of the latter into the combustion-chamber to meet the air issuing from the hollow grate-bars.

During the operation of firing the air-gate in the front of the ash-pit is closed, so that all air which gains access to the fuel enters through the open fire-doors. The consequence of this arrangement is that the portion of air which passes to the fuel enters above the grate-surface and passes down therethrough, and thence out from the ash-pit into the combustion-chamber beyond, while the portion that meets the fuel-gases passes, as before, through the hollow grate-bars. It is manifest that under my system this arrangement might be made permanent, if desired, by simply closing the septum or division wall and the front of the ash-pit and transferring the air-gate in the latter to a point where the air admitted by it would enter above instead of below the fuel. I do not, however, consider such an arrangement so economical or practically available as that which I have described in the above-mentioned Letters Patent about to issue to me.

In using a suction-fan for the purpose of sucking or drawing air into and through the furnace it is requisite to employ condensing appliances to cool the heated air or gas at the time or before it enters the fan.

The form of condenser preferred by me is what I have hitherto distinguished as a "water-contact condenser," in which a spray of water is showered into and through the hot furnace-gases on their way to the fan.

I have now devised another form of condenser, termed a "dew-point condenser," which acts effectively both as an air-cooler and water-heater whenever it is desired to cool the gases leaving a furnace the draft of which is induced by any of the mechanical means already cited.

It is known that water circulating through tubes placed in a chimney is not adequately heated, first, because the air of the chimney is too dry to rapidly radiate its heat to the tubes; second, because if the tubes present sufficient surface to the chimney-gases to allow the water to be even partially heated, the temperature of the chimney-gases becomes lower, and consequently the draft is lessened; third, because if the tubes are sufficiently numerous they obstruct the draft; fourth, because the tubes soon

become coated with soot, which impairs their heat-conductivity. These obstacles I obviate by using, in connection with the suction-fan or other air-exhauster used to create the draft, a casing through which the furnace-gases are drawn, this casing inclosing pipe through which water circulates and around which pass the heated gases, kept moist by a water-spray, which puts them in a condition most favorable to giving up their heat to the pipe. An appliance of this nature is in practice very effective, and will utilize to a great extent the heat of furnace or chimney gases, because it keeps the hot air saturated with moisture to its dew-point.

The nature of my improvements can, however, best be explained and understood by reference to the accompanying drawings, in which I have represented them in what I now believe to be their best form.

Figure 1 is a longitudinal vertical central section of so much of a boiler-furnace as needed for purposes of explanation. Fig. 2 is a horizontal section of the same. Fig. 3 is a perspective view of a portion of the furnace in rear of the septum or division wall. Fig. 4 is a sectional plan of the condenser.

A is the body of the furnace; B, the boiler; C, the ash-pit; D, the fire-box; E, hollow grate-bars, open from end to end, their rear ends extending through to the rear of the septum or division wall and supported in boxes therein; *h*, a sliding register or gate for regulating the admission of air to the grate-bars; *i*, a like register applied to the air-inlet openings *g* in the front of the ash-pit, these two registers being usually connected to and operated by a single lever-handle, (not shown,) substantially in the manner indicated in my Letters Patent before referred to as about to issue, by means of which they are simultaneously moved in opposite directions, so that in proportion as the one is closed the other is opened; *f*, openings in the septum or division wall, through which the fuel-gases pass into the conductory or draft flue G beyond; J, the condenser, and H the suction-fan.

The parts thus far described are arranged and operate substantially in the manner described in the Letters Patent about to issue to me, and they therefore require no further description here. I therefore proceed to the parts in which my present improvements are confined, and shall describe first the damper and then the condenser.

The damper is marked K, and is represented as hinged to the rear face of the cast-iron box *a*, which supports the rear ends of the grate-bars. It is represented in Figs. 1 and 3 in the position which it occupies when the fire-door of the furnace is shut, and in this position it covers and closes an opening, *r*, in the rear wall of the ash-pit, which communicates with the conductory flue beyond. At the time the fire-door is opened the damper should be swung from the position shown to one in which it closes the opening *f* in the septum-wall and uncovers the opening *r*. Inasmuch as the register *i* of the ash-pit is in practice closed during firing, it follows that at this time all the air that enters the furnace (excepting that which is introduced through the hollow grate-bars, whose register *h* is at this time wide open) must enter through the open fire door or doors, and is thence drawn downwardly through the grate-surface into the ash-pit and out from the opening *r* into the flue beyond, meeting as it rises, after passing beyond the ash-pit wall, the heated air drawn through and issuing from the hollow grate-bars. The result is that the gases from the fresh fuel with which the furnace is being charged are drawn down through the incandescent mass of fuel resting on the grate, and I in this way obtain a smokeless flame. When the fire-door is again closed the damper is returned to its former position.

As I have hereinbefore remarked, it is possible, under my system of promoting combustion, to permanently instead of temporarily close the opening *f* in the septum-wall. In this case the front of the ash-pit should be closed tight and the openings *g* and their register *i* transferred to a point on the furnace-front where the air admitted through these openings would enter the fire-box above the fuel resting on the grate therein. The course of the air thus admitted would be down through the fuel into the ash-pit, and thence out through the opening *r* to meet and mingle with the heated air issuing from the rear ends of the grate-bars.

It is desirable in some cases to make the damper K automatic in its action. One convenient arrangement for the purpose is to connect the shaft on which the damper is fastened with the fire-door D′ by a cord or chain, *t*, which, as indicated in Fig. 2, extends from the front of the fire-door over one or more suitable guide rollers or pulleys to the periphery of a sector-pulley, *s*, fast on one end of the shaft which projects from the side wall of the furnace. Upon this end of the shaft is a second sector-pulley, *s′*, to the periphery of which is attached a chain or cord, *v*, supporting a weight, *w*. When the door D′ is opened, as indicated by dotted lines in Fig. 2, the cord *t* is slackened, and the weight *w* causes the damper-shaft to partly rotate in the direction requisite to swing the damper up far enough to cover the openings *f*, by which action the cord *t* is partly wound on sector *s*. When the door is again closed the cord *t* will be thereby pulled and caused to unwind from sector *s*, and in so doing will cause the damper to swing down to its original position against the resistance offered by the weight.

The parts can be so arranged and proportioned that they will be very nearly counterpoised, and thus can be operated without exertion.

The condenser hereinbefore referred to is shown clearly in Figs. 1 and 4. It consists of a drum or casing, J, which contains horizontal superposed coils of tubing forming a continu-

ous pipe or coil, *z*, through which water, either cold or warm, or steam, is forced, the water entering the coil at the lower point, *x*, and leaving it at the upper point, *y*. The suction-fan is connected to the case or drum at H′, and the conductory flue G is connected thereto at G′, or vice versa. The hot gases drawn from the furnace pass through the drum around the coil *z* on their way to the fan. The heated gases, in order to be put in a condition in which they will part with their heat to the water-coil *z*, should be made moist at or before the time they reach the coil. A convenient arrangement for this purpose is shown in the drawings. Within the drum, at the top, is a water-supply pipe and rose, *o*, the spray from which mingles with the heated gases passing into the condenser and imparts to them the necessary moisture. The amount of water or steam discharged from this contrivance should be so graduated as to be just sufficient to saturate the heated gases with moisture. The quantity should not be so great as to incur liability of water condensing and collecting within the drum. The heated gases lose heat by the vaporization of the water-spray, and also readily impart their heat to the coils, because, being saturated with moisture, they radiate and also conduct heat much more easily than dry air.

The coil *z* may be connected with the boiler, and the feed-water can thus be heated to a high degree without being brought into actual contact with the gases, as was done in the first form of condenser used by me. The pump or engine which causes water to pass through the coil *z* should in such case be placed on the inlet side *x*, and not between the outlet side *y* and the boiler.

The external surface of the coil *z* can be washed and kept clean from any soot that may possibly collect by water showered from a water jet or distributer, *o′*, or by a steam jet. This device is used only when it is found necessary to clean the coil. The water thus used collects in the lower part of the drum, and can be drawn off therefrom through a suitable waste or discharge cock, which I have not deemed it necessary to show.

In conclusion, I desire it to be understood that I do not restrict myself to the particular arrangement of contrivances herein described in illustration of my improvements, for the same may be varied considerably without departure from my invention. More than one damper may be used, and the manner of mounting and operating the same can be modified to a very considerable extent. I give preference, however, to the arrangement indicated in the drawings.

What I claim as of my invention is—

1. The combination, with the fire-box, separated from the conducting-flue by a partition or division wall, substantially as described, the ash-pit, the suction-fan or air-exhauster, and the air-inlets which introduce air into the furnace at a point where it will meet the fuel-gases, of air-inlets which admit air to the fire-box at a point above the grate-surface, and a flame-passage leading from the ash-pit to the conducting-flue, substantially as and for the purposes hereinbefore set forth.

2. The combination, with the flame-passages in the septum-wall and the ash-pit, of the fire-door and the switch-damper, connected with and operated by the said door so as to close either the passage in the septum-wall or that in the ash-pit, according as the door is open or shut, substantially as hereinbefore set forth.

3. The combination, with the air-exhausting appliance, the hollow grate-bars, and the registers controlling admission of air thereto and also to the ash-pit, of the septum-wall and ash-pit, provided each with a flame-passage leading to the conducting-flue, and a switch damper or system of dampers adapted to operate in connection with said passages, substantially as hereinbefore set forth.

4. The combination of furnace, suction-fan or air-exhausting appliance, and intermediate condensing apparatus, consisting of a drum or casing, pipe through which water is caused to circulate, inclosed in said drum, and means, substantially as described, whereby the heated gases drawn from the furnace through the drum and around the pipe are moistened, substantially as and for the purposes hereinbefore set forth.

5. A condenser for the heated products of combustion which pass from a furnace, consisting of a drum or case connected to the chimney or discharge-flue of the furnace, so as to receive therefrom the heated furnace-gases, pipe through which water is caused to circulate, inclosed in said drum, and water or steam jets for keeping moist the heated gases which pass through the drum and around the water coil or pipe, substantially as hereinbefore set forth.

In testimony whereof I have hereunto set my hand this 16th day of May, 1882.

EDWARD J. MALLETT, JR.

Witnesses:
P. O'CONNER,
JAS. H. COX.