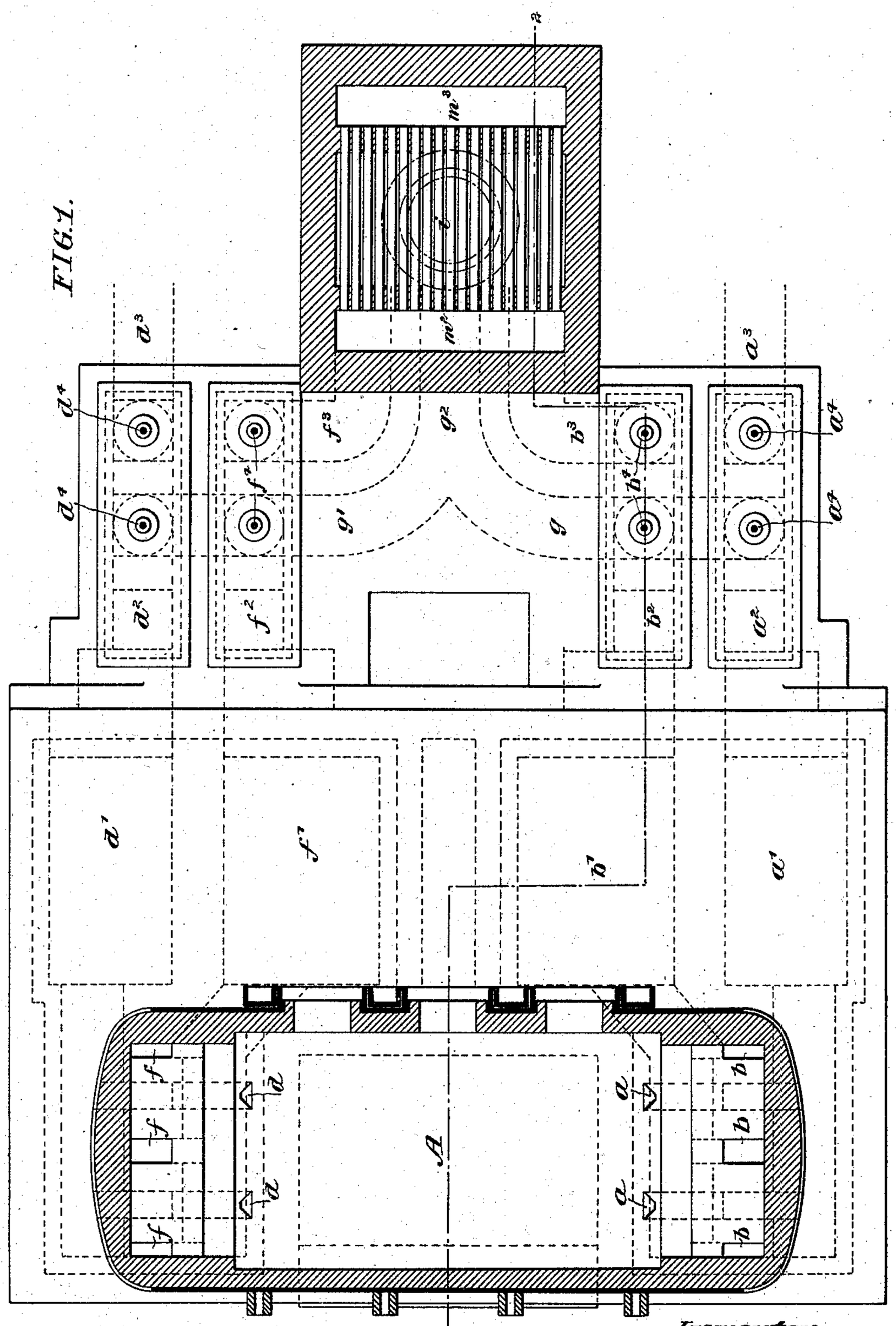
(No Model.) 3 Sheets—Sheet 1.

# S. T. WELLMAN.

## REGENERATIVE FURNACE.

No. 557,924. Patented Apr. 7, 1896.

FIG. 1.




Witnesses:
Hamilton D Turner
Chas. De Coux.

Inventor:
Samuel T. Wellman
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(No Model.) 3 Sheets—Sheet 2.

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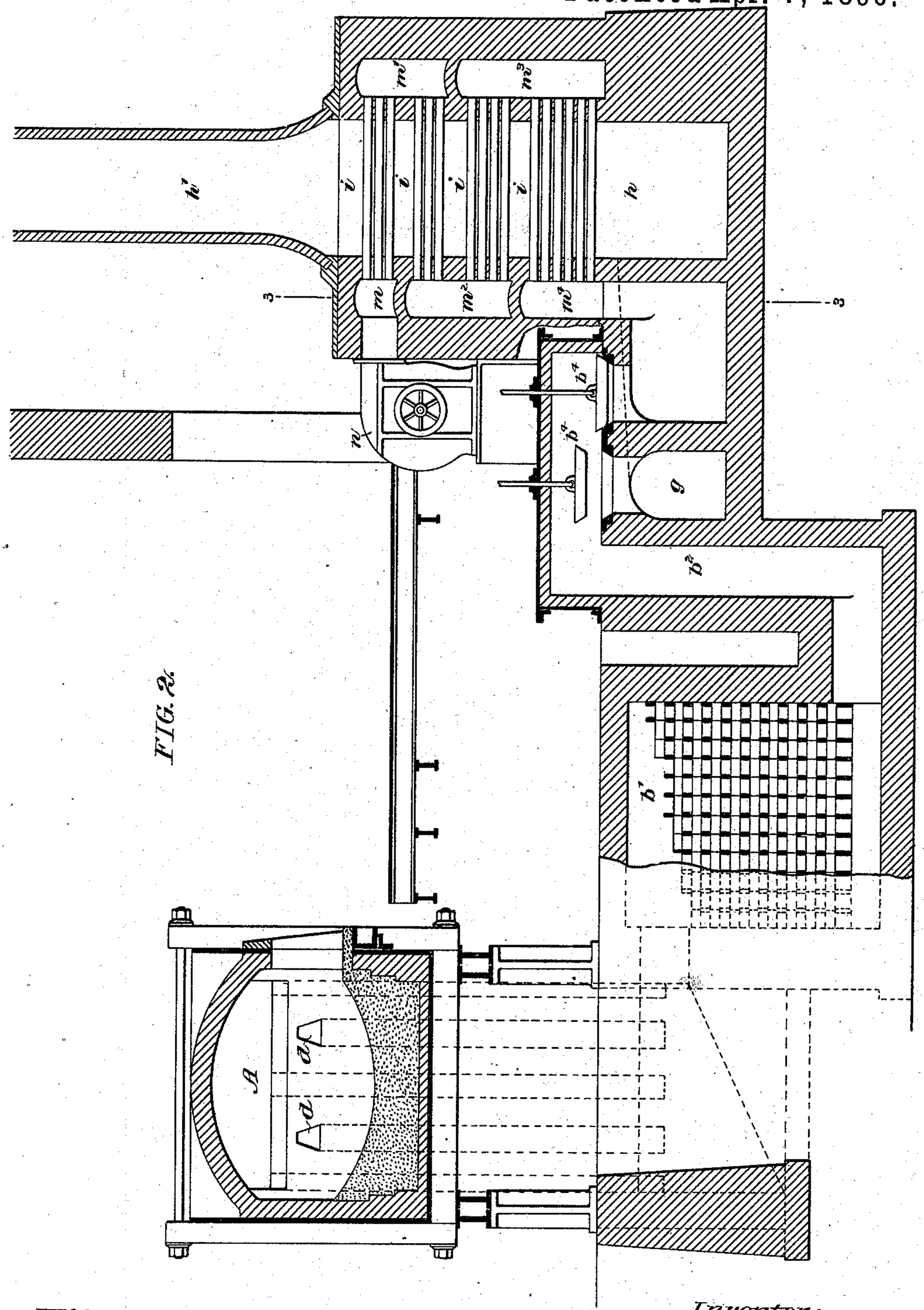


FIG. 2.

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(No Model.) 3 Sheets—Sheet 3.

# S. T. WELLMAN.

## REGENERATIVE FURNACE.

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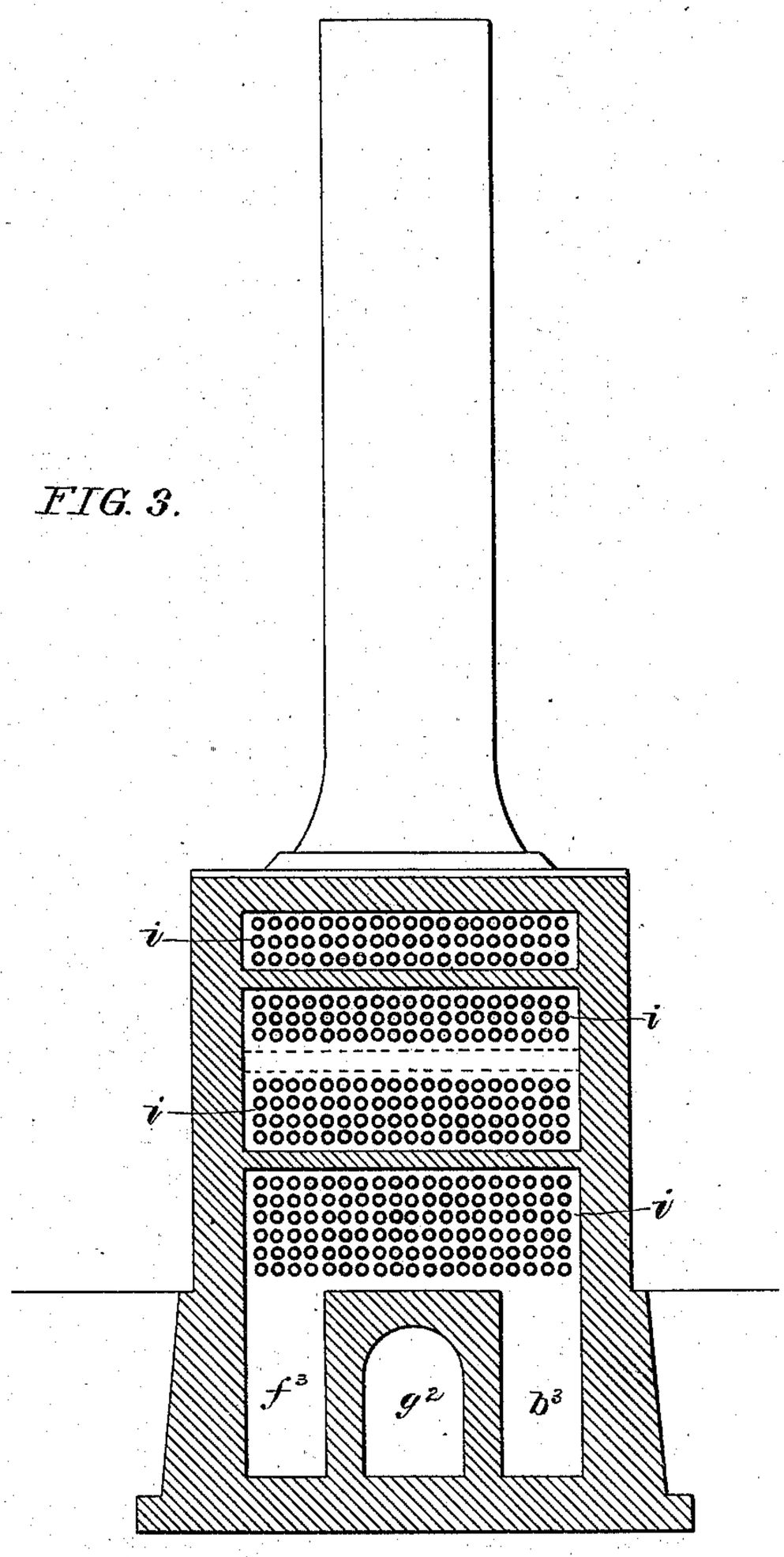
*FIG. 3.*




Witnesses:
Hamilton D. Turner
Chas. DeCourt.

Inventor:
Samuel T. Wellman
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# UNITED STATES PATENT OFFICE.

SAMUEL T. WELLMAN, OF UPLAND, PENNSYLVANIA.

## REGENERATIVE FURNACE.

SPECIFICATION forming part of Letters Patent No. 557,924, dated April 7, 1896.

Application filed January 31, 1895. Serial No. 536,861. (No model.)

*To all whom it may concern:*

Be it known that I, SAMUEL T. WELLMAN, a citizen of the United States, and a resident of Upland, Delaware county, Pennsylvania, have invented certain Improvements in Regenerative Furnaces, of which the following is a specification.

The object of my invention is to improve the efficiency of regenerative gas-furnaces, an object which I attain by heating the volumes of air employed before the latter enter the regenerators, employing for the purpose of such heating the products of combustion which have previously been passed through said regenerators.

In the accompanying drawings, Figure 1 is a view, partly in section and partly in top or plan, of an ordinary form of regenerative gas-furnace to which my improvements have been applied. Fig. 2 is a sectional view of the same on the line 2 2, Fig. 1. Fig. 3 is a transverse section on the line 3 3, Fig. 2.

A represents an ordinary open-hearth regenerative gas-furnace of the Siemens type, said furnace having at one end the gas-inlet ports $a$ and air-inlet ports $b$, and at the opposite end corresponding gas-inlet ports $d$ and air-inlet ports $f$, the gas-inlet ports $a$ and $d$ communicating respectively with gas-regenerators $a'$ and $d'$ and the air-inlet ports $b$ and $f$ communicating respectively with air-regenerators $b'$ and $f'$.

The gas-regenerator $a'$ communicates through a flue $a^2$ either with an outlet-flue $g$ or with a gas-inlet flue $a^3$, communication with either of these flues being controlled by means of valves $a^4$. In like manner the gas-regenerator $d'$ communicates through a flue $d^2$ either with an outlet-flue $g'$ or with a gas-inlet flue $d^3$, communication with either of these flues being controlled by means of valves $d^4$. The air-regenerator $b'$ communicates through a flue $b^2$ either with the outlet-flue $g$ or with an air-inlet flue $b^3$, communication with either of these flues being controlled by valves $b^4$, and the air-regenerator $f'$ communicates through a flue $f^2$ either with the outlet-flue $g'$ or with an air-inlet flue $f^3$, communication with either of these flues being controlled by valves $f^4$. This is the ordinary construction of a regenerative gas-furnace, the furnace being worked first in one direction and then in the opposite direction—that is to say, the gas and air being first forced in through the regenerators $a'$ $b'$ while the products of combustion are escaping through the regenerators $d'$ $f'$, and these conditions being then reversed by suitable manipulation of the valves $a^4$ $b^4$ $d^4$ $f^4$, so that the gas and air introduced through the regenerators $d'$ $f'$ and the products of combustion escape through the regenerators $a'$ $b'$. Normally, however, the air is not heated prior to entering its regenerator, and as the gas coming from the producer is usually at a high temperature the result is that the air entering the furnace is not raised to as high a temperature as the gas, and the air-regenerator cools more rapidly than the gas-regenerator and cannot be as rapidly reheated as the latter. It will be evident, therefore, that the efficiency of the furnace will be materially increased if the conditions under which both the gas and air regenerators act not only in absorbing but also in discharging heat are the same, and with the object of attaining such conditions I provide for heating the supply of air before it enters its regenerator, so that when it enters the same it will be at substantially the same temperature as the gas entering the gas-regenerator, it being understood that the products of combustion leaving the latter are generally at a higher temperature than that of the gas-supply.

Across the discharge-flue $h$, with which both of the outlet-flues $g$ $g'$ communicate at the bottom through a flue $g^2$, I place a series of sets of tubes $i$, which serve to provide a communication between chambers $m$, $m'$, $m^2$, $m^3$, and $m^4$, formed in the front and rear walls of the base or foundation of the stack $h'$, a blower $n$ or other blast apparatus communicating with the chamber $m$, while the chamber $m^4$ communicates with the air-inlet flues $b^3$ and $f^3$.

The air from the blower passes from the chamber $m$ through the top set of flues $i$ into the chamber $m'$, from the latter through the next set of flues $i$ into the chamber $m^2$, from the latter through the third set of flues $i$ into the chamber $m^3$, and from the latter through the bottom set of flues $i$ into the chamber $m^4$, receiving a constant accession of heat as it descends, owing to the fact that the products

of combustion are hottest at the base of the flue *h*, and gradually decrease in temperature as they rise, owing to the absorption of heat therefrom.

The chambers *m* to $m^4$ gradually increase in size and the flues *i* in the different sets increase in number or area from the upper to the lower set, so as to provide increased area for the flow of the air as the latter becomes expanded by heating. While, therefore, the regenerators *b' f'* act alternately as absorbers and distributers of heat, the tubes *i* act as a continuous regenerator—that is to say, they continuously absorb heat from the products of combustion in the discharge-flue *h* and continuously distribute the heat to the air passing through them.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The mode herein described of operating a regenerative gas-furnace, said mode consisting in raising the temperature of the air before it enters its heat-distributing regenerator to a high degree of heat approximating that of the gas entering its heat-distributing regenerator, and employing for the purpose of thus heating the air the products of combustion escaping from the heat-absorbing regenerators, substantially as specified.

2. The combination of a regenerative gas-furnace having two pairs of gas and air regenerators constructed for use alternately as absorbers and distributers of heat, and a single regenerator acting as a continuous absorber of heat directly from the products of combustion on their way to the chimney, and a continuous distributer of a high degree of heat to the air supply on its way to the regenerator, approximating that of the gas entering its heat-distributing regenerator, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SAMUEL T. WELLMAN.

Witnesses:
WILL A. BARR,
JOSEPH H. KLEIN.