W. A. GREENE.

Stove and Furnace.

No. 220,530. **Patented Oct. 14, 1879.**

Fig. 1.

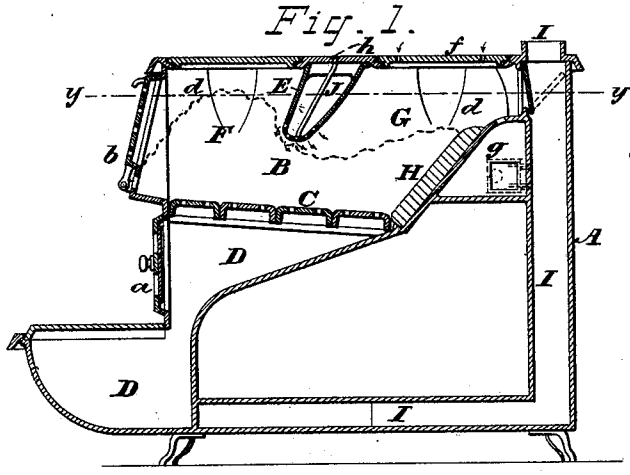


Fig. 3.

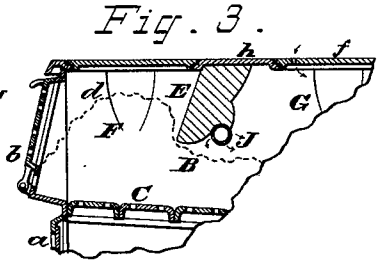


Fig. 4.

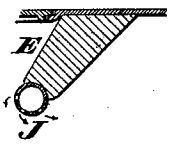


Fig. 2.

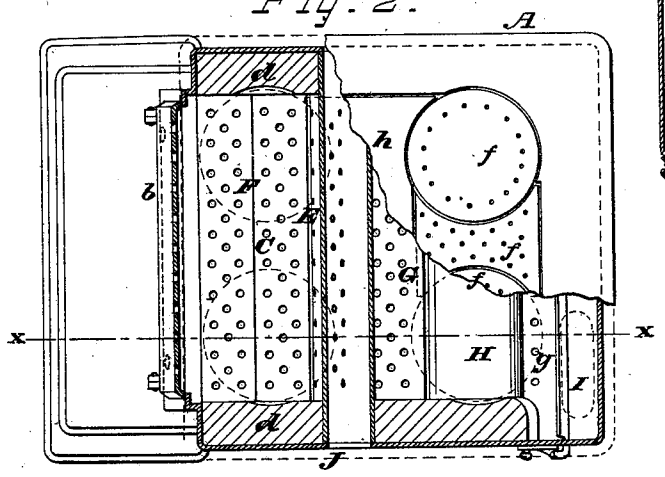


Fig. 5.

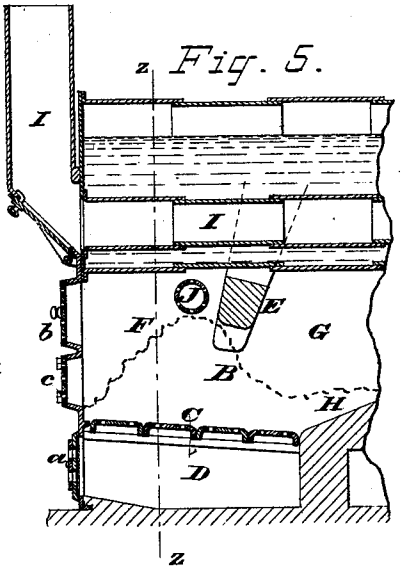
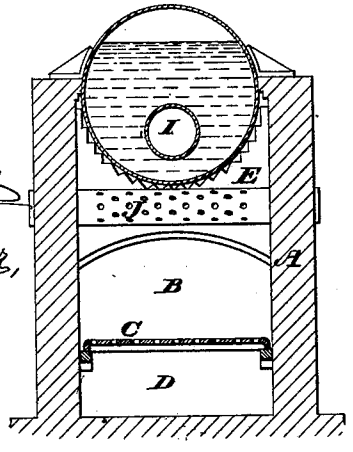


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM A. GREENE, OF ELIZABETHPORT, ASSIGNOR OF TWO-THIRDS OF HIS RIGHT TO EDWIN R. CAHOONE AND ANDREW ALBRIGHT, OF NEWARK, NEW JERSEY.

IMPROVEMENT IN STOVES AND FURNACES.

Specification forming part of Letters Patent No. **220,530**, dated October 14, 1879; application filed July 24, 1879.

To all whom it may concern:

Be it known that I, WILLIAM A. GREENE, of Elizabethport, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Stoves and Furnaces for burning bituminous coal and other fuels rich in hydrocarbons, of which the following is a specification.

This invention relates to that class of stoves and furnaces wherein the fire-box is divided into two parts by a pendent partition, forming a primary fuel-burning chamber, into which the fuel is fed and in which it is coked, and a secondary chamber, into which the coked fuel is pushed and in which the combustion is completed. A grate-surface extends under both chambers and is perforated with substantial uniformity over its entire surface, so as to deliver air in jets to both chambers. A perforated plate or door is also arranged at the front of the primary chamber for the further admission of air.

Stoves of this description are shown, and their operation fully described, in my patents of November 12, 1878, No. 209,806, and April 29, 1879, No. 214,906, and a furnace constructed on the same general principle in my patent of April 29, 1879, No. 214,905, to all of which patents I here make reference.

My present invention consists in the employment, in a stove or furnace of the construction above set forth, of a transverse air-duct extending from one side of the stove or furnace to the other parallel with the pendent partition, opening outside of the stove or furnace, and provided with perforations through which air can pass in jets from its interior to the interior of the fire-box or combustion-chamber above the fuel, while the perforated grate supplies air also in jets below the fuel.

It also further consists in the combination, in a cooking-stove of the character first above set forth, of a series of perforations through the stove-top over the secondary fuel-burning chamber with a series of perforations from an air-chamber beneath, whereby air is admitted simultaneously from opposite sides to mingle with the incandescent gases from the consumed fuel while said gases are passing out of the secondary chamber and before they enter the flue, all as will be hereinafter fully set forth.

In the drawings, Figure 1 is a vertical longitudinal section of a cooking-stove, taken on the plane of the line *x x* in Fig. 2, the air-duct being arranged in the pendent partition. Fig. 2 is a plan view of the same, partly in horizontal section on the plane of the line *y y* in Fig. 1. Fig. 3 is a fragmentary vertical section of a cooking-stove, the air-duct being arranged just behind the partition. Fig. 4 is a section of a partition, the air-duct being arranged just below and embedded in it. Fig. 5 is a fragmentary vertical longitudinal mid-section of a boiler-furnace, the air-duct being arranged in front of the partition; and Fig. 6 is a vertical cross-section of the same, taken on the plane of the line *z z*.

Figs. 1 and 2 answer to the like numbered figures in my Patent No. 209,806, and Figs. 5 and 6 answer to Figs. 1 and 2 in my Patent No. 214,905.

Let A represent the outer wall of the stove or furnace; B, the fire-box thereof as a whole; C, the perforated grate under the fire-box; D, the ash-pit; E, the pendent partition dividing the fire-box into two chambers, the primary fuel-burning chamber F and the secondary fuel-burning chamber G; H, the sloping back hearth, and I the flue for conveying off the products of combustion.

a is the register or dampered door for admitting air to the ash-pit; *b*, the perforated plate or door for admitting air into the primary fuel-burning chamber, and which in Figs. 1, 2, and 3 also serves as a feeding-door. *c* in Fig. 5 is the feeding or charging door of the furnace. *d d* in Figs. 1 and 2 are the side lining-plates or fire-bricks of the stove; and *g* in the same figure is an air-chamber communicating with the outer air at its ends, which are provided with doors or registers, and admitting air through perforations to the rear part of the combustion-chamber G.

The construction and arrangement of these parts and their operation are fully described in my before-mentioned patents.

In the operation of a stove or furnace of the character set forth in my said patents, the green fuel is fed into the primary chamber F, and is there coked, giving off its more volatile compounds of carbon and hydrogen in the form of rich hydrocarbon gases, which are heavily laden with particles of free carbon, forming smoke or soot. As this fuel becomes thoroughly coked or incandescent it is pushed back into the secondary chamber G, where its combustion is completed. The gases generated in the primary chamber are compelled to dive under the pendent partition E before they can reach the secondary chamber, and in so doing are brought into close contact with the incandescent fuel at that point, and their temperature is raised considerably, so that as they enter the secondary chamber they expand and reverberate in the space behind the partition before being drawn into the flue. The reverberating gases in the chamber G are exposed to the heat from the mass of incandescent fuel in that chamber, and their further combustion is here effected. Air to support combustion in these two chambers is admitted in jets through perforations in the grate C and front door or plate, *b*, the air which enters at the grate coming up through the fuel, and that which enters at the door *b* passing into the front of the fuel, which the air from the grate cannot well reach.

I find that in burning bituminous fuel the air must be introduced uniformly, and in a divided state, as large masses or streams of air cool the fuel unnecessarily and pass through the same without thoroughly combining with its combustible portions. This is the effect when introducing the air through slots or slits, as through the spaces between parallel grate-bars, and when a grate of such bars is used perfect combustion of the fuel cannot be secured.

To effect the complete combustion of the gaseous hydrocarbons which are given off from the fuel, a supply of oxygen must be mingled with them after they are disengaged from the solid fuel, and before they leave the chamber G. This I have accomplished in my previous patents by admitting through the grate C and door or plate *b* a volume of air in excess of that required to combine with the fuel in generating these gases, so that it should rise through the fuel with them; but I have found that this method cools the fire too greatly and retards combustion to some extent. It has also been tried to admit air from above; but this, though theoretically the correct method, has never succeeded hitherto, from the fact that the air has always been introduced in large streams through continuous slots, slits, or spaces, so that but a small proportion of it could combine with the gases in the burning-chambers, the remainder passing off with them into the chimney, where, if they eventually combine at all, their heat would be wasted.

To overcome these disadvantages, and introduce air to the hydrocabon gases in such a manner as to effect complete oxidation of and combination with these gases in the stove or furnace itself without in any way cooling the fire, is the object of my present invention. This I accomplish by the use of a transverse air-duct, J, which is located in or near the partition E, so as to act in conjunction with the latter, and which extends parallel therewith in a direct line from one side of the stove or furnace to the other, its ends, or at least one of them, opening to the outside of the outer wall, A, and communicating with the outer air, and provided with uniform perforations through its walls to admit air from its interior to the interior of the fire-box B in numerous jets. The air is thus admitted from below the fuel through the grate C, from in front of it through the door *b*, and above it through the duct J, all three inlets being perforated, so that the air enters in jets or in a finely-divided or broken-up condition, so that it may act to the best advantage upon the fuel and gases.

In Fig. 1 I have shown the duct J as formed in the partition E, the latter being made hollow, or with a longitudinal bore, and extending through from one side of the stove or furnace to the other, its bore or interior opening to the outside air.

I prefer, in a cooking-stove, to form the partition E of cast-iron of V shape or U shape in cross-section, and to fasten it to the long cross or center *h* by a bolt, *e*, as shown in Fig. 1, or by other suitable means. Instead, however, of fastening it to the long cross, a separate piece might be used as a cover, or it might be cast or formed with its top covered over instead of open. This hollow partition I perforate with a number of small holes, preferably arranged in one or more rows at or near its lower side. The air enters through apertures in the outer wall, A, passes into the duct J or hollow interior of the partition E, and issues from thence in fine jets into the fire-box B of the stove or furnace. This air enters the fire-box at the contracted opening under the partition as the gases generated in the primary chamber F are passing through said opening, and it is drawn along by the draft at the same time, mingling and combining with said gases until the secondary chamber G is reached, where the gases reverberate in the space behind the partition, and where the union with them of the air is completed.

In Fig. 4 I have shown a modification of the construction of the air-duct and partition, the duct consisting of a separate perforated tube or pipe, preferably of metal, and the partition being formed of fire-brick, soap-stone, or other refractory material, arranged just above the duct, so that the duct forms, as before, the lower edge or side of the partition. By this construction the duct can be removed and renewed if burned out without necessitating the removal of the partition.

The same result of combining the air entering from the duct with the gases evolved in

the chamber F, above described, can be effected by arranging the duct just in front of the pendent partition, instead of in, under, or as a part of the same, as hereinbefore described.

This construction is shown in Figs. 5 and 6, and consists of a perforated tube similar to that in Fig. 4, its ends embedded in the walls of the furnace or stove, or in the side lining-plates, *d d*, and open to the outer air.

As the air is discharged into the chamber F through the perforations in the tube it is drawn down by the draft and passes under the partition along with the gases generated in said chamber, with which it mingles and combines, and with which it reverberates in the chamber G, where the combination is completed. This arrangement is the best one for furnaces, where the partition has usually to be built up of brick and arched, and in which it would be inconvenient or impossible to form the duct.

In Fig. 3 I have shown the duct-tube arranged just behind the partition and near its bottom. It is placed close to and is partially embedded in the partition, that it may be to some degree protected from the intense heat in the chamber G. Thus arranged, the duct discharges its air into the chamber at the point where the gases, having passed under the partition, are beginning to expand, and the air combines with them as they rise and reverberate in the chamber G. The effect of this arrangement is the same as that of the others, in that the entering air commingles with the gases before they reach the reverberatory space in the chamber G just behind the partition.

In case the cooking-stove with which my invention is used is provided with a water-back, pipes for heating the water may pass through the partition E, or the partition may be made hollow and used as the water-back itself. In this case the shape shown in Fig. 3 is preferable, the air-duct J being arranged outside of the partition.

In cooking-stoves a still further supply of air is required for the secondary chamber, in consequence of that chamber being very short in comparison with the dimensions in a furnace, so that less time is given for the combustion of the gases as they pass through it. This I provide for by forming a series of perforations, *f f*, through the stove-top, preferably in the rear covers or cross-center, as seen in Figs. 1 and 2. These perforations are quite small, so that the air is admitted to the chamber G in fine jets, which act to continue or complete the combustion of the gases generated in the primary chamber F, and to effect the combustion of such as may be given off from the fuel in the chamber G. These perforations act in conjunction with those from the chamber *g* on the opposite side of the throat or passage from the chamber G to the flue, so that the outgoing stream of gases carries with it a sufficient quantity of air admitted from both sides to entirely complete the combustion.

I am aware that it is not new to supply air to the fire-box of a stove or furnace by means of a duct leading from outside the walls of the same, and make no claim to this except when used in connection with a partition partially dividing the fire-box into a primary and secondary combustion-chamber, in each of which fuel is contained and burned, and under each of which is a perforated grate-surface, and also when the air-duct itself is perforated, so as to admit its air in jets in the same manner as the grate.

I am also aware that stoves have been constructed with the usual barred grate and with a hollow pendent partition perforated along its lower edge, air being admitted to the fire-box in jets from the partition; but never, to my knowledge, have the grate and the partition or air-duct both been perforated, so as to admit air to support combustion in jets both above and below the fuel, this being essential to my invention.

I claim—

1. A stove or furnace consisting of the combination of the following-named elements: a fire-box, B, partially divided by a pendent partition, E, into a primary fuel-burning chamber, F, and a secondary fuel-burning chamber, G, a grate, C, extending under both chambers F and G, and perforated for the admission of air in jets thereto, and a transverse air-duct, J, extending across the fire-box B, arranged in or substantially parallel with the partition E, open to the outer air at its ends, and provided with lateral perforations for the discharge of air in jets into the fire-box, substantially as and for the purposes set forth.

2. In a cooking-stove, the combination of the primary and secondary fuel-burning chambers F and G, the perforated grate C, extending under and supplying air in jets to both, and the hollow pendent partition E, extending transversely across the stove under the long-center *h*, between two sets of pot-holes opening outside the walls A A for the admission of air, and perforated along or near its lower edge or side for the discharge of air in jets to the interior of the stove, substantially as set forth.

3. In a cooking-stove, the combination of the fire-box B, divided into two fuel-burning chambers, F and G, by a transverse pendent partition, E, the perforated grate C, extending under both chambers, the sloping back wall H of the chamber G, the perforated front door or plate, *b*, of the chamber F, and the perforated transverse air-duct J, extending across the fire-box, substantially parallel with the partition E, and opening at its ends to the outer air, whereby air is supplied in jets underneath the fuel by the grate C, in front of it by the door *b*, and above it by the duct J, substantially as set forth.

4. In a cooking-stove, the combination of the primary and secondary fuel-burning chambers F and G, the partition E dividing them,

the grate C, extending under both of them, and the flue I to carry off the products of combustion from the chamber G with a series of air-inlet perforations through the top of the stove at *f*, supplying air from above to the products of combustion as they pass into the flue, and an opposite series of air-inlet perforations from the air-chamber *g*, supplying air from below to the said products of combustion, substantially as and for the purposes set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM A. GREENE.

Witnesses:

ARTHUR C. FRASER,

HENRY CONNETT.

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