(No Model.) 2 Sheets—Sheet 1.

E. BACKUS.

Hot Water Heating Apparatus.

No. 238,077. **Patented Feb. 22, 1881.**

Fig. 1

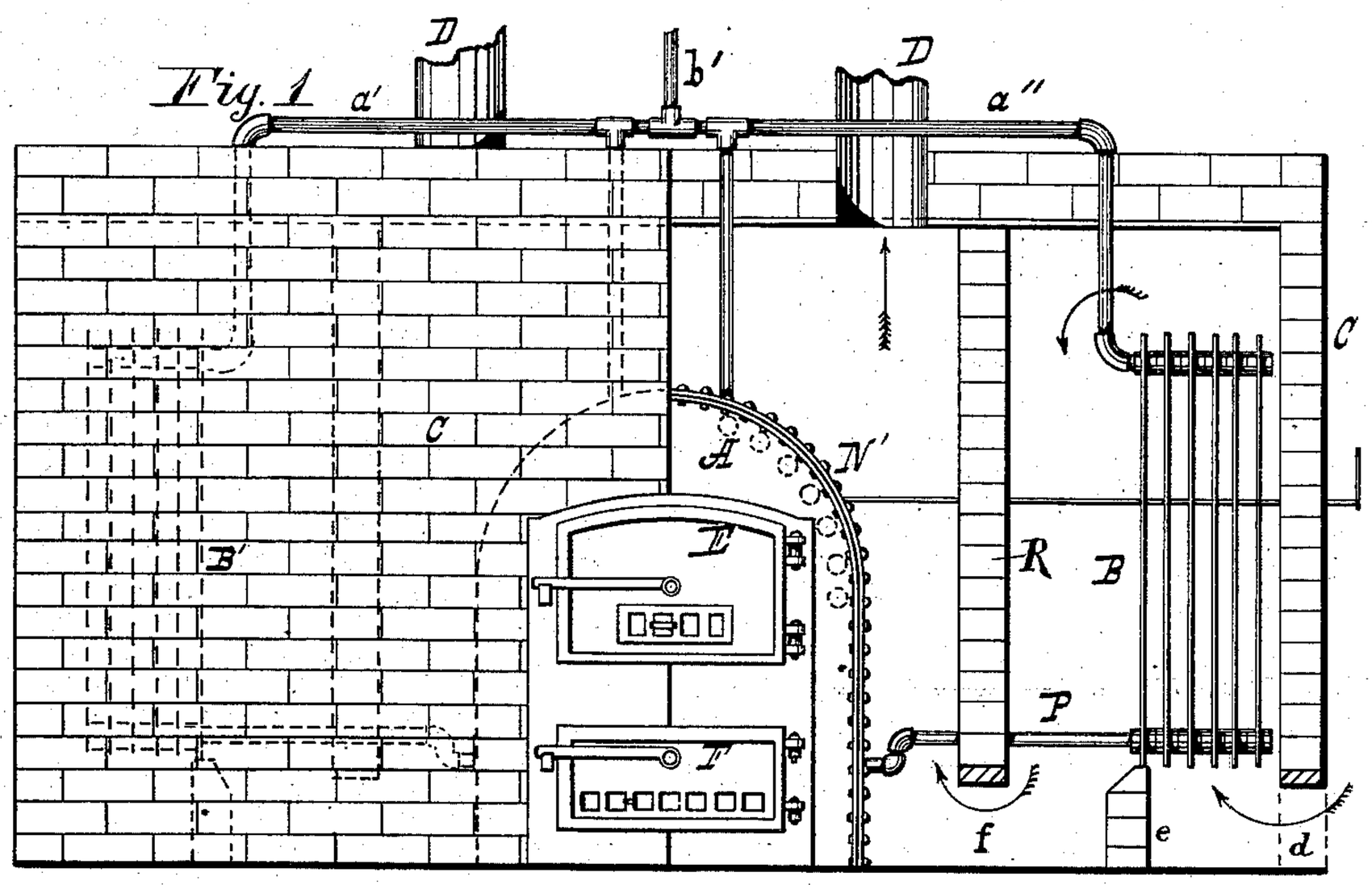
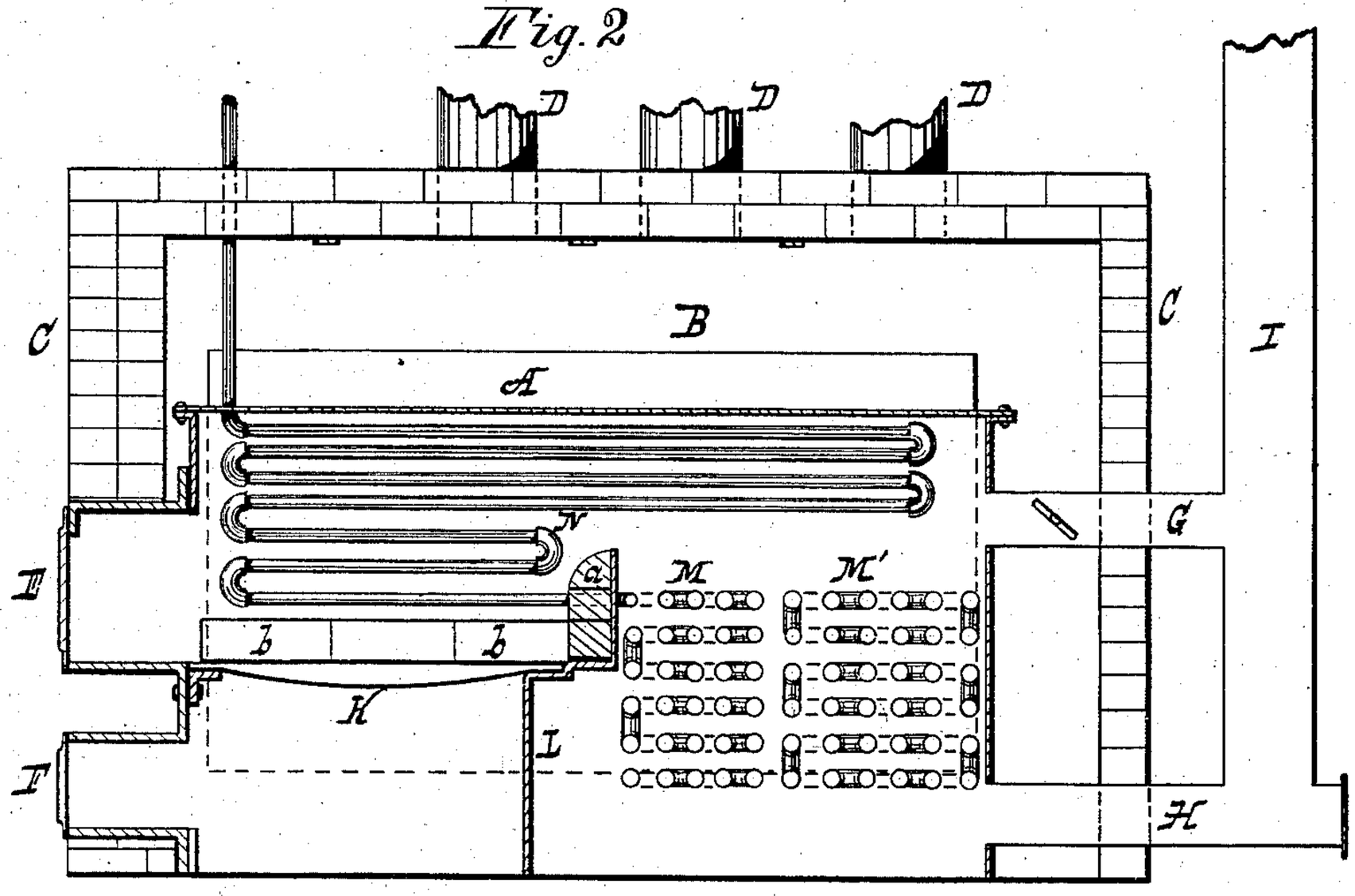


Fig. 2



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(No Model.) 2 Sheets—Sheet 2.

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Hot Water Heating Apparatus.

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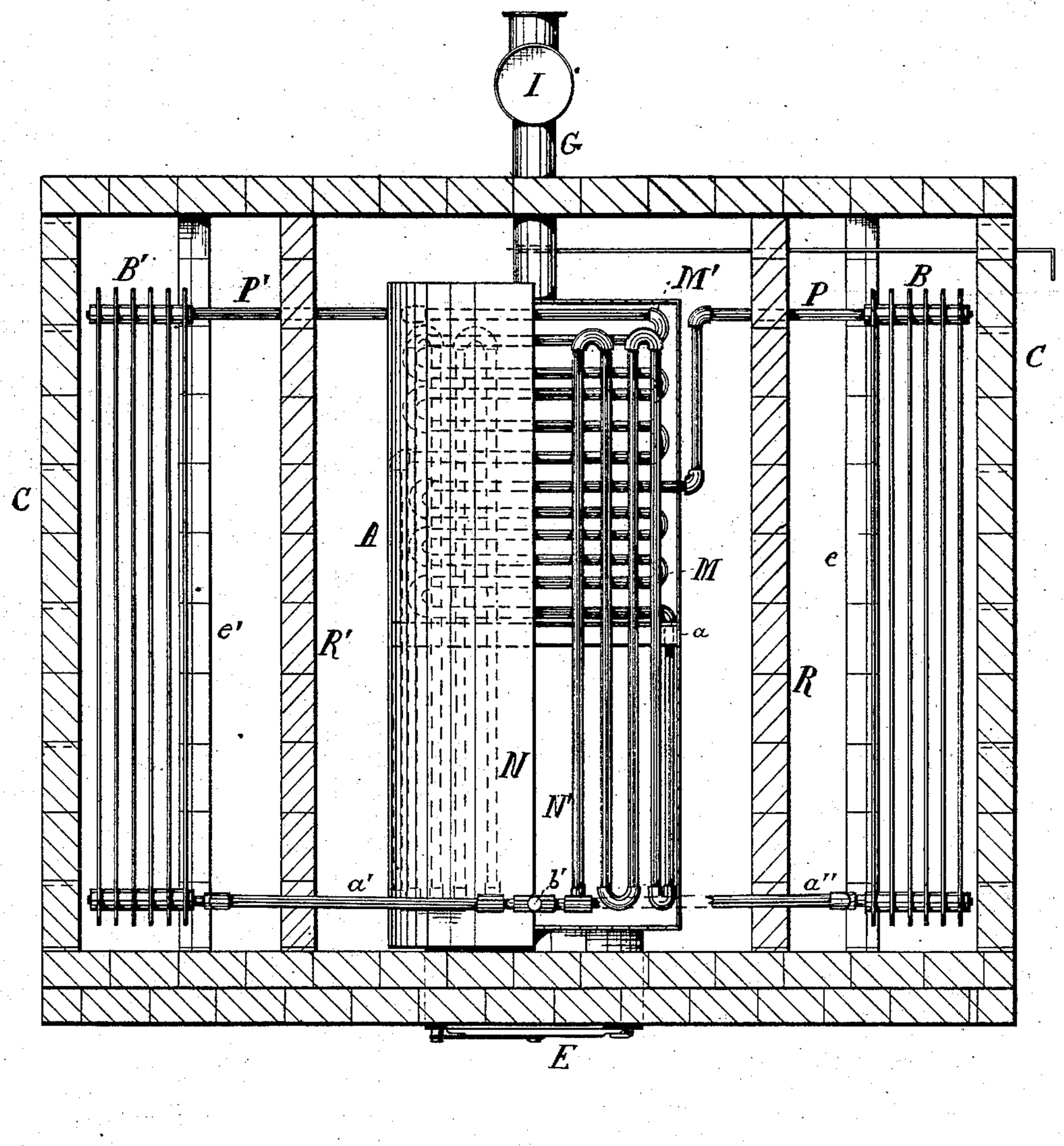
Fig. 3



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UNITED STATES PATENT OFFICE.

EDWARD BACKUS, OF ROCHESTER, NEW YORK, ASSIGNOR TO MARY BACKUS, OF SAME PLACE.

HOT-WATER HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 238,077, dated February 22, 1881.

Application filed March 29, 1880. (No model.)

To all whom it may concern:

Be it known that I, EDWARD BACKUS, of Rochester, New York, have invented an Improved Hot-Water Heating Apparatus, of which the following is a specification, reference being had to the annexed drawings, in which—

Figure 1 is a front elevation, partly in section, of my improved heating apparatus. Fig. 2 is a longitudinal central section of the same, showing the parts to right of the central plane in Fig. 1. Fig. 3 is a horizontal section of the same, taken on a plane immediately below the top or cover of the brick-work, and showing the parts below that plane.

My invention relates to an apparatus for heating air for the warming of buildings by the co-operation of a hot-water radiator and a furnace having an outer heating-surface against which the air impinges; and it consists in a peculiar combination and arrangement of means to secure the end sought, as hereinafter described, but more particularly in the combination of a furnace having an exterior air-heating surface, an air-passage leading to said surface, a water-heater located in the fire-chamber, a second water-heater connected with the first and located in the passage for the outgoing products of combustion, and a hot-water radiator located in the air-passage at a point in advance of the furnace and connected with the water-heaters.

My improved heating apparatus is shown in the accompanying drawings, in which A is the furnace, B B′ the radiators, C the inclosing brick-work, and D D D the hot-air pipes. The course of the air through the apparatus is represented by the arrows in Fig. 1.

The furnace A is constructed of sheet-iron, having a rounded upper surface, and having at either end heads or plates, through which openings are made for the entrance of the coal, the discharge of ashes, and of the heated gases to the chimney or flue.

The fire-place door E and the ash-pit door F are preferably attached to a casting which projects through the casing of brick-work, and is riveted at its inner margin to the head placed at the front end of the furnace.

The direct-draft pipe G and the indirect-draft pipe H are connected with the rear furnace-head and communicate with the chimney or flue I.

The furnace is divided about midway of its length by a vertical partition, L, which is bent backward, so as to afford support to the rear end of the grate-bars K, Fig. 2, and the fire-brick *a* at the back end of the fire-space. The sides of the fire-space are also lined with fire-brick *b b*, Fig. 2. The partition L rises some distance above the grate-bars, so that the heated gases produced by the combustion are compelled to pass over the top of the partition and downward through the coils of pipe M M′ on their way to the indirect-draft pipe H.

Within the fire-chamber and along the inside of the furnace are placed the coils of pipe N N′, which communicate respectively at their lower ends with the upper parts of the coils M M′. The upper part of the coil N′ communicates, through the pipe *a″*, with the top of the radiator B. The lower part of the radiator B communicates, through the pipe P, with the lower portion of the coil M. Provision is thus made for obtaining a circulation of water from the lower and coolest portion of the radiator through the coil M, which is but moderately heated by the outgoing products of combustion, to the hot coil N′, whence it is returned to the top of the radiator B by the pipe *a″*.

b′, Fig. 1, is a stand-pipe, which connects with the circulating-pipes *a′ a″*, and rises to any desired distance above the heating apparatus, for the purpose of maintaining the requisite pressure on the pipes and radiators.

I prefer to construct my improved heating apparatus with radiators and air-passages on each side of the furnace, as represented in Figs. 1 and 3. The principle of my invention is, however, fully carried out by one radiator and a furnace.

In the accompanying drawings my improved heating apparatus is represented with radiators and air-passages located on each side of the furnace, the radiators being marked respectively B and B′, the vertical partitions *e* and *e′*, R and R′, the fire-chamber coils N and N′, the circulating-pipes *a′* and *a″*, and the coils in the gas-outlet passage M and M′.

The operation of the parts is the same on

each side of the furnace, the radiator B communicating through the circulating-pipe *a''* with the coil N', and this with the coil M, whence the pipe P extends to the radiator B, as shown in Fig. 3. In a similar manner the radiator B', on the opposite side of the furnace, is connected by pipe *a'* with the coil N, and this coil with M', whence the pipe P' extends to the radiator B', Fig. 3.

The furnace is inclosed in a suitable brick-work chamber, C, having sufficient interior capacity for the radiators B B' and the air-passages. The air enters through suitable openings at the base of the vertical side walls, (designated *d*, Fig. 1,) and is heated moderately at first by passing through the radiator B, which consists of a number of sheet-metal heaters fastened together at top and bottom by suitable joints. The inner heater of the radiator B acts as a partition to compel the air to pass between the other heaters, and it rests at bottom on the brick-work partition *e*. After passing through the radiator B the air descends along the partition R, and, passing through the opening *f* at the base of this partition, comes in contact with the hot exterior surface of the furnace, by which it is fully heated, and thence is distributed through the pipes D to the various apartments to be heated.

In order to reduce the temperature of the outgoing products of combustion as much as possible, they are caused to pass downward through the coils of pipe M M' on their way to the chimney. One of these coils is connected with the radiator on one side of the furnace and the other with the radiator on the other side thereof.

It will be perceived that in my construction the coldest water—*i. e.*, that which comes from the bottom of the radiators—passing into the lower part of the coils M M' in the exit furnace-passage, is brought in contact with the coolest outgoing gases—a condition essential to the abstraction of the greatest amount of heat from them; and it will also be seen that as the water circulates onward on its way back to the radiator, it is brought successively in contact with sources of heat of increasing temperature, until it finally passes alongside of the fire itself, in order to prevent the fire-place from overheating.

The lower part of the radiator is connected with the lower portion of the heating-coil or other suitable water-heating device within the furnace, and the upper portion of the radiator with the upper end of the coil, in order to secure the proper circulation.

I am aware that air has been heated by admitting it directly between a fire-pot on one side and a hot-water coil on the other; also, that air has been admitted past a hot-water coil at the base of a furnace directly upward against the exterior of the furnace-body.

I am also aware that various other forms of apparatus have been employed for the heating of air.

I claim—

1. The combination of the furnace having an exterior air-heating surface, an air-passage leading to said surface, a water-heater located in the fire-chamber, a second water-heater connected with the first and located in the passage for the outgoing products of combustion, and a hot-water radiator located in the air-passage at a point in advance of the furnace and connected with the first and second water-heaters, as described.

2. The combination of furnace A, the air-passage containing the depending wall R and wall *e*, the radiator B, located in the passage upon wall *e*, and the two water-heaters, M and N, located in the furnace and connected with each other and with the radiator, as shown.

3. The improved furnace for heating air by a combination of direct and indirect radiation, the same consisting of the combination of the outside horizontal furnace-body, the grate, the walls *a* and L, above and below the grate, respectively, the water-coil N, located in the fire-chamber, and the connected coil M, located behind wall L in the base of the furnace.

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