L. N. McDONALD.

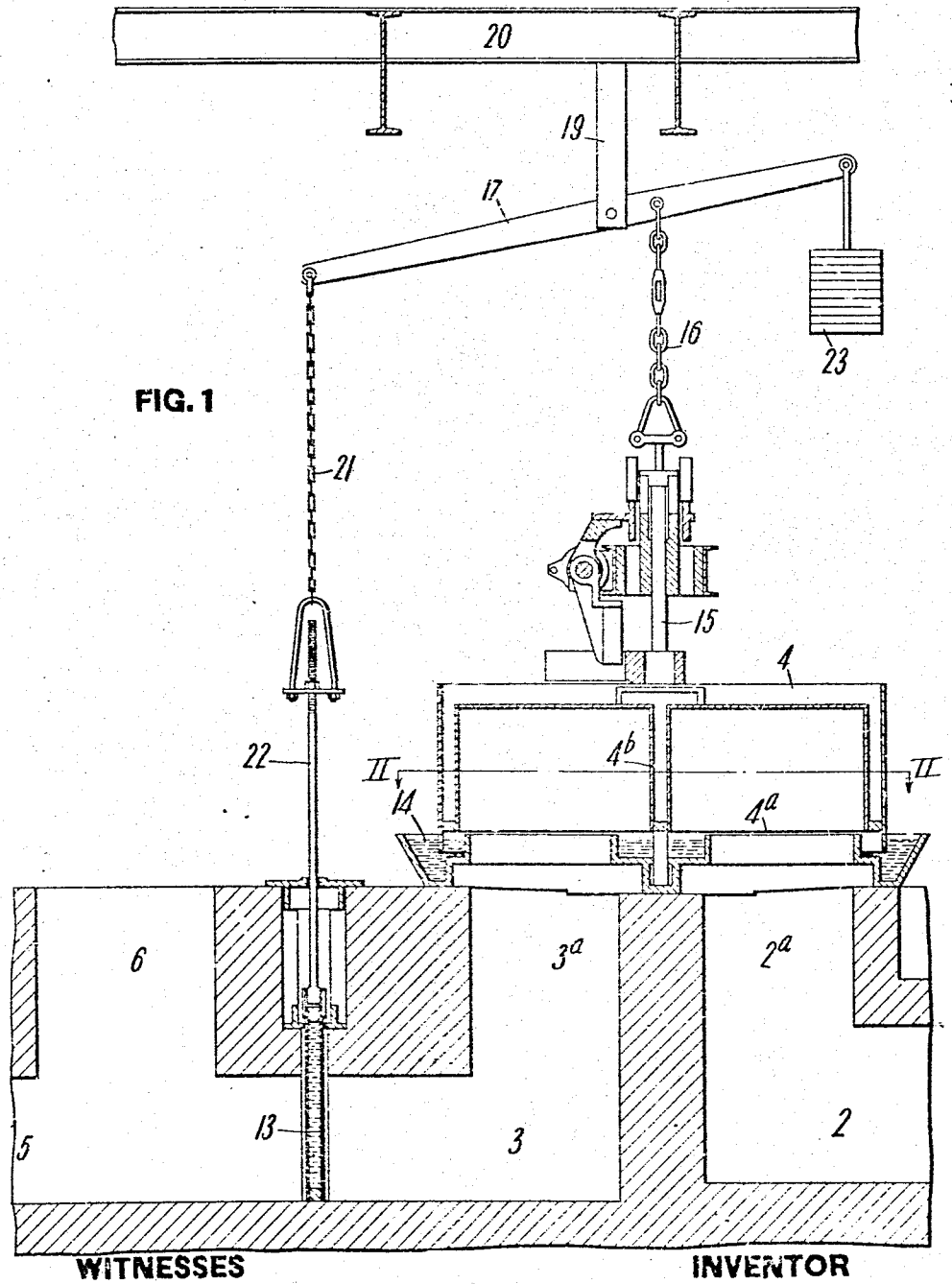
VALVE MECHANISM FOR REGENERATIVE FURNACES.

APPLICATION FILED JAN. 7, 1911.

987,734. Patented Mar. 28, 1911.

2 SHEETS—SHEET 1.

FIG. 1



WITNESSES

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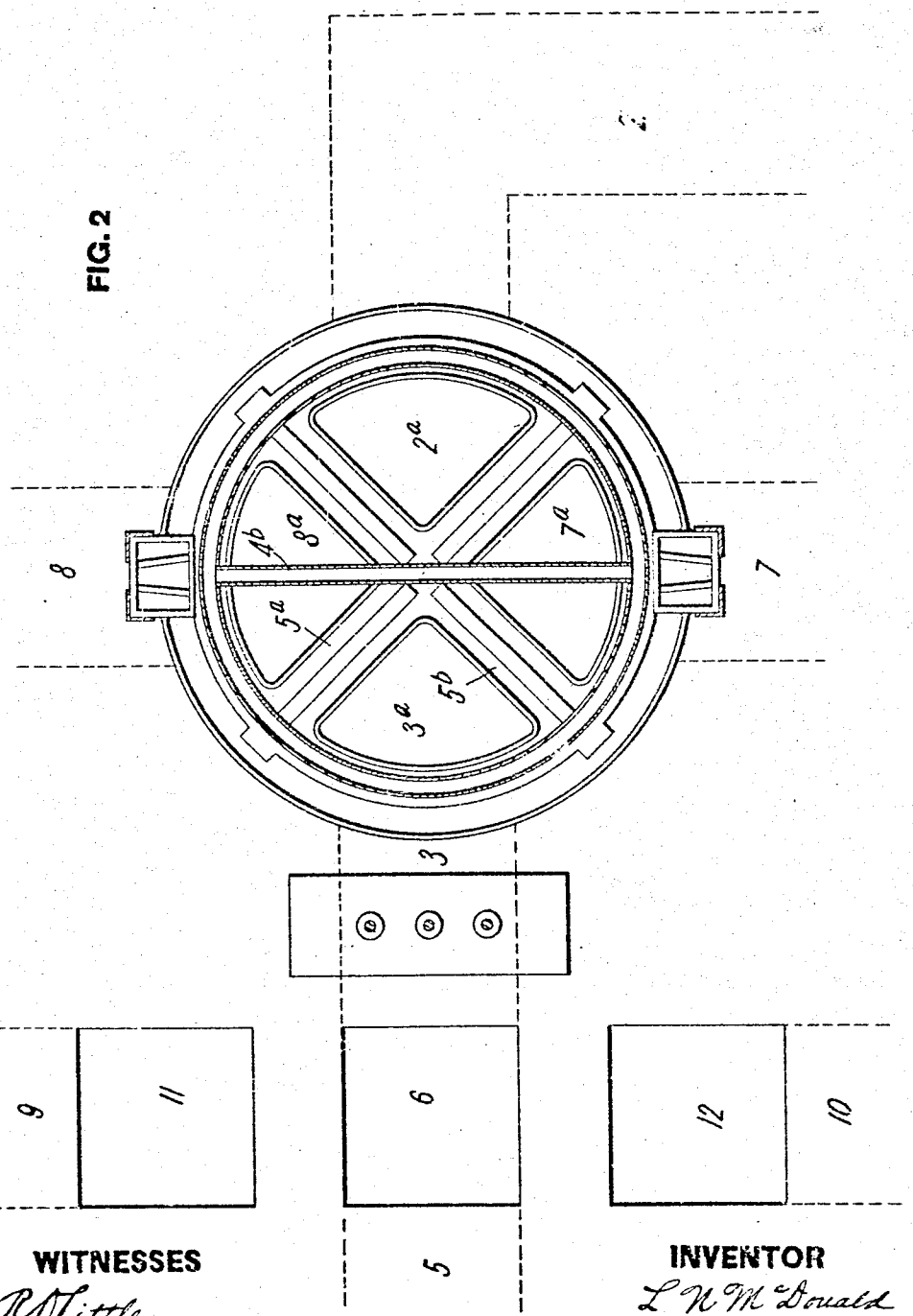
2 SHEETS—SHEET 2

FIG. 2



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UNITED STATES PATENT OFFICE

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VALVE MECHANISM FOR REGENERATIVE FURNACES.

987,734. Specification of Letters Patent. Patented Mar. 28, 1911.

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To all whom it may concern:

Be it known that I, LOUIS N. McDONALD, of Youngstown, in the county of Mahoning and State of Ohio, have invented new and useful Improvements in Valve Mechanism for Regenerative Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to the construction and arrangement of the valves used in regulating the flow into and out of regenerative furnaces, of the air and gases passed into and through such furnaces, and more particularly relates to the construction and arrangement of the reversing valves and stack valves and valve operating mechanism employed in connection with such furnaces. Heretofore, in the operation of such regenerative furnaces, the main gas flues leading from the gas producers become directly connected to the stack flues through the partly open reversing valves, during the interval the valves are being actuated through the frequent reversing movements necessary to change the direction of flow of the gases through the furnace and furnace regenerators.

One object of my invention is to provide an improved valve mechanism adapted for use in regulating and controlling the air and gases passing into and out of the regenerator chambers of regenerative open hearth and heating furnaces and to provide apparatus having novel means whereby connection of the main gas flue through the reversing valves with the stack flue during the reversing movements of the gas reversing valves is automatically prevented, the escape of unburned gases is obviated and escape of unburned gases from the main gas flue, through the reversing valve, into the stack flue rendered practically impossible.

Referring to the drawings, Figure 1 is a sectional elevation showing a reversing valve (of the Dyblie type) as applied for use to the gas flues of a regenerative furnace. Fig. 2 is a sectional plan on the line II—II of Fig. 1, showing the arrangement and relative location of the gas flues, regenerator flues and stack flue.

In the drawings, 2 designates a main gas flue leading from a gas producer or other source of gas supply and 3 is a flue connection leading from a reversing valve 4 to the stack flue 5. A flue connection 6 is provided leading from the stack which connects to the air valves of the regenerative furnace. The gas reversing valve 4 is employed to connect the gas regenerator flues 7 and 8 with the gas flue 2 and inlet 3 leading to the stack flue 5. Flues 9 and 10 which lead respectively to the air regenerators located at the opposite ends of regenerative furnaces are provided with connecting flues 11 and 12 which are arranged in a suitable location relative to the air inlet 6 leading into the stack flue. A suitable valve, usually of the Siemens butterfly type, is employed to connect the flues 9 and 10 from the air regenerators with the inlet 6 leading to the stack flue 5.

Located between the branch flue 3 leading to the reversing valve 4 and the branch flue 6 connecting the air valve with the stack flue 5, is a shutter or damper valve 13 which is mounted in suitable recesses or grooves in the opposite side walls of the flue, so as to be slidingly movable in a vertical direction in opening and closing or shutting off the flue connection 3 from the stack flue 5.

In the drawings, a rotary reversing valve 4 of the Dyblie type is shown employed to connect the gas and stack flues with the gas regenerator flues. A suitable turning mechanism is provided with this type of valve in which the first movement in the reversing operation is to lift the casing of the valve 4 vertically in order to raise the bottom marginal edge 4^a of the partition in the valve above the upper marginal edge of the water seal 14 which is placed on top of the masonry in which the vertically extending flue outlets are formed.

As shown in the drawings, a valve stem or rod 15 is employed to connect the valve casing 6 with a chain or other flexible connection 16 which is suspended from the lever 17. The lever 17 is pivoted at an intermediate point in its length from a bracket 19 which is secured as shown to the floor beams 20, covering the valve pit usually employed in connection with regenerative furnaces. In cases where the outlets from the gas and regenerator flues are led upwardly to the floor level the bracket 18 may be suspended from the roof of the furnace building or other suitable supporting framework.

On one end of the lever 17 is a chain or flexible connection 21 which is adjustably connected to the rod 22 which in turn is connected by its lower end to the vertically

movable damper valve 13. As shown, the damper valve 13 is formed of two plates spaced apart from each other to provide a water space for keeping the valve cool and preventing excessive warping thereof. Suitable connections are also employed to lead the cooling water into and out of the valve; this damper construction, however, not forming part of my invention, is not further described.

One end of the lever 17 is provided with a counterweight 23 which is employed to counter-balance or partly counter-balance the damper valve 13, this construction permitting the stack valve or damper being opened and held open to a greater or lesser extent when the reversing valve is in its closed or operative position.

In the drawings, the casing 4 of the Dybvalve is shown in its lifted position and with the valve rotated through half of its travel in reversing the furnace. When in this position and while the valve is being rotated, unburned gases are free to flow from the gas flue 2 and branch 2^a and under the partition 4^b in the valve casing 4 into the opening 3^a leading to the branch flue 3 which connects into the stack flue 5. The rotary movement of the valve is continued from the position shown until the partition wall 4^b in the valve is in line with one or the other of the transverse troughs or recesses 5^a, 5^b, which are provided in the top of the water pan 14 forming the water seal of this type of valve.

When the valve body 4 has been rotated to bring the partition 4^b in line with one or the other of the recesses 5^a, 5^b, the valve is lowered by lifting upon the stack-valve rod 22 until the lower marginal edge 4^a of the partition in the valve 4 is below the surface of the water maintained in the pan 14. When so lowered, the opening 2^a leading into the gas flue 2 is connected with the opening 8^a leading to the regenerator flue 8 and the opening 7^a leading to the regenerator flue 7 is connected with the opening 3^a leading to the branch flue 3 which connects into the stack flue 5.

By reference to Fig. 1, it will be seen that when the rod 22 is moved downwardly and the casing 4 of the valve is thereby moved into its lifted position (that shown in the drawings) the lever 17 is rocked on its fulcrum so as to lower the outer end of this lever and simultaneously with the lifting movement of the valve 4 lower the damper valve 13 into the position shown. After the valve is moved into position to reverse the furnace, the casing 4 is lowered, as has been before described. When this occurs the counter-weight end of the lever 17 is then lowered and its opposite end lifted and simultaneously with the lowering of the casing 4 the damper 13 will be raised so as to open communication between the flue 3 and the stack flue 5 so as to permit escape of gases past the damper 13 into the stack. Assuming that the partition 4^b is now lowered into the recess 5^a in the trough 14, the unburned gases will pass through the flue 2 upwardly through the opening 2^a in the bottom of the water pan 14 and outwardly from the valve casing through the opening 8^a in the bottom of the water pan into the regenerator flue 8 and after passing through the gas regenerator connected to the flue 8, in which the unburned gases become highly heated, will enter the furnace where the heated gases are mixed with air and burned. The products of combustion will pass out of the opposite end of the furnace into and through the gas regenerator located at the opposite end of the furnace into the regenerator flue 7 so as to heat this regenerator. The burned gases pass through the flue 7 and rise upwardly through the opening 7^a in the bottom of the water pan of the gas valve, and then pass downwardly through the opening 3^a connecting into the flue 3 which connects the reversing valve 4 with the stack flue. When the valve 4 is lowered in one or the other of its two operative positions, the damper 13 may be raised, (when desired, until a full stack flue opening is obtained), so as to permit regulating of the draft on the furnace by means of the furnace stack. When it is desired to reverse the furnace the valve 4 is again lifted by pulling downwardly on the rod 22, as has been described, and is rotated until the partition 4^b is above and in line with the recess 5^b in the water pan 14. When the valve is lifted the counter-weight end of the lever 17 is also raised and the damper valve 13 lowered simultaneously therewith so as to shut off the connection between the branch flue 3 and the stack flue 5. The damper valve 13 remains in its closed position until the lifting movement of the valve 4 is completed, and the turning movement of the valve has been accomplished, and the valve is again lowered into its sealing position. In this regard it will be noted that escape of unburned gases from the gas flue 2 through the valve 4 into the branch 3 leading to the stack flue is effectively prevented during the reversing movement of the valve, in this way avoiding any waste of unburned gases which is present with the reversing gas valves as applied heretofore on regenerative furnaces.

The above described operations are repeated as often as is required in reversing or changing the direction of flow of the gases into and out of such furnaces.

The advantages of my invention are many and will be appreciated by those skilled in the art. The apparatus is simple and is cheaply constructed and easily repaired. By its use the escape of unburned gases to the

stack flue is prevented and losses of unburned gases due to this cause overcome.

Although the amount of gas lost at any one reversing operation with the apparatus used heretofore is comparatively small, when the number of reversing movements required in a day or week, or any given time is considered, the volume of unburned gases escaping in this manner is very great, resulting in expensive waste, as well as being the cause of liability of disastrous explosions.

By the arrangement of the damper valve and gas valve and the operating mechanism, as shown, the damper is automatically opened and closed simultaneously with the reversing movement of the gas valve, the occurrence of explosions prevented, and waste heretofore present in the operation of such furnaces is prevented.

Modifications in the construction and arrangement of the parts may be made without departing from my invention.

I claim:—

1. In a regenerative furnace, a furnace valve mechanism comprising a reversing valve operatively connecting the stack and gas flues with the furnace regenerator flues and a stack damper valve adapted to prevent passage of gases through the stack flue when in closed position, the stack and reversing valves being operatively connected together with the connecting mechanism constructed and arranged to move the damper valve into its closed position when the reversing valve is operated to reverse the direction of flow of gases in the furnace.

2. In a regenerative furnace, a valve mechanism comprising a reversing valve operatively connecting the stack and gas flues with the furnace regenerator flues and a stack damper valve adapted to prevent passage of gases through the stack flue when in closed position, the stack valve and reversing valve being operatively connected together, said connecting mechanism being constructed and arranged to move and maintain the damper valve in its closed position during the reversing movements of the gas valve.

3. A valve mechanism for regenerative furnaces comprising a reversing valve, a stack damper valve, a pivoted valve operating lever, and connections from said lever to the valves arranged to close one valve when the other is opened.

4. A valve mechanism for regenerative furnaces comprising a reversing valve, a stack damper valve, a pivoted valve operating lever, and connections from said lever to the valves arranged to close the damper valve when the reversing valve is opened in reversing.

5. A valve mechanism for regenerative furnaces comprising a reversing valve, a stack damper valve, a pivoted valve operating lever, and connections from said lever to the valves arranged to close the stack valve when the reversing valve is opened in reversing, the connecting mechanism being arranged to permit movement of the damper valve to regulate the draft of the stack flue when the reversing valve is in closed position.

In testimony whereof, I have hereunto set my hand.

LOUIS N. McDONALD.

Witnesses:
J. C. BARRETE,
JOHN HULST.