(No Model.)

S. H. LA RUE.

STOVE AND HEATER.

No. 324,944. Patented Aug. 25, 1885.

Fig. 1.

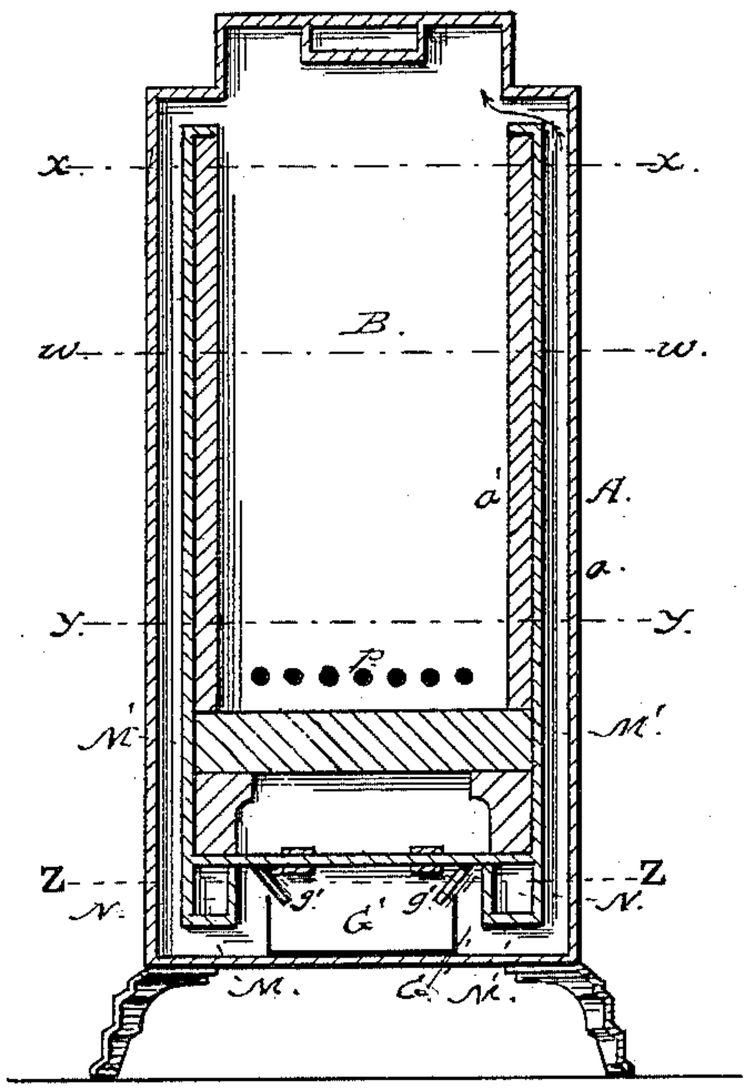


Fig. 2.

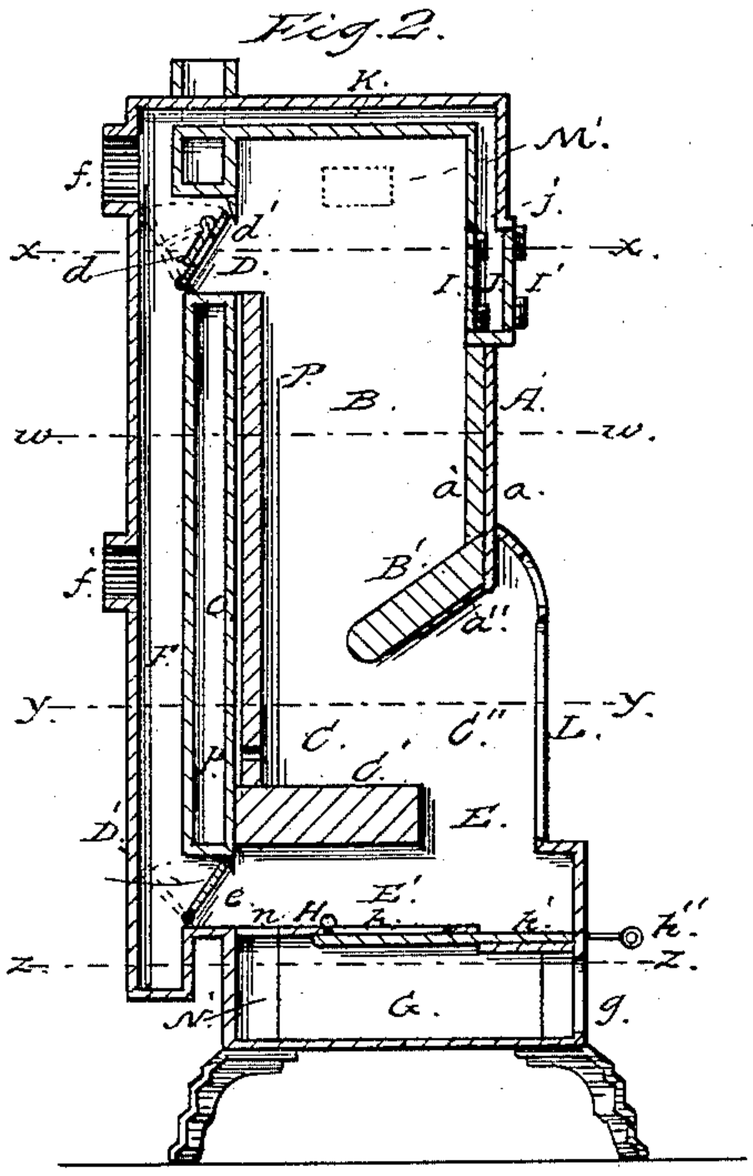


Fig. 6.

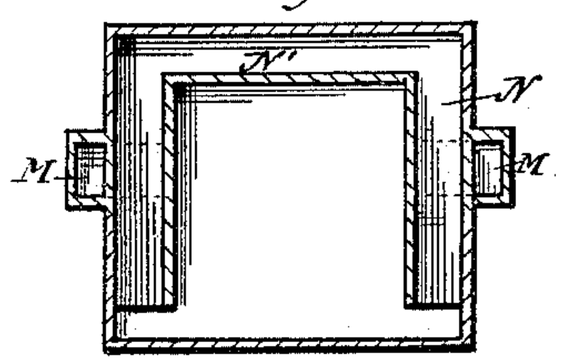


Fig. 3.

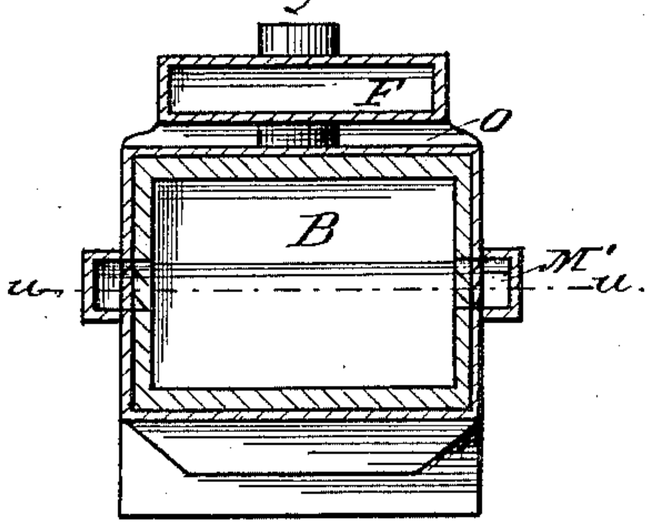


Fig. 5.

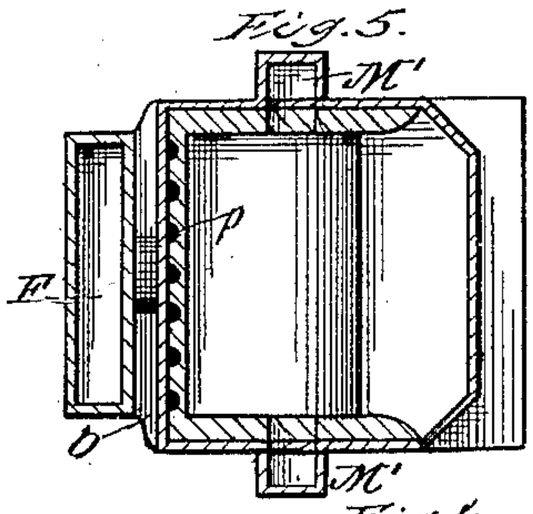
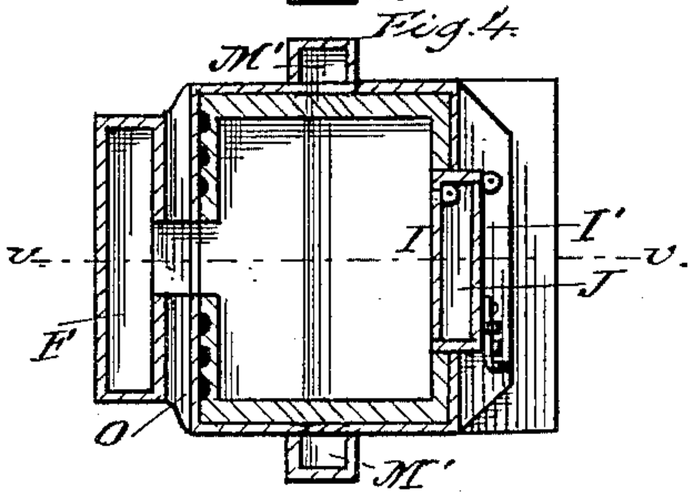


Fig. 4.



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UNITED STATES PATENT OFFICE.

SILAS HUFFMAN LA RUE, OF READING, PENNSYLVANIA.

STOVE AND HEATER.

SPECIFICATION forming part of Letters Patent No. 324,944, dated August 25, 1885.

Application filed October 1, 1883. (No model.)

To all whom it may concern:

Be it known that I, SILAS H. LA RUE, a citizen of the United States, residing in the city of Reading, county of Berks, and State of Pennsylvania, have invented certain new and useful Improvements in Heating Stoves and Furnaces, of which the following is a full, clear, and exact description.

The improvements which I have devised are designed particularly for application in heating-stoves; but they will be found equally useful in furnaces, especially those which are used for heating air for warming apartments.

In making this invention the object sought has been the production of a heater which will effectually utilize the caloric-producing properties of the fuel consumed; and the invention consists in certain peculiarities in the construction of the apparatus, as will be more fully hereinafter described, and specifically indicated in the claims.

In the drawings, Figure 1 represents a central vertical transverse section from side to side on the line *u u*, Fig. 3. Fig. 2 is a central vertical transverse section from front to rear, as on line *v v*, Fig. 4. Fig. 3 is a horizontal section on the line *w w* of Figs. 1 and 2. Fig. 4 is a horizontal section on the line *x x* of Figs. 1 and 2, the damper being omitted. Fig. 5 is a horizontal section on the line *y y* of Figs. 1 and 2. Fig. 6 is a horizontal section on the line *z z* of Figs. 1 and 2, the rear vertical flue being omitted.

A is the body of the stove or heater, *a* being the iron plates and *a'* the fire-brick lining thereof.

B is the upper fuel, combustion, and coking chamber.

C is the lower fuel, combustion, and coking chamber.

D is the direct-exit opening, and *d* the damper thereof, provided with safety or gas-escape valve *d'*.

E is a short vertical flue connecting the lower combustion-chamber and the ash-pit.

E' is the lower or indirect-draft passage, connecting the flue E with the rear vertical exit-passage; and *e* is a damper provided at the rear extremity thereof.

F is a rear vertical chamber which serves the twofold purpose of an exit-flue and a heating-drum, D' being an opening thereinto from the flue chamber or passage E'; and *f* and *f'* are respectively upper and lower collars or flue-connections on the same, leading to the chimney.

G is the ash pit; *g*, the door of the same, which in practice will be provided with the usual register; G', the ash-pan, and *g' g'* the usual guide-plates, forming a chute thereto.

H is the partition or diaphragm which separates the flue E' from the ash-pit G, and which has an opening, *h*, which is provided with a closing-slide, *h'*, which is operated by a handled rod, *h''*.

B' is the upper fuel-bed composed of extra-heavy fire-brick, extending from side to side of the stove, and supported in part, if desired, upon inclined stove-plate *a''*.

C' is the lower fuel-bed, composed, like the upper bed, of heavy fire-brick, which extends across the stove, and at its ends and at its rear is preferably embedded in the lining thereof, as shown.

I is an inner and I' is an outer feed-door, both provided, if desired, with mica windows, between which is inclosed a space, J, which, through an opening, *j*, in its top, communicates with an independent gas-escape flue, K, which, passing centrally up the front and along the top of the structure, discharges into the rear exit-flue, F.

L is a door extending, substantially, from top to bottom of the illuminating-flame space C'' in front of the chamber C and its fuel-bed C'. This fuel or fire chamber, it will be observed, is wholly closed at its bottom by the imperforate tile or fuel bed, and its sides and rear are also closed, except as air and gases are supplied through the orifices *p;* but at its front it is neither closed nor grated, but is wholly open and unobstructed, as shown.

M M are short flues leading laterally outward from the ash-pit chamber G, and M' M' are vertical flues which connect with the flues M and, extending upwardly to the top or near the top of the stove, discharge into the interior of the same in the manner indicated by the arrows in Fig. 1.

N N are side flues extending along the ash-pit from a point near the front thereof to the rear of the same, where they connect with

a cross-flue, N′, which discharges through an opening, *n*, into the rear portion of the space E′ immediately in front of the lower or indirect-exit opening, D′.

O is a hot-air flue or air-warming space between the rear wall of the stove and the broad rear flue, F.

P are air-tubes cast or otherwise formed in the rear wall of the stove or in the lining thereof, to conduct jets of air discharged from the fresh-air flues at their upper extremities to the orifices *p* in the rear wall of the lower fuel or fire chamber.

It is manifest that the fresh-air flues may be placed in the rear or in the front wall of the stove, if desired; but I prefer to place them at the sides, as described and shown.

The construction of the stove being thus described, and the relation of the several parts being clearly indicated, the operation may be described as follows: Kindling material is placed upon the fire-bed, the upper or direct damper is thrown open, as in dotted lines in the drawings, the ash-pit door or doors and the register therein are closed to prevent the admission of air through the same into the side flues and its consequent discharge into the upper chamber, the mica door is slightly opened to admit air for combustion, and the damper in the lower or indirect-exit opening is closed to prevent it from acting as a cut-off to the direct draft. A match being then applied, the combustion and draft will be as in an ordinary feederless or surface-burning stove, the products passing continuously upward to the upper or direct-exit opening. After a short time the kindling will have become well ignited and the chimney-flue heated, so that a strong tendency to a vacuum will be produced therein. Coals of any kind and of any ordinary dimensions may then be supplied through the upper doors in proper quantity for starting the fire, and after these have been allowed to ignite sufficiently, which in an ordinary draft will be accomplished within twenty to thirty minutes, the lower damper may be opened, the upper damper closed, the illuminating door or doors shut, and the ash-pit door or the register therein opened. The stove will then be at once changed in its operative character from an updraft or surface-burner to a downdraft or base-burner, and the course of the gaseous products of combustion, observable through the mica windows, will be seen to be downward, a beautiful smokeless flame being thrown from the burning fuel in the open-front fuel-receptacle toward the mica front, and curving downwardly over the edge of the fire-bed, closely resembling a waterfall in its general appearance as it descends into the lower flue-chamber of the stove. The entire lower portion of the stove is thus heated, and the front thereof is illuminated with a degree of brilliancy not attainable in any other stove construction now in use, so far as I am aware.

Such quantities of fuel may be added from time to time as may be found necessary or desirable, and the upper chamber may be filled to a level with the feed-opening, such chamber thus becoming, as it were, a fuel-magazine. To check the fire a small quantity of air may be admitted into the flue below the fire-bed, either the mica door or the ash-slide *h′* being employed for this purpose. The action of the stove may thus be controlled perfectly and with great precision, for the fresh air admitted below will drive the products of combustion in that part of the stove to the surface of the coal in the upper combustion or coking chamber, and should cold air be admitted freely and in large quantities into the lower flue the upward pressure will be so great that gas and smoke will be forced into the gas-chamber between the feed-doors, the inner door being made slightly smaller than the interior of the feed-opening or gas-chamber, so as to be swung outwardly from its ordinary position and within the gas-chamber under slight pressure, and, instead of being discharged into the apartment, as in ordinary stoves under similar circumstances, will be carried into the independent gas-flue, through which they will reach the exit-pipe. If the pressure upward in checking the fire be very strong, the safety-valve in the upper damper will be lifted by it, and the excess of pressure will thus be relieved, thereby rendering impossible either an escape of gas into the room or an explosion.

It will thus be seen that it will be impossible for any of the products of combustion to escape from the stove, either when it is in active operation or when the fire is checked, except through the exit-openings specially provided therefor.

If it be found desirable to cool off the stove quickly, it may be done by simultaneously throwing open the direct-damper and the feeder-doors, when the draft across the surface of the fire will speedily reduce the temperature of the stove to any desired degree.

When the brick-lining and the brick fire-bed become highly heated, the gases which come in contact with or near to them will be ignited and consumed, the combustion being so nearly perfect that there will be little or no escape of unconsumed smoke into the chimney-flue.

Both the lower exit-flue and the fresh-air flues being at all times connected with the ash-pit chamber, it follows that when the ash-pit slide is drawn outwardly the volume of air which before passed into the fresh-air flues will be diminished just in proportion as the opening is uncovered. As already stated, the lower damper, *e*, is opened whenever the upper damper is closed, and it is therefore obvious that when the slide *h′* is wholly withdrawn little or no air will pass from the ash-pit chamber to the fresh-air flues, its most direct exit being through the uptake-flue to the chimney; and it is equally apparent that when the slide is drawn outwardly the volume of

air conveyed through the horizontal side and rear flues into the rear portion of the lower or indirect-exit flue will also in like manner be correspondingly diminished.

From the foregoing the advantages of the construction described and shown will become apparent, and attention will be drawn particularly to the facility with which the fire may be controlled, the manipulation above described enabling the stove to be used at will either as a surface-burner or as a base-burner. The fire-bed, consisting of a single massive fire-brick, having a thickness of several inches, when once heated to a high degree is a powerful heating agent, and has the property of a burner-plate in a vapor-stove, all combustible gases being instantly ignited and flashing into flame on being brought within its influence. All gases generated in the lower part of the stove will be effectually consumed and utilized, while the small quantities produced in or which may find their way into the independent upper chamber will be discharged therefrom through some one of the escape-openings provided therefor, as above described. This thorough combustion of the valuable properties of the fuel effects the greatest possible economy in its use. The provision of the refractory fire-bed renders a constant use of a down-draft possible, as it would not be if a grate were employed, the intense heat to which the fire-bed is subjected being sufficient to utterly destroy within a very brief period a grate or a fire-bed of any other material than that which I employ. The draft being ordinarily downward the heat is not wasted by being carried off into the exit-flue, but is retained within the base of the stove until it is absorbed by the atmosphere of the surrounding apartment. The several openings being first suitably adjusted, as above described, a very little fire may be kept in an inactive state for a great length of time, ready to be brought at once into active combustion when a higher degree of heat is required.

The illuminating power of the stove is, as will be observed, greater than that of any stove which illuminates from above the level of the grate only, because not only the fire-chamber, but the space immediately below and in front of that chamber, becomes an illuminating-space. It is obvious that the lower exit-opening will carry off all dust that may be set in motion when the fire is being cleaned of refuse, and that none can escape into the apartment.

The introduction of jets of highly-heated air supplied through the side passages, the rear air-tubes, and the orifices *p*, insure the combustion of any portions of the fuel which, trickling down in a semi-liquid form, might otherwise, especially when "soft coal" is used, accumulate in the lower part of the angular space at the junction of the fire-back and the fire-bed.

As will be inferred from the foregoing description, when bituminous fuel is used it will be coked in the upper chamber by reason of the great heat of the lower chamber, with which it directly communicates. This upper chamber, because of its various uses and functions under diverse manipulation, may appropriately be termed a "fresh-air-supply chamber," a "gas-chamber," a "coking-chamber," a "fuel-magazine," or a "combustion-chamber," for it may be either of these, as hereinbefore explained.

It will be understood that the linings of the body of the stove may be composed of soapstone or other refractory material instead of fire-brick; but the upper fire-bed brick, deflector, or chute, and the lower fire-bed should be of fire-brick of the best quality.

The independent gas-escape flue may lead to the chimney flue direct, or to some other point of discharge, instead of to the rear vertical flue; but I prefer the construction which is represented in Fig. 2.

It will be seen that the flues N N and N', which are at all times open, serve to prevent too rapid escape of the products of combustion through the lower or indirect-exit flue. Moreover, if through any mischance gas should be forced from the coking-chamber through the fresh-air flues into the ash-pit chamber, these open flues will serve to conduct it into the exit-flue, and thus prevent it from finding its way into the apartment.

I am aware that a patent has been granted for a stove in which the draft may be either downward or upward through the fuel-chamber, and in which a flame or heat chamber is located in the same horizontal plane with the fuel-chamber. In that stove the products of combustion after leaving the fuel-chamber are conducted upwardly only, while in my construction the products may at the will of the operator be carried either upwardly or downwardly from the fuel or combustion chamber to the exit-flue or uptake.

I am also aware that a patent has been granted for a stove in which the draft is downward through a fuel-magazine which is provided with an inclined fuel-supporting ledge near its lower end, such inclined ledge being located nearly over the center of an oppositely-inclined closed base-plate, which supports and guides the fuel. In that stove the products of combustion find their exit from the combustion-chamber in an upward direction only, while in my construction the products may be discharged either upwardly or downwardly from the combustion-chamber.

I am also aware that a patent has been granted for an open-front grate or stove which is provided with air-induction tubes which conduct air from a point near the floor outside the grate or stove, and discharge it into the rear portion of the body of the fuel. In my construction the air-tubes lead from the ash-chamber, a point within the stove and not exterior to it, and they discharge at a point above the body of the fuel instead of into the midst of it.

I do not, therefore, claim either of the three

constructions above described; and I do not claim a fire-place or stove which is provided with a fuel-receptacle which is solid at its bottom and rear and grated at its front, and in which the indirect draft is rearward and downward, my fuel-receptacle or fire-bed being entirely flat and wholly unobstructed at its front, and the products escaping therefrom, for indirect draft, at the front and downwardly.

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

1. The fresh-air draft-passages leading from the ash-pit to the coking-chamber, in combination with the brick fire-bed or fuel-support, and the exit-flue below said fire-bed and between the fire-bed and the ash-pit.

2. The fire-bed, imperforate and wholly unobstructed at its front, as shown, and the exit-flue beneath said fire-bed, in combination with the front downward-discharge passage and the illuminating combustion-chamber, as described.

3. The ash-pit, the fresh-air flues leading from the ash-pit to the coking-chamber, the coking-chamber, the combustion-chamber, the fire-bed, and the exit-flue beneath the imperforate open-front fire-bed, all in combination, substantially as described.

4. The direct-exit opening in the upper portion of the independent coking-chamber, the coking-chamber, the fuel or fire chamber open and unobstructed at its front and wholly closed at its bottom by the imperforate fire-bed which projects from the rear toward the front of the stove and which has a lower flue beneath the same, the combustion and illuminating chamber opposite the fire-chamber, and the mica doors opposite the illuminating-chamber, in combination.

5. The ash-pit, the orifice in the top of the ash-pit, the slide or valve which controls the orifice, the fire-bed, and the flue which leads from and extends beneath the fire-bed, in combination.

6. The lower imperforate fire-bed projecting from the rear wall forward and having an indirect-draft flue beneath the same, and the upper imperforate bed projecting from the front wall backward and overhanging the lower fire-bed at some distance above the same, in combination, substantially as described.

7. The updraft-exit opening, and the downdraft-exit passage extending under the fire-bed, in combination with the coking-chamber, the fuel-support of which extends rearwardly from the front wall of the stove, and with the combustion-chamber, the fire-bed of which projects from the rear wall of the stove toward the front thereof, substantially as set forth.

8. The brick-lined coking-chamber the diaphragm at the bottom of which projects from the front wall of the stove, the bricked fire-chamber the brick fire-bed of which projects from the rear wall of the stove, and the exit-flue which passes downwardly at the front of and extends rearwardly beneath the fire-bed, in combination, substantially as described.

9. The fresh-air flues leading from the ash-pit chamber, as described, the coking-chamber receiving air from the fresh-air flues, the fire-bed and its combustion-chamber, the ash-pit chamber separated from the flue-space above it by a partition or diaphragm, an orifice or opening, *h*, in such diaphragm, and a slide which is adapted to control such orifice, in combination.

10. The independent gas-flue, and the gas-chamber between the feed-doors communicating with the independent gas-flue and with the coking-chamber, which in turn communicates interiorly with the indirect exit-flue, in combination with the fresh-air flues which exteriorly connect the ash-pit with the coking-chamber and which operate to affect the pressure within the coking-chamber by discharging air into the same.

11. The independent gas-flue connecting the gas-chamber and the exit-pipe, the safety-valve arranged between the coking-chamber and the exit-pipe and adapted to be opened by gaseous pressure, and the coking-chamber communicating with the combustion-chamber and with the downdraft-exit flue beneath the fire-bed, all combined and operating substantially as described.

12. The vertical brick-lined rear fire-wall, the brick fire-bed projecting from the rear fire-wall, the over-projecting brick shelf, the front discharge-passage, the illuminating door or doors opposite the discharge-passage, and the flue for downdraft beneath the fire-bed, combined substantially as described.

13. The direct-exit flue, the indirect-exit flue, the fire-bed or fuel-chamber, and its combustion and illuminating chamber, which communicates, as described, with the direct-exit flue and with the indirect-exit flue, and the flues which are arranged along the vertical walls of the ash-pit and through which air is conveyed from the ash-pit and is discharged into the flue which leads downwardly and rearwardly from the fire-chamber, in combination.

14. The coking-chamber, the gas-chamber between the two feed-doors and opening out of the coking-chamber, the uptake-flue, the gas-flue which connects the gas-chamber with the uptake-flue, the direct-exit damper which controls the opening between the coking-chamber and the uptake-flue, the lower or indirect-exit flue which discharges into the uptake-flue, and the damper for controlling the opening between the indirect-exit flue and the uptake-flue, in combination.

15. The combination of the coking-chamber, the direct-exit opening near the top of the coking-chamber, the imperforate fire-bed, and the indirect-exit passage leading first downwardly along the front vertical face of

the fire-bed and then rearwardly along the bottom of the same to the opening in the uptake-flue, substantially as described.

16. The fresh-air flues, the coking-chamber, the combustion-chamber, the fire-bed, and the small air-conduits leading from the top of the coking-chamber down the rear wall of the stove to a point above the level of the fire-bed, where they enter the fire-chamber through orifices in the rear wall for the purpose of aiding combustion, all in combination, substantially as described.

17. The combination of an upper fuel and coking chamber which at its front is provided with an imperforate fuel-supporting diaphragm, with a lower fuel or fire chamber directly under the coking-chamber, and which at its rear above a horizontal indirect-exit flue has an imperforate fixed non-adjustable fire-bed, substantially as described.

18. The combination of an upper fuel and coking chamber which has a supporting-diaphragm at its front, with a lower fuel or fire chamber which has an imperforate fire-bed which projects from the rear of the stove toward the front thereof, the fire-bed being non-adjustably secured in position, and the fire-chamber being adapted to burn with an upward draft or with a downward draft through a flue beneath the fire-bed, substantially as described.

19. The combination of an upper fuel and coking chamber which at its front has an imperforate fuel-supporting diaphragm, with a lower fuel or fire chamber which is directly under the coking-chamber, such lower chamber having beneath it an indirect-exit passage and being open at its top for communication with the coking-chamber, and wholly open at its front so that the rays of light may have unobstructed passage through the lower combustion and illuminating chamber beneath the supporting-diaphragm to the mica lights in front of the same, substantially as specified.

20. The combination of an upper fuel and coking chamber and a lower fuel or fire chamber, such lower chamber being directly under the coking-chamber and being provided with an imperforate fire-bed, and adapted by the provision of a lower indirect-exit flue which leads downwardly and rearwardly under the fire-bed to burn with a downward draft.

21. A stove the fire-chamber of which has a series of minute perforations in one of its walls for the introduction of air and gases to support combustion, which is entirely open at one side and at the top for the escape of air and the products of combustion, and which is entirely closed at all other points.

22. The combination of an upper fuel, coking, and combustion chamber which is provided with an opening for the direct exit of the products of combustion, with a lower fuel or fire chamber which is partially separated from the coking-chamber by an imperforate diaphragm, and which has an imperforate fire-bed, between the front edge of which and the front wall of the stove is an opening or passage for the indirect escape of the products of combustion.

23. The combination of an independent upper fuel and coking chamber which is provided with a direct-exit opening and a front diaphragm, and a lower combustion-chamber which has an imperforate fire-bed, and which discharges its products of combustion at the front through a short vertical flue downwardly directly into a horizontal flue-chamber or exit-passage which extends rearwardly along the under surface of the imperforate fire-bed, substantially as set forth.

24. The combination of an upper fuel supply and coking-chamber, a fuel-receptacle below the fuel supply and coking chamber, a flue-chamber below the fuel-receptacle for the passage of the volatile products of combustion and for the temporary reception of the solid incombustible portions of the fuel, and a chamber below such flue-chamber adapted to receive and to discharge air for combustion, and also to receive the unconsumed portions of the fuel.

25. The combination of a coking and fuel-supply chamber with a fixed imperforate fire-bed which is directly under the fuel-supply chamber, and which has beneath it an indirect exit-flue, the fuel-supply chamber having a fire brick or tile at its bottom, which extends from side to side of the coking-chamber and from the front thereof toward the rear of the same, the rear extremity of the fire brick or tile being directly or nearly directly over the center of the fire-bed.

26. A coking and fuel supply chamber which has at its lower extremity a tile of refractory material, a gas-chamber which has an orifice in its top, a gas-passage which leads from the gas-chamber to a smoke-exit pipe, and a damper which is provided with an orifice which is adapted to be closed by an automatically-acting valve, combined for operation in a stove, substantially as described.

27. The combination, with the ash-pit, of laterally-extending air-flues adapted to conduct air into the upper part of the stove, and other air-flues directly over the laterally-extending flues and leading at right angles thereto from a point near the front to a point near the rear of such ash-pit and adapted to conduct air into the lower part of the stove, substantially as and for the purposes set forth.

28. The combination, with the ash-pit, of flues which are adapted to receive air therefrom at a point near the front thereof and to discharge it into the lower smoke-exit passage, and other flues adapted to receive air from the ash-pit and to convey it to the coking and fuel-supply chamber.

29. The combination, in a stove, of a smoke-passage which connects at its lower extremity with a flue chamber or passage for indirect escape of the products of combustion which

is directly under the fire-chamber, and of one or more vertical passages which connect with an air-chamber which is directly below such flue-chamber, and with the interior of the stove at a point or points in the upper portion thereof, substantially as described.

30. In a heating apparatus substantially of the character herein described, the combination, with the upper fuel supplying and coking chamber thereof, of an exit-opening for such chamber, a damper in such exit-opening, an orifice in such damper, a gas-valve which is attached to the damper and which is adapted to close the orifice therein, and a loosely-swinging door or valve which is hinged to an opening in the wall of the coking-chamber and which is adapted to move outwardly under slight pressure of gas and permit the escape of the same from such coking-chamber.

31. In a stove, a fuel or coking chamber which is provided on one of its sides with a perforated and valved damper, and on another side with a gas-escape chamber the inner wall of which is composed of a loosely-pivoted, freely-swinging door which moves outwardly under pressure of gas and permits its escape into such gas-chamber.

32. The combination of a fire-bed or fuel-support which at one side is wholly unobstructed, a fire back or wall which has air-inlet openings a short distance above the fire-bed, and an overhanging fire brick or tile which serves to direct fuel to the fire-bed below it and to support fuel for combustion or for coking above it, and which forms the principal portion of the upper wall or ceiling of a combustion and illuminating chamber.

33. The combination, with the lower or indirect-exit flue which is provided with a damper at its rear extremity, of the side and rear flues which conduct air from the front part of the ash-pit to the rear part of the exit-flue, and the dampered orifice in the top of the ash-pit through which air is admitted directly from the ash-pit into the exit-flue.

SILAS HUFFMAN LA RUE.

Witnesses:
J. P. KREMP,
D. KREMP.