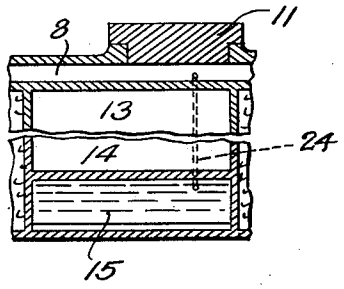
June 7, 1932. G. DALÉN 1,862,009

COOKING STOVE WITH HEAT ACCUMULATOR

Filed Sept. 18, 1929

Fig. 2.



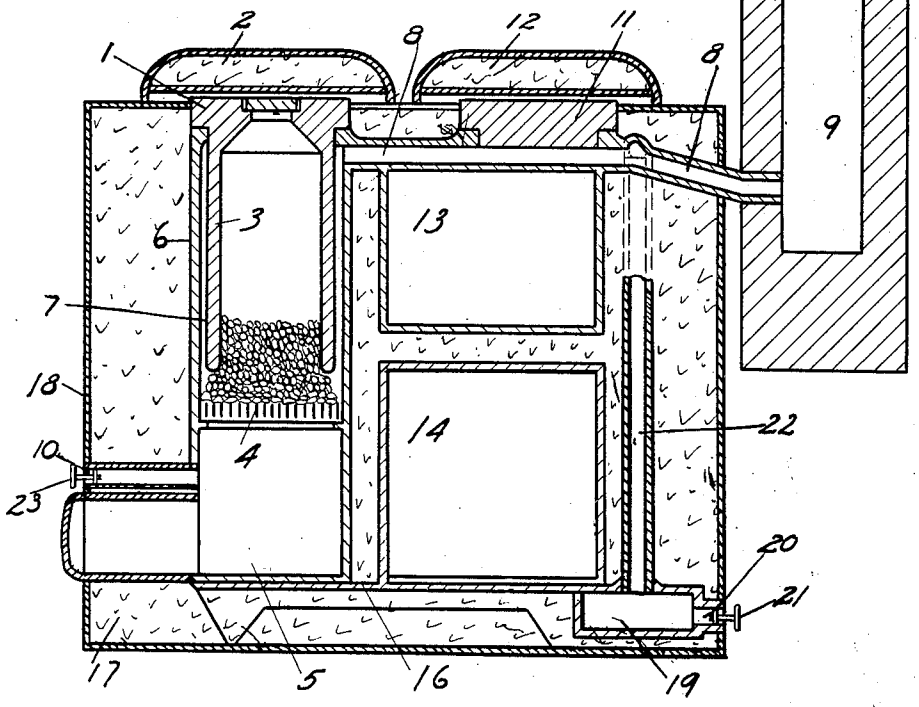


Fig. 1.

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UNITED STATES PATENT OFFICE

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COOKING STOVE WITH HEAT ACCUMULATOR

Application filed September 18, 1929, Serial No. 393,512, and in Sweden October 11, 1929.

The present invention relates to cook stoves of the type disclosed in my Patent No. 1,559,162, granted October 27, 1925, in which there is a heat accumulator in the form of a metal block of comparatively large dimension continuously maintained at high temperature, and which are provided with a magazine for the storing of solid fuel which is burned in heat transmitting relation with the heat accumulator and continuously maintained at combustion temperature. In a heat accumulating stove of the above character, there is a very slow rate of combustion and combustion gases are produced having a high content of carbon dioxide. Consequently, such combustion gases are heavy, that is, their specific gravity is high. Furthermore, such stoves operate to absorb a large proportion of the heat of the combustion gases within the stove structure in utilizable state before the gases leave the stove and the exit temperature may be relatively low.

In heat accumulating cook stoves of the above described type, the exit temperature of the combustion gases is practically constant while the temperature of the atmosphere to which combustion gases are discharged may vary between wide limits. It thus may happen, for example, on hot summer days, that the specific gravity of the atmospheric air will be as low as or even less than the specific gravity of the combustion gases. That is, the atmospheric air may be lighter than the combustion gases. Under such conditions, the natural draft created by the discharge of such gases to a chimney will be poor or even negative; that is to say, tending to produce a reverse or back draft in the chimney.

It is highly important to the successful operation of heat accumulating cook stoves that combustion be not stopped because of lack of sufficient draft to maintain the fire and the general object of the present invention is to improve upon prior forms of apparatus and methods of operation so as to eliminate the difficulties heretofore encountered in maintaining a continuous draft of sufficient magnitude regardless of variations in atmospheric or other conditions ordinarily affecting natural draft. In general, it may be said that the object of the invention is attained by continuously or at desired periods admixing the combustion gases with a lighter draft-producing or draft-maintaining fluid to keep the specific gravity of the gases in the chimney at a low enough value to insure the maintenance of a proper draft. The combustion gases and the assisting fluid are preferably mixed after the combustion gases have had a substantial portion of their utilizable heat abstracted therefrom in the stove, so that they are at a relatively low temperature. Preferably the gaseous medium to be mingled with the combustion gases is fresh air which is preheated before being mixed with the combustion gases. As will hereinafter more fully appear, the heating of such gaseous medium is accomplished by the utilization of a portion of the heat absorbed from the combustion gases in the stove in utilizable state and conducted through the structure of the stove to the medium to be preheated, the fluid to be preheated drawing on heat absorbed and accumulated in the stove to continuously produce a gaseous medium lighter than the atmospheric air of the surroundings and the draft so produced being utilized to draw air to the fuel bed and the resulting combination gases into admixture with the heated medium. Various gaseous mediums may be employed in the practice of the invention. Air is to be preferred, but water vapor or steam generated from a water supply within the stove may also be utilized.

Fig. 1 is a vertical section through a cook stove of the heat accumulating type in which the invention is employed; and

Fig. 2 is a section showing a part of a similar stove incorporating the invention in a different form.

Turning now to Fig. 1, the stove comprises a metal mass heat accumulating member comprising a head portion 1 providing a cooking plate or hot plate surface, covered by a removable cover 2, and a depending skirt portion 3 providing a storage space or magazine for any suitable form of solid fuel for supporting combustion in the combustion space or fireplace indicated at 4. Numeral 5 rep-

resents the usual ash pit, and 6 denotes a combustion housing supporting a grate receiving the fuel and surrounding the skirt 3 between which parts the combustion gases flow upwardly to the upper horizontal conduit or channel 8 opening into the chimney 9. Numeral 10 indicates the inlet for admitting air to support combustion, the flow of air through this inlet being regulated in any suitable known manner, as, for example, by means of an adjustable regulating valve indicated diagrammatically at 23.

A second cooking plate is indicated at 11, this plate being covered by the removable cover 12. Plate 11 is heated by combustion gases passing through the channel 8. An oven designed to be maintained at relatively high temperature for roasting or the like is indicated at 13 and a second or simmering oven is indicated at 14. As will be observed from the drawing, heat is transmitted directly to oven 13 from the products of combustion in the channel 8 and heat may conveniently be conducted to the walls of oven 14 through the medium of a metal plate 16 connecting the oven structure with the portion of the combustion housing forming the ash pit.

Insulating material indicated generally at 17 is used to fill the spaces between the above described elements of the stove and between these elements and the outer casing of the stove, indicated at 18.

In accordance with the present invention, and in order to, permanently or when necessary, reduce the specific gravity of the combustion gases, the stove is provided with a vertically extending conduit 22 extending substantially the entire height of the stove and within the insulation 17. A receiver 19 is provided substantially at the bottom of the stove. The lower end of conduit 22 is connected to receiver 19. The upper end of conduit 22 is connected to channel 8. Receiver 19 is provided with an air inlet 20 advantageously controlled by any suitable form of adjustable means such as the valve indicated diagrammatically at 21.

All the metallic parts of the stove are in direct heat transmitting relation. The plate 16 extends from the ash pit to receiver 19. Thus a path of metallic heat conduction is provided between the combustion housing and the air heating parts 19 and 22. Furthermore, the air heating parts 19 and 22 can draw on all the accumulated heat in the stove. The body of insulating material prevents rapid radiation of the absorbed heat so that the accumulated heat within the stove may be stored therein at a relatively high temperature level. It will further be evident that the heat absorbing and heat accumulating parts constitute a path for the transfer of heat by conduction from the source of heat to the conduit 22 through which air is admitted to the channel 8 and that this path for the conduction of heat has sufficient mass so that the temperature level of the path of heat conduction is maintained relatively stable independently of momentary variations in the rate of heat generation at the place of combustion.

Air, which for equal temperatures is lighter than the combustion gases in the channel 8, is heated by conduction from the several heated parts of the stove with which the conduit 22 and reservoir 19 are in heat conducting relation, so that the specific gravity of the air in this conduit is reduced by heating, and this heated air mingling with the combustion gases at the exit end of the channel 8 serves to dilute these gases and reduce the specific gravity of the mingled products which are delivered to the stack 9. Due to the heating of the air in the conduit 22, a continuous natural flow of air through this conduit is maintained, which flow may conveniently be termed thermal flow as distinguished from flow which might be created by mechanical means such as a draft fan or the like. Even if the air supply through air inlet 10 be shut off, the heating of conduit 22 and the resulting flow of air will be sufficient to maintain the draft of the chimney. It will be noted that the air passing through conduit 22 does not pass through oven 13 or in contact with the hot plates 1 or 11. The air heated in conduit 22 is introduced into the path of the combustion gases after substantially all the usable heat has been extracted therefrom and where the temperature is so low as to avoid secondary combustion due to the admixture of fresh air with the combustion gases.

When the air supply is restricted so that there is a very slow rate of combustion, the conduit 22 and reservoir 19 draw on the heat accumulated in the stove.

It is important that the inlet 20 of the conduit 22 be at a lower level than the inlet of pipe 10 for supplying air for combustion. This is due to the necessity of preventing reverse flow through conduit 22 of combustion gases in the event that for any reason the gases cannot escape through the chimney 9. If the inlet 20 were on the same level as or above the level of the inlet of pipe 10 and the combustion gases were prevented from flowing through the chimney, it will be evident that a condition is possible wherein the column of gaseous fluid in the space 7 would be lighter than the column of gaseous fluid of equal or less height in the conduit 22 so that flow of combustion gases could take place upwardly through space 7 across the channel 8 and downwardly through the conduit 22 to the opening 20 which would, under these conditions, serve as an outlet. In such an event, the stove would burn until the fuel in the magazine is consumed, and com-

bustion gases would escape into the room. By placing the opening 20 well below the level of the inlet to pipe 10, the greater height of the column of air in conduit 22 as compared with the height of the column of hotter combustion gases in the space 7 will prevent the underside reverse flow through conduit 22 in the event that the normal exit of the products of combustion through the stack 9 is prevented.

In addition to providing a relatively large area for the transfer of heat by conduction, the chamber 19 provides a reservoir of relatively large capacity which is normally filled with air. All installations of the character dislosed are subjected periodically to momentary back drafts due to gusts of wind entering the chimney, such back drafts tending to reverse the normal flow of the gases through the several passages. By providing the reservoir 19, momentary back drafts in the conduit 22 will not ordinarily operate to force combustion gases out of the stove through the opening 20 because of the relatively large volume of air which must first be forced out through this opening from the reservoir 19 before combustion gases from the flue 8 can escape through this opening.

In Fig. 2 there is illustrated diagrammatically another arrangement adapted to utilize steam instead of air for diluting the products of combustion and lowering the specific gravity of the gases discharged to the stack. In this arrangement the lower part of the oven 14 is formed as a water receiver which is connected by means of a pipe 24 with the channel 8. Steam is generated due to heat in the stove which passes through the conduit 24 and into the channel 8 and acts in the same way as the air heated in conduit 22 above described.

It is to be understood that I am not to be limited except by the appended claims taken in the light of the prior art.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. The method of maintaining draft in a cook stove provided with heat accumulating mass which comprises burning fuel at such rate as to produce relatively heavy combustion gases, absorbing usable heat from said gases and reducing the temperature thereof to a relatively low value, accumulating absorbed heat in the stove, heating a fluid with a portion of said absorbed heat to produce a gaseous medium having a lower specific gravity than that of the combustion gases and mingling the heated gaseous medium with the combustion gases after substantially all of the usable heat has been withdrawn therefrom into the stove.

2. The method of maintaining draft in a cook stove provided with heat accumulating mass which comprises burning fuel at such rate as to produce relatively heavy combustion gases, absorbing usable heat from said gases and reducing the temperature thereof to a relatively low value, accumulating absorbed heat in the stove, heating air in the stove with a portion of said absorbed heat to provide a gaseous medium having a lower specific gravity than that of the combustion gases and mingling the heated air with the combustion gases after substantially all of the usable heat has been withdrawn therefrom into the stove.

3. The method of maintaining draft in a cook stove provided with heat accumulating mass and with a natural draft chimney which comprises burning fuel at such rate as to produce relatively heavy combustion gases, absorbing usable heat from said gases and reducing the temperature thereof to a relatively low value, accumulating absorbed heat in the stove, utilizing a portion of the absorbed heat in the stove for continuous heating of an auxiliary air supply and increasing the natural draft of said chimney by mingling the heated air with the combustion gases after the temperature of the combustion gases has been substantially reduced by the absorption of usable heat therefrom into the stove.

4. The method of maintaining draft in a cook stove provided with heat accumulating mass and with a natural draft chimney which comprises burning fuel at such rate as to produce relatively heavy combustion gases, absorbing usable heat from said gases and reducing the temperature thereof to a relatively low value, accumulating absorbed heat in the stove, continuously heating an auxiliary air supply by conduction of absorbed heat thereto through the stove and increasing the natural draft of said chimney by mingling the heated air with the combustion gases after the temperature of the combustion gases has been substantially reduced by the absorption of usable heat therefrom into the stove.

5. The method of maintaining draft in a cook stove provided with heat accumulating mass and with a natural draft chimney which comprises burning fuel at such rate as to produce relatively heavy combustion gases, absorbing usable heat from said gases and reducing the temperature thereof to a relatively low value, accumulating absorbed heat in the stove, continuously heating an auxiliary fluid by conduction of a portion of the absorbed heat through the stove to provide a gaseous medium having a specific gravity less than that of the combustion gases and increasing the natural draft of said chimney by utilizing thermal flow of said gaseous medium to introduce the same into the combustion gas path at a point therein of relatively low temperature value.

6. The method of maintaining draft in a

cook stove provided with heat accumulating mass and operating with a natural draft chimney which comprises burning fuel at such rate as to produce relatively heavy combustion gases, absorbing usable heat from said gases and reducing the temperature thereof to a relatively low value, accumulating absorbed heat in the stove, continuously heating an auxiliary air supply by conduction of absorbed heat thereto through the stove and increasing the natural draft of said chimney by utilizing thermal flow of the heated air to introduce the air into the combustion gas path at a point therein of relatively low temperature value.

7. In a cook stove, means for burning fuel to provide a source of heat, means providing a passage for conducting products of combustion from said source, means for absorbing usable heat from said source, said last named means constituting a heat-conducting path and comprising mass providing accumulative capacity for maintaining the temperature in said path relatively stable independently of variations in the rate of heat generation at said source, and a conduit for delivering air to said passage to dilute said products of combustion, said conduit being heated by conduction through said path of a portion of the absorbed heat.

8. In a cook stove, means including an air inlet for burning fuel to provide a source of heat, means providing a passage for conducting products of combustion from said source, means for absorbing usable heat from said source, said last named means constituting a heat-conducting path and comprising mass providing accumulative capacity for maintaining the temperature in said path relatively stable independently of variations in the rate of heat generation at said source, and a conduit for delivering air to said passage at a level higher than that of said inlet, said conduit having an inlet at a level lower than that of said first named inlet and being heated by conduction through said path of a portion of the absorbed heat.

9. In a cook stove, means including an air inlet for burning fuel to provide a source of heat, means providing a passage for conducting products of combustion from said first named means, heat absorbing and accumulating means for absorbing usable heat from said source and storing said heat in the stove, said last named means constituting a path for transmitting heat by conduction and comprising mass sufficient to maintain the temperature in said path relatively stable independently of variations in the rate of heat generation at said source, and a conduit for admitting air to said passage at a level higher than that of said inlet to dilute the combustion gases therein, said conduit having an inlet at a level lower than that of said first named inlet and having a relatively large wall area in heat conduction relation with said last named means.

10. In a cook stove, means including an air inlet for burning fuel to provide a source of heat, means providing a passage for conducting products of combustion from said first named means, heat absorbing and accumulating means for absorbing usable heat from said source and storing said heat in the stove, said last named means constituting a path for transmitting heat by conduction and comprising mass sufficient to maintain the temperature in said path relatively stable independently of variations in the rate of heat generation at said source, and a conduit for admitting air to said passage at a level higher than that of said inlet to dilute the combustion gases therein, said conduit having an inlet at a level lower than that of said first named inlet and including a reservoir in the path of air flow through the conduit, said reservoir providing a relatively large wall area to which heat is transmitted by conduction through said first named path

11. The method of producing and using heat in a cook stove operating with natural draft and including heat accumulating mass which comprises supplying air to and burning solid fuel at such rate as to produce heavy combustion gases, absorbing heat resulting from the combustion into the stove by passing said combustion gases in contact with said heat accumulating mass and accumulating heat in the stove when the demand for heat is low, continuously maintaining fuel in the stove at combustion temperature due to accumulation of heat in the stove, utilizing absorbed and accumulated heat in the stove to continuously produce a gaseous medium lighter than the atmospheric air of the surroundings and to produce continuous natural draft, and utilizing the draft so produced to draw air to said fuel and the resulting combustion gases into admixture with said light gaseous medium while retaining said lighter gaseous medium out of contact with said heat accumulating mass.

12. The method of producing and using heat in a cook stove operating with natural draft and including heat accumulating mass which comprises supplying air to and burning solid fuel at such rate as to produce heavy combustion gases, absorbing heat resulting from the combustion into the stove by passing said combustion gases in contact with said heat accumulating mass and accumulating heat in the stove when the demand for heat is low, continuously maintaining fuel in the stove at combustion temperature due to accumulation of heat in the stove, heating fresh air by heat absorbed and accumulated in the stove to continuously produce flow out of contact with said heat accumulating mass of lighter air than the air of the surroundings and to produce continu-

ous draft, and utilizing the draft so produced to draw air to said fuel and the resulting combustion gases into admixture with the heated fresh air.

13. The method of producing and using heat in a cook stove operating with natural draft and including heat accumulating mass which comprises supplying air to and burning solid fuel at such rate as to produce heavy combustion gases, absorbing heat resulting from the combustion into the stove and accumulating heat in the stove when the demand for heat is low, continuously maintaining fuel in the stove at combustion temperature due to accumulation of heat in the stove, heating fresh air by heat absorbed and accumulated in the stove to continuously produce flow of lighter air than the air of the surroundings and to produce continuous draft, utilizing the draft so produced to draw air to said fuel and the resulting combustion gases into admixture with the heated fresh air, and causing such admixture of combustion gases and air to take place at a point in the path of travel of the combustion gases after substantially all the utilizable heat thereof has been absorbed in the stove and such that the temperature of the combustion gases has been so reduced as to avoid secondary combustion due to the admixture therewith of the fresh air.

14. The method of producing and using heat in a cook stove operating with natural draft and including a hot plate, an oven and heat accumulating mass which comprises supplying air to and burning solid fuel at such rate as to produce heavy combustion gases, absorbing heat resulting from the combustion into the stove by passing said combustion gases in contact with said heat accumulating mass and accumulating heat in the stove when the demand for heat is low, continuously maintaining fuel in the stove at combustion temperature due to accumulation of heat in the stove, heating fresh air by heat absorbed and accumulated in the stove to continuously produce flow of lighter air than the air of the surroundings and to produce continuous draft, conducting said lighter air into the presence of said combustion gases without contacting said heat accumulating mass and without passing through said oven, and utilizing the draft so produced to draw air to said fuel and the resulting combustion gases into admixture with the heated fresh air.

15. The method of producing and using heat in a cook stove operating with natural draft and including a hot plate, an oven and heat accumulating mass which comprises supplying air to and burning solid fuel at such rate as to produce heavy combustion gases, absorbing heat resulting from the combustion into the stove and accumulating heat in the stove when the demand for heat is low, continuously maintaining fuel in the stove at combustion temperature due to accumulation of heat in the stove, heating fresh air by heat absorbed and accumulated in the stove to continuously produce flow of lighter air than the air of the surroundings and to produce continuous draft, conducting said lighter air into the presence of said combustion gases without passing through said oven, utilizing the draft so produced to draw air to said fuel and the resulting combustion gases into admixture with the heated fresh air, and introducing the lighter air into said combustion gases at a point in the path of travel of the combustion gases after substantially all the utilizable heat thereof has been absorbed in the stove and such that the temperature of the combustion gases has been reduced so as to avoid secondary combustion due to the admixed air.

16. A cook stove comprising means for burning fuel to provide a source of heat, means providing a channel for conducting combustion gases from said source, an air conduit for delivering air to said channel, means providing a metallic heat transmitting path between said source of heat and said air conduit, a heavy mass of metal constituting a heat accumulator arranged to be directly heated by the combustion gases in heat conducting relation with said heat transmitting path, said air conduit communicating with said channel at a point in the path of flow of combustion gases beyond the heat accumulating mass.

17. A cook stove comprising a combustion housing, food heating members, a casing, insulation between said casing and said members, a gas conduit for conducting combustion gases from said combustion housing, and an air conduit in said casing separate from said food heating members, said stove including a heavy mass of metal constituting a heat accumulator arranged to be directly heated by the combustion gases, said housing, members, conduits and metal mass being in metallic heat conducting relation with each other within said casing, and said air conduit being connected to said gas conduit to deliver heated air thereto to mix with the combustion gases at a point in the path of flow of the combustion gases beyond the heat accumulating mass.

18. A cook stove comprising a combustion housing, food heating members including an oven, a casing, insulation between said casing and said members, a gas conduit for conducting combustion gases from said combustion housing, and an air conduit in said casing providing a path of flow of air independent of the interior of said oven, said stove including a heavy mass of metal constituting a heat accumulator arranged to be directly heated by the combustion gases, said housing, members, conduits and metal mass being in

metallic heat conducting relation with each other within said casing, and said air conduit being connected to said gas conduit to deliver heated air thereto to mix with the combustion gases at a point in the path of flow of the combustion gases beyond the heat accumulating mass.

19. A cook stove comprising a combustion housing, cooking members including a hot plate and an oven, a casing, insulation between said casing and said cooking members, means providing a fuel magazine, a fireplace, an ash pit and a metal mass heat accumulator, a gas conduit for conducting combustion gases from said combustion housing, an air conduit in said casing connected with said gas conduit and providing a path of flow for air independent of the interior of said oven and out of contact with said heat accumulator, and means for supplying air to said air conduit.

20. A cook stove comprising a combustion housing, cooking members including a hot plate and an oven, a casing, insulation between said casing and said cooking members, means providing a fuel magazine, a fireplace, an ash pit and a metal mass heat accumulator, a gas conduit for conducting combustion gases from said combustion housing, an air conduit in said casing connected with said gas conduit and providing a path of flow for air independent of the interior of said oven and out of contact with said heat accumulator, means for supplying air to said air conduit, and metallic heat conduction means between said combustion housing and said air conduit independent of said oven.

21. A cook stove comprising a combustion housing, cooking members including a hot plate and an oven, a casing, insulation between said casing and said cooking members, means providing a fuel magazine, a fireplace, an ash pit and a metal mass heat accumulator, a gas conduit near the upper part of the stove for conducting combustion gases from said combustion housing, an air supply conduit communicating with the ash pit and communicating with the atmosphere above the bottom of the stove, and an air heating conduit in said casing connected with said gas conduit and providing a path of flow for air independent of the interior of said oven and out of contact with said heat accumulator, said air heating conduit communicating with the atmosphere at a lower point than the point of communication of said air supply conduit with the atmosphere.

22. A cook stove comprising a combustion housing, cooking members including a hot plate and an oven, a casing, insulation between said casing and said cooking members, means providing a fuel magazine, a fireplace, an ash pit and a metal mass heat accumulator, a gas conduit for conducting combustion gases from said combustion housing, a vertically disposed air conduit in said casing extending substantially the full height of the stove and connected with said gas conduit and providing a path of flow for air independent of the interior of said oven and out of contact with said heat accumulator, and means for supplying air to said air conduit.

23. A cook stove comprising a combustion housing, cooking members including a hot plate and an oven, a casing, insulation between said casing and said cooking members, means providing a fuel magazine, a fireplace, an ash pit and a metal mass heat accumulator, a gas conduit near the upper part of the stove for conducting combustion gases from said combustion housing, an air supply conduit communicating with the ash pit and communicating with the atmosphere above the bottom of the stove, and a vertically disposed air heating conduit in said casing extending substantially the full height of the stove and connected with said gas conduit and providing a path of flow for air independent of the interior of said oven and out of contact with said heat accumulator, said air heating conduit communicating with the atmosphere at a lower point than the point of communication of said air supply conduit with the atmosphere.

In testimony whereof I have signed my name to this specification.

GUSTAF DALÉN.

CERTIFICATE OF CORRECTION.

Patent No. 1,862,009. June 7, 1932.

GUSTAF DALEN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: In the heading to the specification, date of filing in Sweden, for "1929" read "1928"; page 3, line 7, for "underside" read "undesired"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of November, A. D. 1932.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)