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DOMESTIC HEATING APPARATUS FIRE-BOX WITH TWO COMBUSTION FLUES

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Fig. 1

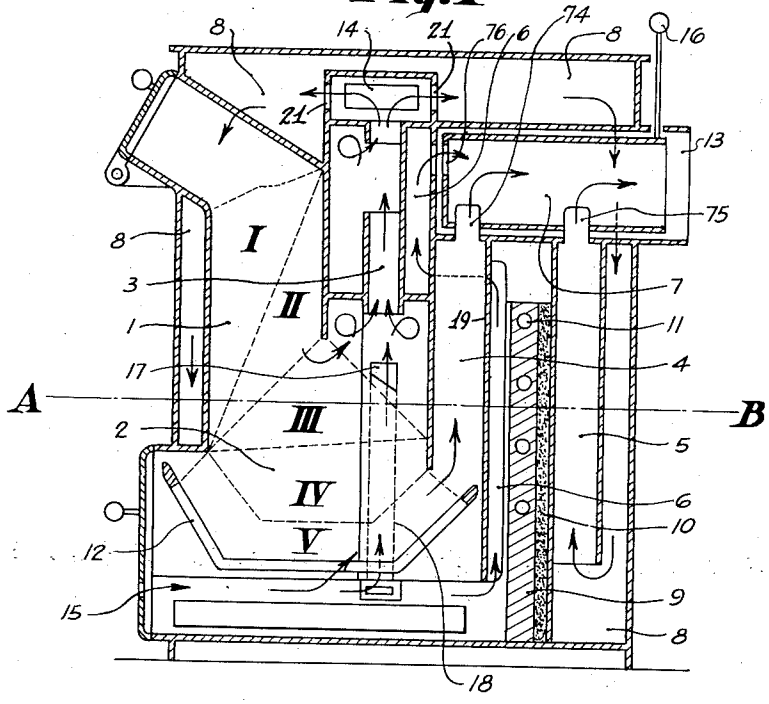
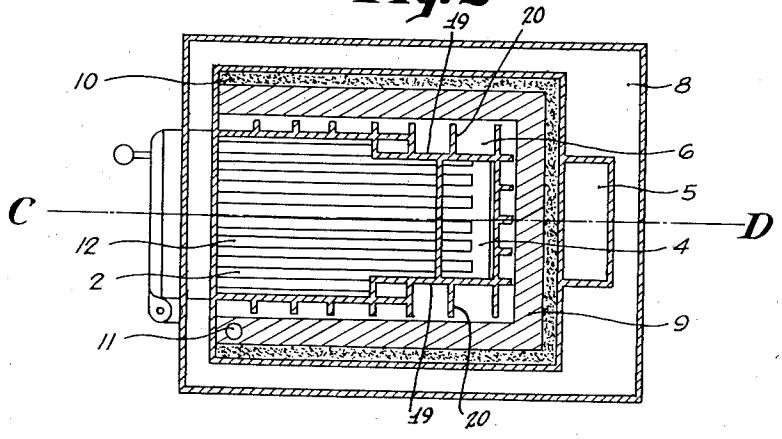


Fig. 2



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DOMESTIC HEATING APPARATUS FIREBOX WITH TWO COMBUSTION FLUES

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4 Claims. (Cl. 110—147)

The present invention relates to improvements in domestic heating apparatus for solid fuel having two combustion flues.

The main feature of the present invention is in its register situated at the upper evacuation outlet of the apparatus, and in that three hot gaseous currents of different temperatures and coming from three distinct flues or paths are constantly fed in an adjustable proportion into the said register. These three separated paths or flues are:

A. A first path or flue which I call the direct path of combustion. It is fed with primary cold air and is intended to burn the solid parts of the fuel in a lower fire chamber, from whence the products of this combustion reach directly said register.

B. A second path or flue, which I call the indirect path of combustion. It is fed with secondary heated air, and is intended to burn the gaseous parts of the fuel in an upper flame chamber—from whence the very hot gases arising from this combustion abandon most of their heat to a radiator body before reaching indirectly said register;

C. A third path or flue, which I call the path of drafting air. It forms a passage between an air admission, provided under the grate of the apparatus, and said register for a gaseous current of air which travels herein upward without taking any part in the combustion, while being strongly heated by contact with the exterior surfaces of the walls of both the fire and the flame chambers, and the interior surfaces of a heat accumulating body. These walls of the fire and flame chamber are made very thin, and are preferably provided with flanges in order to enhance this heating of said drafting air.

The heat-accumulating body is relatively very heavy and is arranged around the fire and flame chambers so as to leave a narrow space between the two. It can also be utilized as a heating body for the production of hot water, and is insulated on its exterior surfaces against losses of heat.

The register abovementioned is such that it assures, in substantially invariable and defined proportions, the mixture of the three gaseous currents constituted by the burnt gases and the heated drafting air, thus providing a constant and automatic draft made substantially independent from the rate of combustion, either of the solid parts of the fuel in the fire chamber or of the gaseous parts of the fuel in the flame chamber, by said heat accumulator. The annexed drawing shows, by way of example, a form of construction of the invention.

Fig. 1 is a vertical section of the apparatus, taken on the line 1—1 of Fig. 2, and

Fig. 2 is a transverse section taken on the line 2—2 of Fig. 1.

The fuel is introduced at the upper part of the apparatus into a magazine 1 and descends into a fire chamber 2 onto a grate 12, and forms during the working of the apparatus the five following superimposed zones:

In the magazine 1—the zone I, where the solid fuel (for instance coke) is dried, and the zone II, where the fuel commences to distil and is converted into semi-coke;

In the fire chamber 2—the zone III, where the distillation is terminated and the fuel becomes ignited;

The zone IV, where the incandescent coke is in the form of a thick layer which reduces the carbon dioxide (CO_2) formed in the zone V into carbon monoxide (CO), and

The zone V, where the incandescent coke is in the form of a thin layer on the grate 12 and is transformed by the combustion into carbon dioxide (CO_2).

The feed air enters into the bottom of the apparatus through an orifice 15 and is divided under the grate 12 into the three streams previously referred to under headings A, B, and C.

A. A part of the feed air, which I call the primary air, passes through the grate 12 and supports the combustion of the fuel in the zone V. The exhaust gases of said combustion pass partly through the zone IV and partly through the direct combustion flue 4 and through a port 14 into a drum 7, constituting the register, from which they are evacuated by a pipe 13, thus forming the gaseous current of the direct combustion path.

B. Another portion of the feed air, which I call the secondary air, is strongly heated in two channels 18 from whence it passes into the flame chamber 3 through orifices 17, where it combines with both the products of distillation arising from the zones II and III and the carbon monoxide arising from zone IV. The whole of these ignited gases is then directed into the flame chamber 3 which is provided with baffles (not shown) intended to create eddies so as to mix these different gases homogeneously and thus facilitate their combustion. The exhaust gases arising from this combustion, and which are of very high temperature, pass through orifices 14 and 21 into a radiator body 8, where they lose

their heat by radiation to the heating surfaces of said body. These gases, thus considerably cooled, are then directed through a channel 5 and a port 75 into the drum 7 and are finally evacuated through the pipe 13, thus forming the gaseous current of the indirect path of combustion.

C. The rest of the feed air entering through 15, which I call the drafting air, is directed, without taking any part in the combustion, into a relatively narrow space 6 provided between the flanges 20 with which the walls 19 of the fire and flame chambers 2 and 3 are provided and the interior surfaces of a heat accumulator 9, where it is heated strongly by contact with these hot surfaces before entering into the drum 7 through a relatively small port 76. This air moving at a much higher speed than the two former currents of air, is then evacuated through the pipe 13, dragging in its wake the exhaust gases issuing from 75, due to its higher speed and temperature and thereby enhancing the draft of the apparatus.

The mixture of these three gaseous currents of different temperatures can be adjusted by rotation of the drum 7, actuated by means of an exterior arm 16 which permits—by modifying more or less the sections of the ports 74, 75, and 76—the obtaining of a constant and automatic draft in the apparatus, and this independently of the rate of combustion in the fire chamber 2 and the flame chamber 3.

The heat accumulator 9 is constituted by a relatively big block of very hard material in which may be enclosed a serpentine 11 which is intended to regulate the amount of heat stored in this accumulator and to heat water with all the excess heat thus recuperated. This heat accumulator 9 is insulated on its exterior surface by means of a layer of insulating material 10, which keeps this accumulator at a higher temperature than the radiator 8 and makes it act as a draft regulator and as a device to distribute heat more evenly along the heating surfaces of said radiator 8. This heat accumulator 9 is heated by radiation of the heat coming from the walls 19 and the flanges 20, these latter being thin and made of a material which is a very good conductor of heat.

As the radiator 8 communicates on one hand with the flame chamber 3 through the orifice 14 and on the other hand with the outlet 13 through the channel 5 and the port 75 and as there is always a draft in this outlet 13, created by the drafting air issuing from the small port 76, the gases are taken off the surface of the fuel in the flame chamber 3 even when the fire in the fire chamber is very low provided the heat accumulator is at an elevated temperature and port 76 is open.

The invention can be applied to all types of domestic heating apparatus—for instance, a hot air stove, a cooking stove, a hot water boiler, etc.

Having thus described my invention, I claim:

1. In a domestic heating apparatus for solid fuel having a lower fire chamber fed with primary cold air for the combustion of the solid parts of the fuel, an upper flame chamber fed with secondary heated air for the combustion of the gaseous parts of the fuel and an ash pit, a direct flue connecting the fire chamber to the chimney and an indirect flue connecting the flame chamber to the chimney, a third flue connecting the ash-pit to the chimney and forming around said fire and flame chambers an air space for a current of draft air entering into the chimney without taking any part in the combustion proper, means to heat the draft air in said air space, and a common register controlling the passage of the exhaust gases and of said draft air, respectively, from said three flues to the chimney.

2. In a heating apparatus according to claim 1, a fire-box having very thin walls made of a material which is a very good conductor of heat and provided with outer flanges preferably made of the same material, a heat storing body surrounding said fire-box and provided with an outer insulation and a narrow air space provided between these thin flanged walls and this heat storing body, the current of draft air admitted under the grate of the apparatus being therefore strongly heated in said air space before reaching the common register controlling the combustion and the draft of the apparatus.

3. In a domestic heating apparatus for solid fuel having a lower fire chamber fed with primary cold air for the combustion of the solid parts of the fuel, an upper flame chamber fed with secondary heated air for the combustion of the gaseous parts of the fuel and an ash pit, a cylindrical mixing chamber having an outlet connected to a chimney and three inlet ports, a direct flue connecting the fire chamber to the mixing chamber through one of said inlet ports, an indirect flue connecting the flame chamber to the mixing chamber through another of said inlet ports, a third flue connecting the ash pit to the mixing chamber through the third of said inlet ports, a rotary register rotatably nested in and forming part of said mixing chamber, said register having ports adapted to register with the three ports in said mixing chamber, and manually actuated means for rotating said register to control the flow through said flues to the chimney.

4. In a heating apparatus, a thin walled fire-box comprising a lower fire chamber, an upper flame chamber and an ash pit, a massive heat storing body around said fire-box and spaced therefrom to provide an air space, a radiator casing surrounding the body and spaced therefrom to provide a passageway, a mixing chamber above said heat storing body and within the radiator casing, a direct flue connecting the fire chamber with the mixing chamber, a flue, including the passageway between the heat storing body and radiator casing, connecting the flame chamber with the mixing chamber, a third flue, including the air space between the fire-box and heat storing body, connecting the ash pit with the mixing chamber and having a flow of air induced therethrough by the heating effect of the fire-box or of the heat storing body on the air in said space, said flow of air passing through the mixing chamber and inducing flows through the other flues.

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