J. M. GANTVOORT.

BAKER'S OVEN.

APPLICATION FILED AUG. 10, 1908.

982,665. **Patented Jan. 24, 1911.**

7 SHEETS—SHEET 1.

Fig. 1.

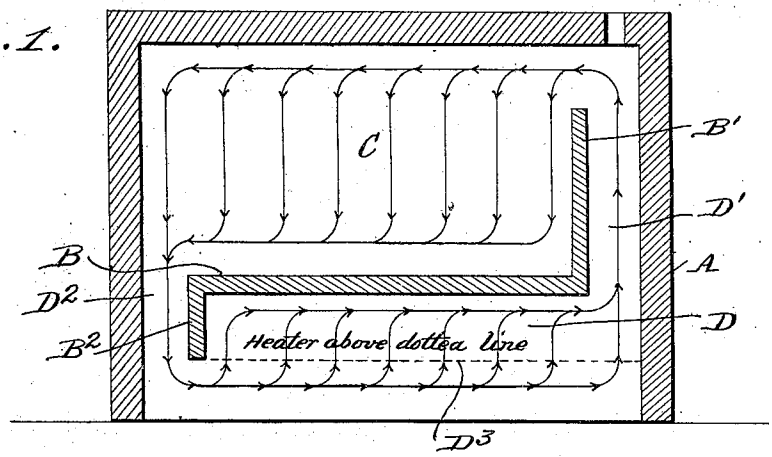


Fig. 2.

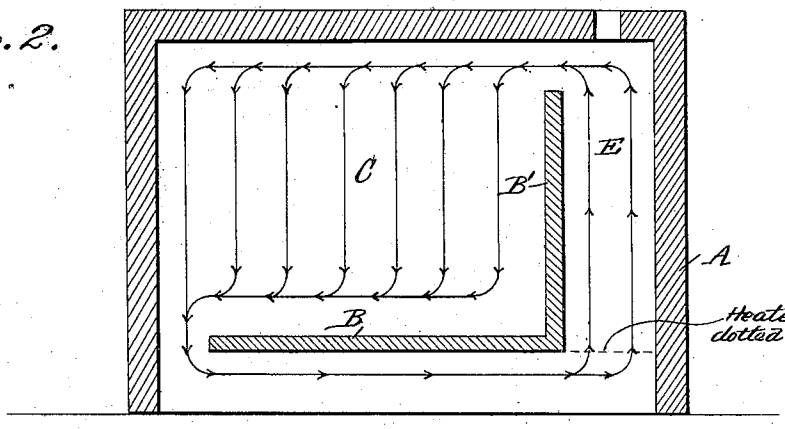
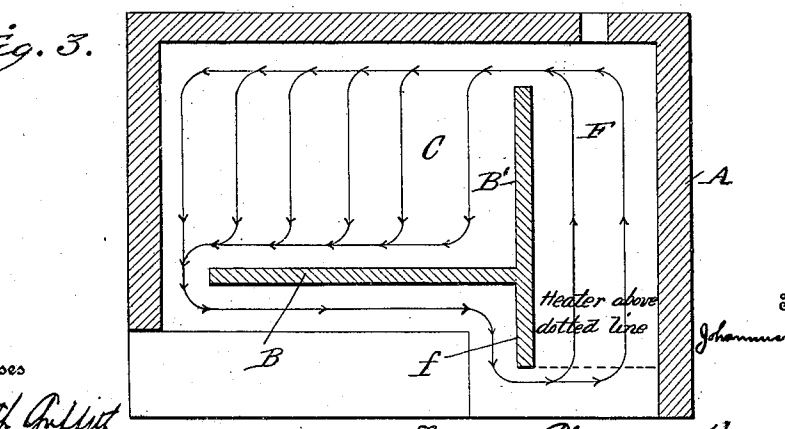


Fig. 3.



Witnesses

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7 SHEETS—SHEET 2.

Fig. 4.

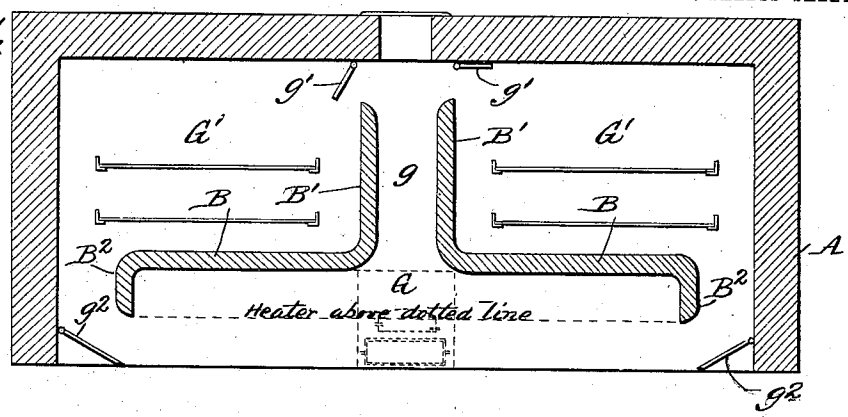


Fig. 5.

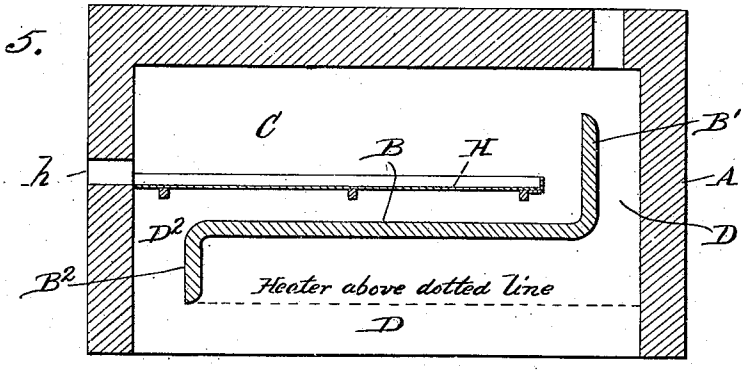
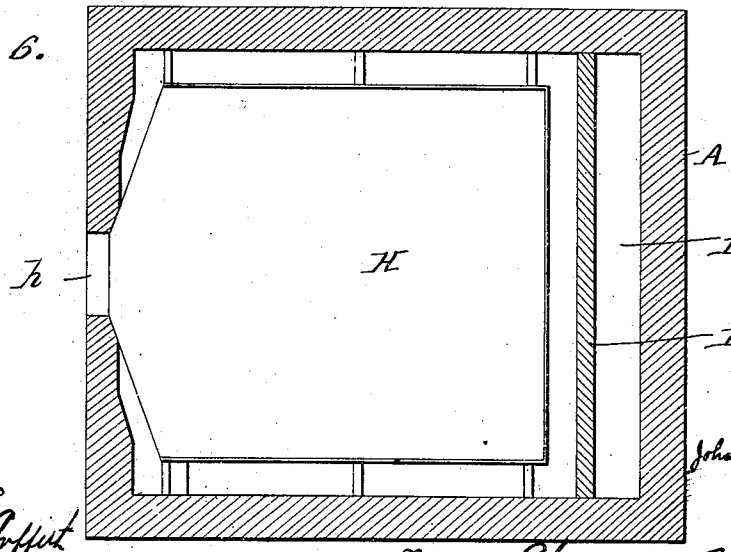


Fig. 6.



Witnesses

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7 SHEETS—SHEET 3.

Fig. 7.

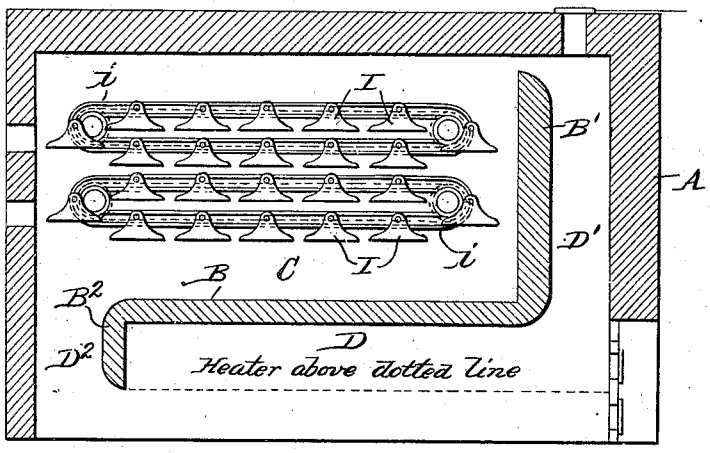


Fig. 8.

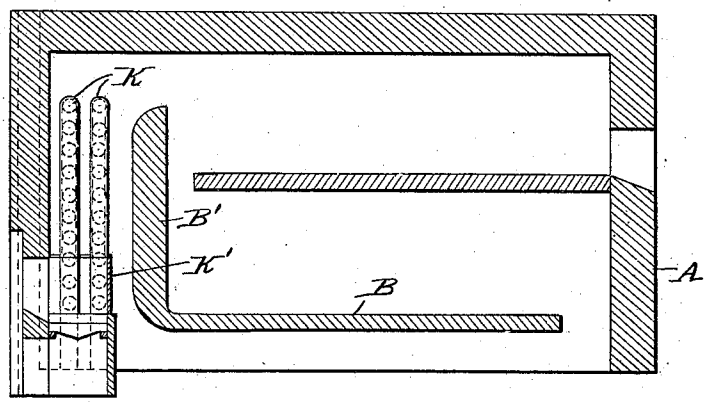
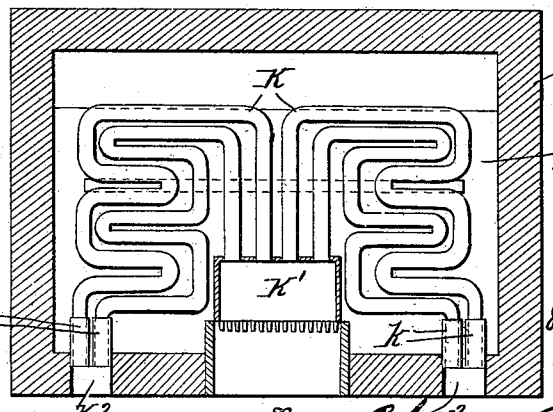


Fig. 9.



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7 SHEETS—SHEET 4.

Fig. 10.

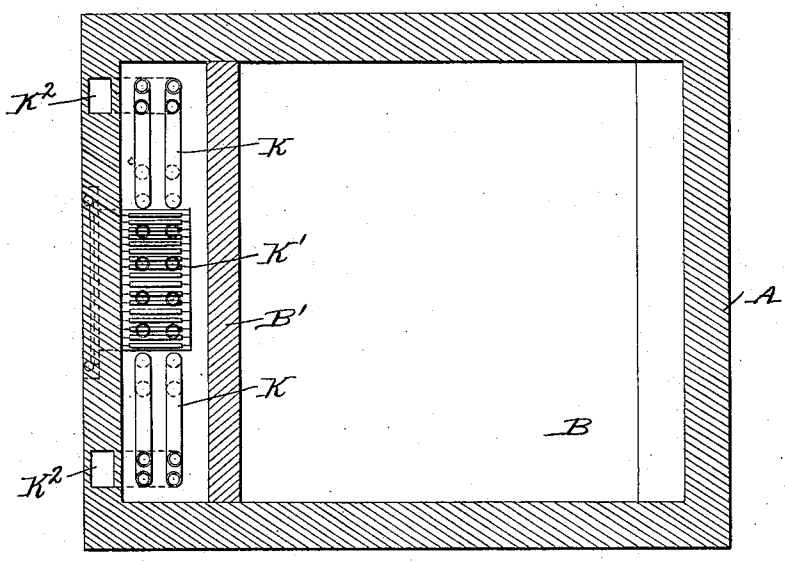
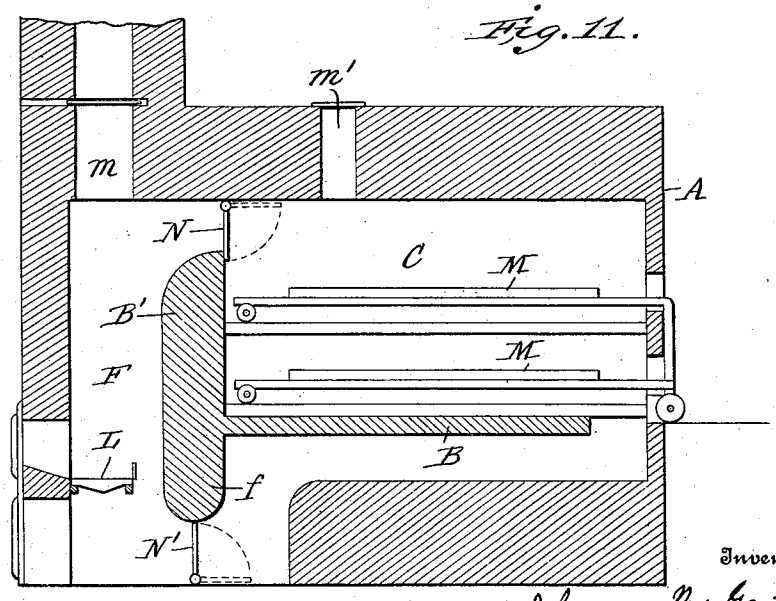


Fig. 11.



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APPLICATION FILED AUG. 10, 1908.

982,665. Patented Jan. 24, 1911.

7 SHEETS—SHEET 5.

Fig. 12.

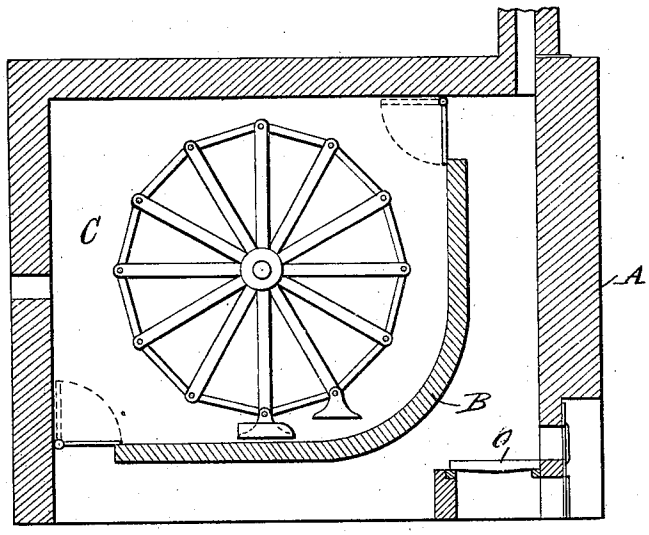
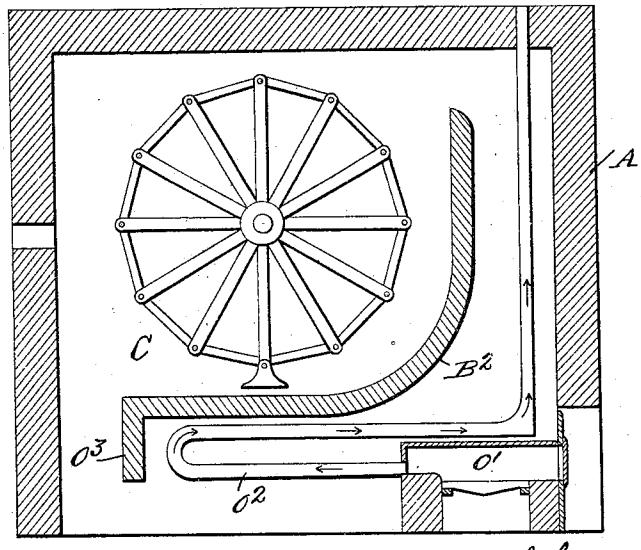


Fig. 13.



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APPLICATION FILED AUG. 10, 1908.

982,665. **Patented Jan. 24, 1911.**

7 SHEETS—SHEET 6.

Fig. 14.

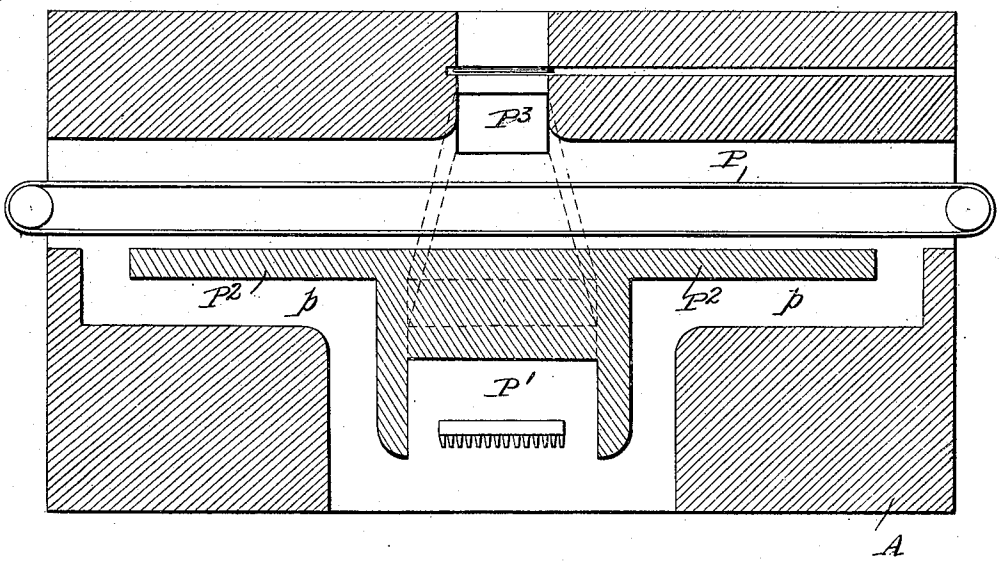
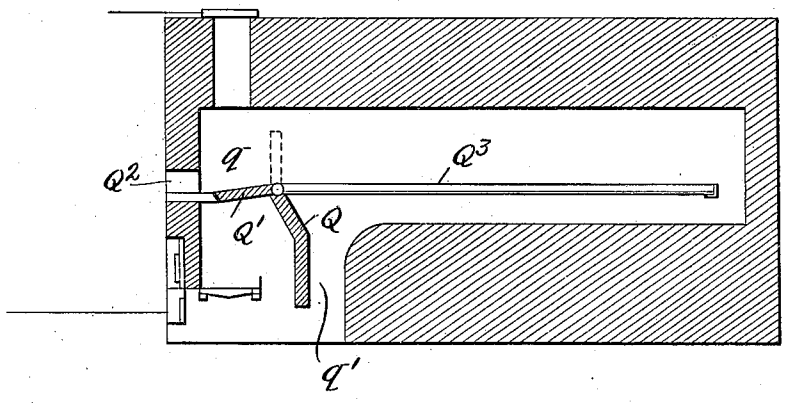


Fig. 15.



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APPLICATION FILED AUG. 10, 1908.

982,665. Patented Jan. 24, 1911.

7 SHEETS—SHEET 7.

Fig. 16.

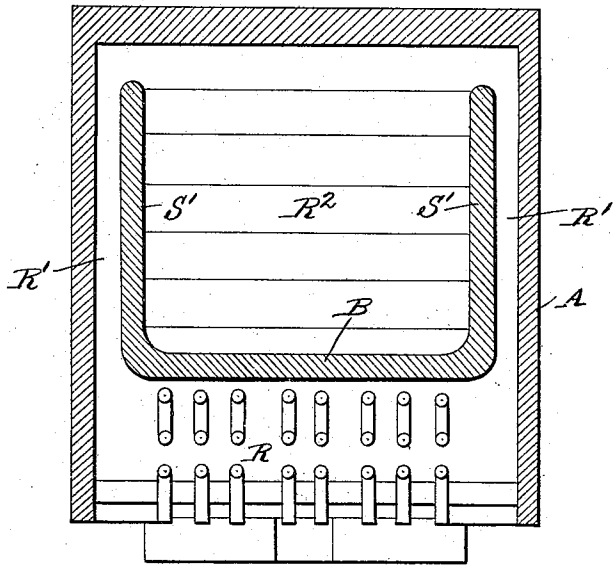
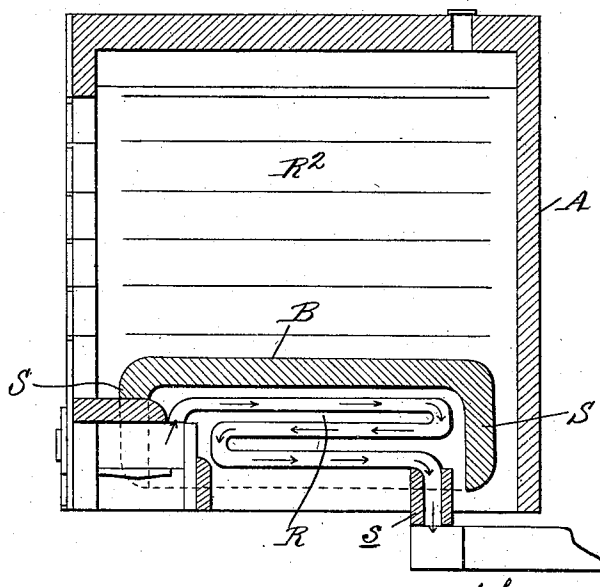


Fig. 17.



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UNITED STATES PATENT OFFICE.

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BAKER'S OVEN.

982,665. Specification of Letters Patent. Patented Jan. 24, 1911.

Application filed August 10, 1908. Serial No. 447,796.

To all whom it may concern:

Be it known that I, JOHANNUS MARTINUS GANTVOORT, a subject of the Queen of the Netherlands, residing at Fishkill-on-the-Hudson, in the county of Dutchess, State of New York, have invented a certain new and useful Improvement in Bakers' Ovens; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

This invention relates to ovens, particularly such as are designed for the baking of bread in large quantities and which consequently necessitate the employment of relatively large baking chambers, although the features of the invention, as will be clear to those skilled in the art, are applicable to baking ovens of many different kinds.

The objects of the invention are to provide a baking oven in which the baking chamber will be uniformly heated throughout, or so heated as to give uniform results, and with which the heat may be maintained in the baking chamber with the expenditure of a minimum quantity of fuel for heating purposes.

Generally stated, the invention consists of an oven having the baking chamber separated from the heating chamber, but connected therewith by flues and passages arranged to maintain a forced circulation of heated air or gases from the heating chamber successively into the top of the baking chamber downwardly through the interior of the baking chamber then to a point below the source of heat, and thereafter to the heating chamber, the heat resulting from the direct radiation of the heater having its access to the baking chamber barred by the interposition of a non-conducting wall or barrier whereby the disturbing influence of radiant heat on the circulating air or gases is prevented.

The invention further consists in certain novel details of construction and combinations and arrangements of parts, all as will be now described and pointed out particularly in the appended claims.

Referring to the accompanying drawings: Figures 1, 2, and 3 are diagrammatic views illustrating the application of the principle of the invention in connection with slightly different forms of ovens. Fig. 4 is a similar view showing one way of applying the invention in a twin double deck oven. Fig. 5 is a vertical section through a single-hearth oven showing the application of the invention in accordance with the diagrammatic view in Fig. 1. Fig. 6 is a sectional plan view of the arrangement shown in Fig. 5. Fig. 7 is a sectional view showing a similar application of the invention in a traveling-shelf oven. Fig. 8 is a similar section showing the application of the invention as diagrammatically illustrated in Fig. 2 to an indirectly heated oven. Fig. 9 is a vertical section at right angles to the plane of Fig. 8 showing the system of indirect heating pipes. Fig. 10 is a sectional plan of the arrangement shown in Figs. 8 and 9. Fig. 11 is a vertical section through a direct heating draw-plate oven with the present improvements embodied therein. Figs. 12, 13 and 14 are similar views through reel and traveling chain ovens and showing different arrangements for direct and indirect heating. Fig. 15 is a vertical section showing the application of the invention to a direct heating Vienna oven. Figs. 16 and 17 are central vertical sections in planes at right angles to each other of an indirect heating portable-shelf oven.

Like letters of reference in the several figures indicate the same parts.

In accordance with the present invention, the baking chamber of the oven is protected from the radiant heat of the heater by a barrier, wall or partition of non-conducting material, and the said chamber is heated by air or gases kept in constant circulation in one direction from the heater to and through the baking chamber and again back to the heater, a special provision being made for preventing any conflict in the movement of the air currents due to the difference in temperature at different points in the circulating system.

The principle of the invention will be readily comprehended from Figs. 1, 2 and 3 of the accompanying drawings, wherein, as in all of the other figures of the drawing, the letter A indicates the external wall of a baker's oven, which wall may, and preferably is, made of brick and of sufficient thickness and non-conducting qualities to retain the heat within the oven or, under certain circumstances, to radiate its heat back into the oven for continuing the baking operation after the normal heat supply has been cut

off or slackened. Within the oven A there is introduced a division or partition for separating the oven into baking and heating chambers, thus, as shown in Fig. 1, the horizontal partition B separates the oven into an upper baking chamber C and a lower heating chamber D, the partition B being made of non-conducting material, whereby the lower portion or bottom of the baking chamber may be maintained as the coolest portion of that chamber in spite of the fact that the adjacent or upper portion of the heating chamber is the hottest part of that chamber. In order that the heated air and gases from the heating chamber may enter the hottest or upper portion of the baking chamber and in doing so force the circulation of air and gases in the system, the partition B is provided with an upward extension B′ which forms a flue D′ leading up from the heating chamber and discharging in the upper portion of the baking chamber. In order that there may be no tendency to create a reverse flow from that set up by the upward movement of air and gases through the flue D′ and also to assist in the forcing of the circulation by causing the cooler products from the baking chamber to descend to the bottom of the heating chamber, the said partition B is provided with a downward extension B^2, forming a return flue D^2, leading from the baking chamber to the bottom of the heating chamber.

To secure the most efficient results, the heater itself should invariably be located at or above the level of the top of the discharge opening of the return flue or above the dotted line D^3 in Fig. 1. With an arrangement such as described, the heated products will follow substantially the course indicated by the arrows, the return air not only being heated uniformly and forced to travel with considerable rapidity in the system, but as it enters the highest or hottest part of the baking chamber it will descend in uniform strata and insure a uniform regular heating of the whole baking chamber without any tendency to eddy or change its direction of movement because of local heating of the walls or backward movement of the heated products in the heating chamber.

In Fig. 2 the baking chamber is made somewhat larger or of greater height by the omission of the downward extension B^2 of the partition B, but in this instance the heating chamber is located above the level of the bottom of the partition in the space E, which latter space constitutes the lower end of the uptake for carrying the heated products into the upper portion of the baking chamber.

In Fig. 3 there is illustrated a combination of the arrangements shown in Figs. 1 and 2, that is to say, the heating chamber is located at F in the uptake for the heated products, while the partition B is provided with a downward extension *f*, which forms one side of the heating chamber, and the return flue leading from the baking chamber C to the heating chamber passes under the horizontal portion of the partition B.

The invention as illustrated diagrammatically in Figs. 1, 2 and 3, is applicable to practically any and all types of bakers' ovens, for it will be readily understood that one or the other of the arrangements illustrated diagrammatically, or combinations of two or more of them, may be adapted by those skilled in the art to suit any conditions which may be found to exist in the many varieties of ovens now in use.

In Fig. 4 a twin double-deck oven is illustrated, the heating chamber G and uptake *g* being formed by oppositely disposed partitions similar in form to that illustrated in Fig. 1, thereby forming two baking chambers G′, one on each side of the central uptake *g*. For regulating the circulation in the respective baking chambers and for providing a direct stack connection where the heating device is a direct heater, dampers *g′* may be provided for closing the inlet openings of the uptake to the baking chambers, and in addition dampers g^2 may be provided in the return flues leading from the baking chambers to the heater or heating chamber.

In Figs. 5 and 6 the arrangement shown in Fig. 1 is applied to an oven having an ordinary hearth H extending from an opening *h* into the baking chamber, and from Fig. 6 it will be seen that the hearth H is preferably of less area than the horizontal cross sectional area of the baking chamber whereby an open space is provided entirely around the hearth, except for the portion immediately adjacent the opening *h* through which the peel is introduced for placing the bread in and withdrawing it from the oven.

In Fig. 7 a similar arrangement is shown in connection with a traveling shelf oven wherein the pans I are suspended on endless carriers *i* so as to be carried to and from the openings *i′* through which the material to be baked is introduced and withdrawn.

In Figs. 8, 9 and 10 the arrangement diagrammatically illustrated in Fig. 2 has been adopted in connection with an indirect heater. This indirect heater, as shown, embodies a system of pipes K passing upwardly from a fire chamber K′ in the uptake portion of the circulating system and extending from their highest point in serpentine form downwardly at each side of the fire chamber K′ to suitable stack connections K^2. In order to avoid any possibility of back pressure by heating the returning air below the level of the partition B and B′ the discharge ends of the pipe K below the level of the partition are made of non-conducting material or are provided with non-conducting coverings *k*. In this arrangement the whole uptake

practically constitutes a heating chamber in which the circulation may be forced.

In Fig. 11 the arrangement shown diagrammatically in Fig. 3 has been adopted in connection with what is known as a draw-plate oven with direct heating. In this arrangement the heater is located in the lower portion of the uptake of the circulating system at L, which thus constitutes the heating chamber. The draw plates M are arranged above the portion of the partition lettered B and exit openings m and m' having suitable dampers or means for closing the same are provided for permitting of the escape of products of combustion and of heated air and gases from the baking chamber. In this construction there is also shown an arrangement of dampers N and N′ at the top and bottom of the partition for controlling the circulation of the heated air and gases through the baking chamber, and it will be understood that a similar arrangement of dampers may be employed in connection with any of the different forms of oven illustrated herein inasmuch as it is often found desirable to restrict the circulation or to check the same entirely so as to cool off the oven.

In connection with the arrangement illustrated in Fig. 11 it may be stated that the damper opening m' is especially for cooling the baking chamber or for forming an outlet for steam and heated air and gases. During cooling the dampers N N′ should be closed whereby the heat accumulates in the heating chamber and flues and when the dampers are again opened the accumulated heat causes a more rapid circulation and heating of the baking chamber.

In Figs. 12 and 13 the invention is shown as applied to reel ovens, the partition in these instances being curved at B^2 to substantially conform to the curvature of the path of movement of the reel, and to the path of flow of the product through the baking chamber. In Fig. 12 a direct heating arrangement is shown, the heater or grate being located at O in the lower portion of the uptake of the circulating system, while in Fig. 13 an indirect heater is shown with the fire pot O′ below the base of the uptake and a duct or flue O^2 for the products therefrom leads across beneath the partition and thence up through the uptake. In this last arrangement a skirt or downward extension O^3 is provided corresponding to the partition extensions B^2 and f (Figs. 1 and 3) for directing the return products into the heating chamber at a point below the level of the heater and for preventing any tendency of the heated air and gases to reverse their movements in the circulating system.

In Fig. 14 an oven having a traveling chain P is illustrated, and the heating chamber P′ is shown below the center of the apron. The partition lettered P^2 extends longitudinally of the chain while the uptake P^3 extends transversely of the chain to a point above the center of the same from whence the products circulate toward the end of the chain and down around the ends of the partition in flues p, which terminate below the level of the heater in the manner hereinbefore described.

In the Vienna oven arrangement illustrated in Fig. 15 the partition, lettered Q in this instance, is arranged in a substantially vertical position, thereby dividing the front end of the oven into an uptake q and a return flue q' opening into the heating chamber below the level of the heater. In this arrangement also it will be noted that the upper end or portion of the partition lettered Q′ is hinged to the lower portion and is adapted to be turned into either its upright position indicated in dotted lines, or into a substantially horizontal position indicated in full lines. When in the latter position it is adapted to substantially bridge the uptake and to leave a free passageway in line with the oven door opening Q^2 for the insertion and removal of bread. The circulating system formed by the partition Q and hearth Q^3 forces the heated air and gases to pass over the partition into the baking chamber and thence down around the inner end of the hearth and back to the heating chamber below the hearth and through the passage q'..

In Figs. 16 and 17 the invention is shown in connection with an indirect portable shelf oven in which the heating chamber R is formed by downwardly extending skirts S of the partition B located at the front and rear of the heating chamber and the uptakes R′ are formed by upwardly extending projections S′ of the partition located at opposite sides of the baking chamber R^2.

The hot air circulates from the heating chamber, through the uptakes R′ to the top of the baking chamber, from there over the edge of the insulated partition to the interior of the baking chamber, R^2, downwardly through the same, and farther downwardly out of the baking chamber through the flues formed by the partition S and the oven walls, to the bottom of the heating chamber.

To secure the most highly efficient results, the walls of the baking chamber should be invariably of such a non-heat-conducting construction that the air when circulating on and around the baking chamber, or compartment cannot communicate any heat to the interior of the same, for if the walls of the baking compartment are of such a construction that the heat is conducted from the outside of the baking compartment through the walls of the same to the inside of the baking chamber, the heated and up-

going air in the uptakes would give off heat to the walls of the baking chamber or compartment, and by doing so be cooled and tend to go down before reaching the interior of the baking chamber. In the meantime walls of the baking compartment being heated will form in the baking chamber an upwardly current of air and baking goods put in the baking chamber would form a downwardly current in the same. Upwardly and downwardly circulating air would meet each other and the result would be a retarded circulation.

By having the walls of the baking compartment absolutely non-heat-conducting and the baking compartment open at top and bottom, the heated air from the heating chamber or from the hot air chamber as for instance, Figs. 16 and 17, will be fed into the baking chamber, and as long as the interior of the baking chamber is not of the same temperature as the source of heat, the air that is fed into the baking chamber will be cooled by the latter and will go downwardly through the same and through the openings at the bottom of the baking chamber, to a point below the source of heat, and thereafter to the heating chamber. It will be clear that in this way the heated and cooled air will always help each other to accelerate the circulation, and putting baking goods in the baking chamber will immediately accelerate the circulation, and the baking chamber will be easily kept at an even temperature.

It will be noticed that in all the different types of ovens in my system the circulating air or gases pass downwardly through the baking chamber and whether a hearth or shelves are inserted in the baking chambers, or pans or shelves move through the same, the downwardly circulating air comes always in direct contact with the baking goods.

An advantage of this system is that steam injected in the baking chambers will circulate with the circulating air, and by doing so will continuously flow over and on the baking goods, and the dampness that is in the circulating air will condense on the baking goods.

Obviously the heater, be it direct or indirect, may be of any well known type, either fire chamber and flues, steam, direct fire or electrical.

Having thus described my invention, I do not claim broadly the use of circulating air for baking purposes but

What I claim as new and desire to secure by Letters Patent, is:

1. A baking oven wherein the baking is directly effected by downwardly circulating convection currents embodying a baking chamber, a heating chamber, a non-heat-conducting barrier interposed between the heating and baking chambers to prevent the transmission of radiant heat from one to the other, a flue connecting the upper portion of the heating chamber with the upper portion of the baking chamber, and a flue leading from the lower portion of the baking chamber to a point in the heating chamber below the source of heat therein.

2. A baking oven wherein the baking is directly effected by downwardly circulating convection currents embodying baking and heating chambers separated from each other by a partition of non-heat-conducting construction, and each forming a part of the circulating system through which the currents pass, flues connecting the chambers at top and bottom respectively, and a heater located in the heating chamber above the lower edge of the partition, substantially as described.

3. A baking oven wherein the baking is directly effected by downwardly circulating convection currents, embodying baking and heating chambers, each forming a part of the circulating system through which the convection currents pass, a non-heat-conducting partition between said chambers having a horizontal portion underlying the baking chamber and a vertical portion extending above the heater in the heating chamber, and flues connecting the chambers above and below the partition.

4. A baking oven wherein the baking is directly effected by downwardly circulating convection currents, embodying baking and heating chambers, each forming a part of the circulating system through which the convection currents pass, a non-heat-conducting partition between said chambers having a horizontal portion underlying the baking chamber and vertical portions extending above and below the heater in the heating chamber and flues connecting the chambers above and below the partition.

5. A baking oven wherein the baking is directly effected by downwardly circulating convection currents, embodying baking and heating chambers separated from each other by a partition of non-heat-conducting construction, and each forming a part of the circulating system through which the convection currents pass, flues connecting the chambers at top and bottom above and below the partition, and dampers for controlling the passage of air and gases through said flues.

6. A baking oven wherein the baking is directly effected by downwardly circulating convection currents, embodying baking and heating chambers, each forming a part of the circulating system through which the convection currents pass, a non-heat-conducting partition between said chambers having a vertical portion separating the chambers from each other and forming a vertically arranged uptake as a continuation

of the heating chamber and a horizontal portion extending beneath the baking chamber whereby connecting flues between the chambers at top and bottom are formed above and below the partition, and a heater located in the heating chamber above the level of the bottom of the partition.

7. A baking oven wherein the baking is directly effected by the downward circulation of convection currents embodying a non-heat conducting partition dividing the oven into a heating chamber and a baking chamber, each forming part of the circulating system through which the convection currents pass, said partition extending from a point in proximity to the top of the baking chamber to a point below the level of the heating surface of the heater whereby an opening is left above the partition for conducting heated products from the heating chamber into the baking chamber and an opening is left below the partition for conducting cooled products from the bottom of the baking chamber to the bottom of the heating chamber and dampers controlling said openings.

8. A baking oven including a heating chamber and a hot air chamber, a non-heat conducting barrier interposed between said chambers, a source of heat arranged in the heating chamber, means for directing the convection currents from the source of heat into the relatively upper portion of the hot air chamber, and means for directing the said currents from the hot air chamber to the heating chamber at a plane below the source of heat, whereby the convection currents circulate exclusively downward in the hot air chamber.

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