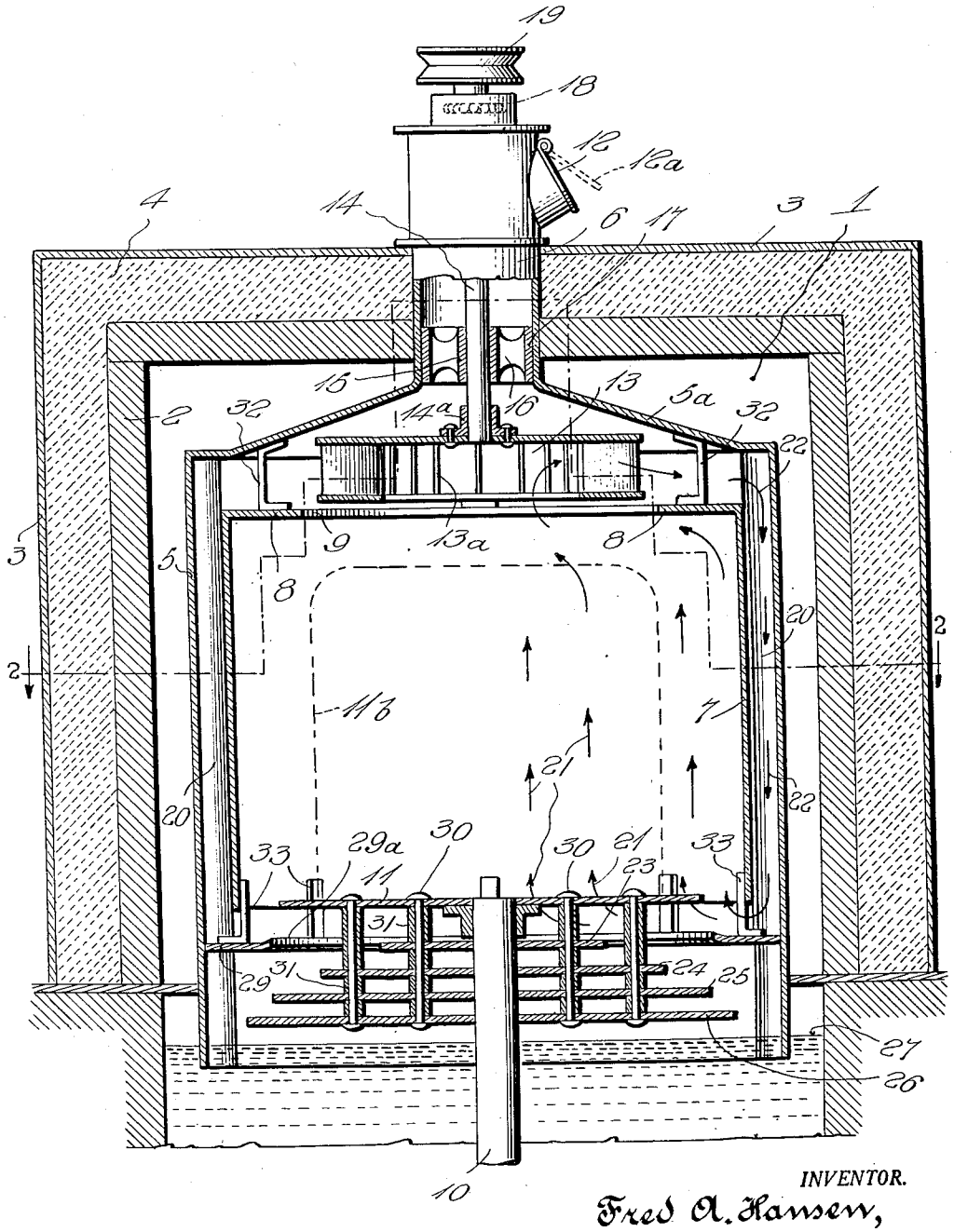
Oct. 6, 1931. F. A. HANSEN 1,825,790

RETORT FURNACE

Filed Aug. 10, 1929 3 Sheets-Sheet 1

FIG. 1



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RETORT FURNACE

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FIG. 2

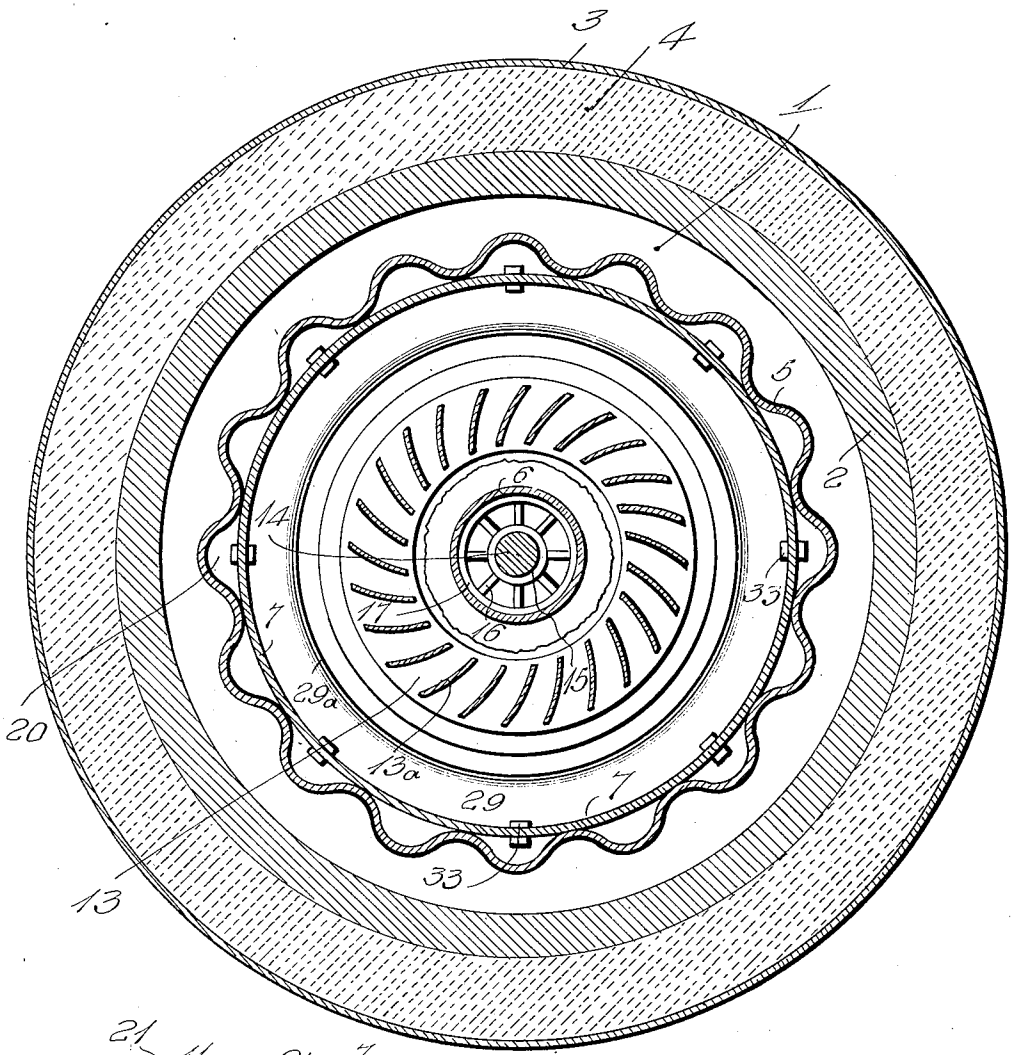
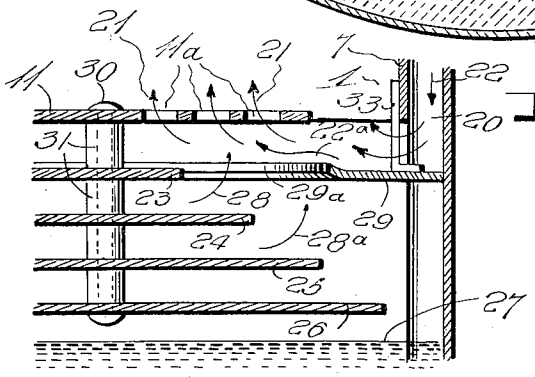


FIG. 3



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RETORT FURNACE

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FIG. 4

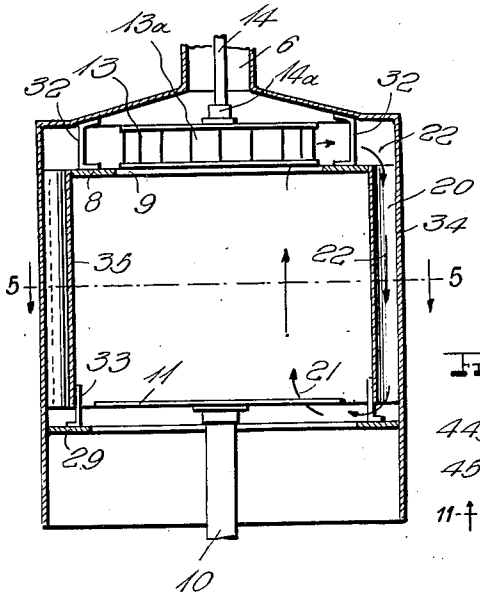


FIG. 8

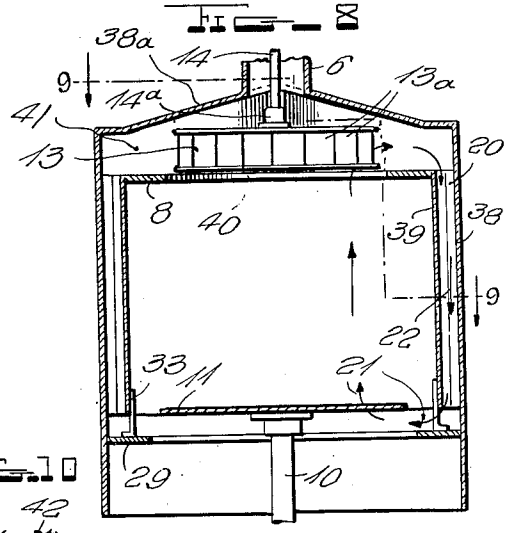


FIG. 10

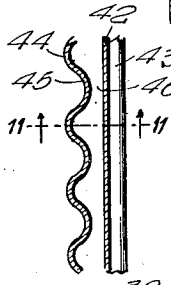


FIG. 9

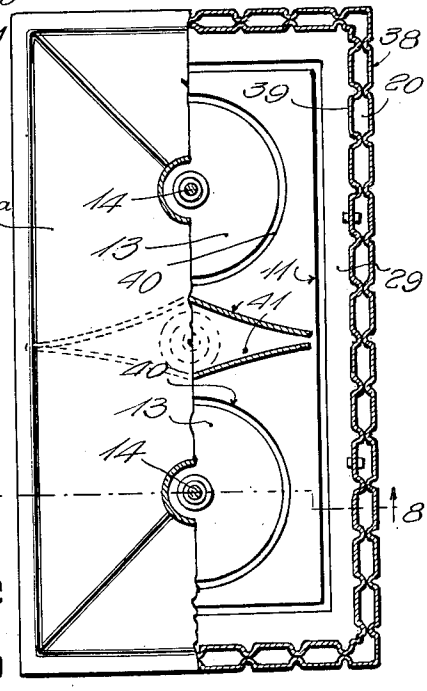


FIG. 5

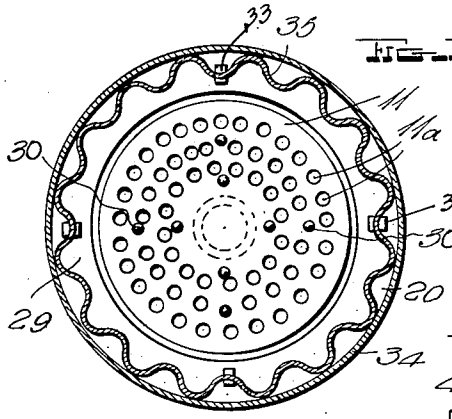


FIG. 11

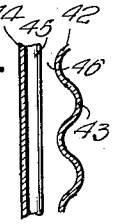


FIG. 12

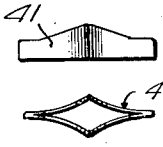


FIG. 6

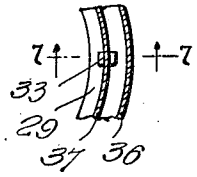


FIG. 7

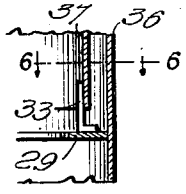


FIG. 13

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UNITED STATES PATENT OFFICE

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RETORT FURNACE

Application filed August 10, 1929. Serial No. 384,952.

My invention relates broadly to retort furnaces and more particularly to a retort furnace of the liquid-seal type.

One of the objects of my invention is to provide a retort furnace having means for circulating air or gases within the furnace for securing uniform temperature throughout the charge, the circulating air or gases being confined within the retort.

Another object of my invention is to provide a construction of retort furnace of the liquid-seal type in which the speed of production may be increased at the same time that a more uniform temperature may be maintained throughout the charge in the furnace.

Still another object of my invention is to provide a construction of retort furnace of the water-seal type having means for removably carrying the charge within the retort furnace, with means for circulating air or gases within the furnace for heating the bottom portion of the charge as rapidly as that portion of the charge which is located remote from the water-seal.

A further object of my invention is to provide a construction of retort furnace in which the temperature gradient existing between the furnace chamber and the interior of the retort may be reduced for avoiding the tendency of collapse of the walls of the retort due to the external surface being at a higher temperature than the internal surface of the retort.

A still further object of my invention is to provide a construction of retort furnace of the water-seal type, wherein there is a substantial reduction of the time cycle necessary to thoroughly saturate a charge and maintain such charge at a uniform temperature over a predetermined time interval.

A further object of my invention is to provide a construction of water-seal retort furnace wherein an elevator structure is employed to raise and lower a charge preparatory for heat treatment within the retort furnace, the elevator structure having a multiplicity of horizontally disposed baffle plates thereon for controlling the path of air or gases through the interior of the retort furnace and confining the heat within the retort furnace.

Other and further objects of my invention reside in the construction of retort furnace described in the specification hereinafter following by reference to the accompanying drawings in which:

Fig. 1 is a cross-sectional view through the retort furnace of my invention with some of the parts shown in side elevation; Fig. 2 is a lateral cross-sectional view through the retort furnace on line 2—2 of Fig. 1; Fig. 3 is an enlarged cross-sectional view showing the arrangement of baffle plates and perforated platform on the elevator and cooperating deflector plate in the retort by which the directed circulation of air or gases is confined within the retort; Fig. 4 is a cross-sectional view showing a modified arrangement of retort furnace embodying the principles of my invention; Fig. 5 is a lateral cross-sectional view taken through the retort furnace of Fig. 4 on line 5—5 thereof; Fig. 6 is a fragmentary cross-sectional view on line 6—6 of Fig. 7 showing the arrangement of a modified structure of retort employing my invention; Fig. 7 is a vertical cross-sectional view taken on line 7—7 of Fig. 6 and showing the relative arrangement of walls of the retort illustrated in the cross-sectional view of Fig. 6; Fig. 8 is a longitudinal cross-sectional view taken through a further modified form of retort furnace embodying the principles of my invention; Fig. 9 is a plan view partially in cross-section showing the arrangement of parts in the modified retort furnace structure of Fig. 8; Fig. 10 is a lateral cross-sectional view showing a modified arrangement of the walls of a retort constructed according to the general plan of the retort in Figs. 8 and 9; Fig. 11 is a longitudinal cross-sectional view taken on line 11—11 of the modified arrangement of retort walls shown in Fig. 10; and Figs. 12 and 13 are views of the baffle plates 41 which are used for directing the air from the fans to the flues in the construction of retort furnace shown in Figs. 8 and 9.

Referring to the drawings in more detail the retort furnace of my invention is illustrated as including a furnace chamber 1 which

may be heated by any suitable means such as by gas or by means of electrical resistors mounted in any suitable manner familiar to those versed in the art, or as, for example by the method disclosed in copending application Serial No. 279,810, filed May 27, 1928, by Edwin L. Smalley for heating element mounting construction. The furnace is enclosed by a shell 3 which surrounds the furnace walls which may be of the customary form of inner fire-brick lining such as represented at 2 surrounded by suitable insulating materials 4. The furnace retort proper is shown at 5 in the form of a corrugated wall having a generally cylindrical contour terminating in a conical top portion at 5*a* to which is secured the throat or stack indicated by reference character 6. The inner lining of the retort is shown at 7 comprising a substantially cylindrical enclosure which fits within the corrugated wall 5. The inner lining 7 terminates in an annular inturned flange portion 8 freely suspended inside of the retort 5 by means of straps represented at 32. The retort 5 and lining 7 may be of any suitable material such as sheet or cast non-oxidizing metal. The annular top plate 8 of lining 7 is apertured at 9 in the form of a circular opening for the passage of air and gases within the retort, as will be more fully described hereinafter.

The elevator which conveys and supports the load which is subjected to heat treatment is comprised in part by a plunger or piston 10 forming part of any suitable type of cylinder hoist not shown. On the top of such piston is mounted a suitable load platform 11. The load platform 11 is preferably perforated as represented at 11*a* and carries the load which is designated in dotted lines at 11*b*. The load which is treated may be of a variety of different forms, such as a charge consisting usually of copper in coils or in the form of rods, wires or tubes. The load platform 11 has suspended therefrom a multiplicity of deflector or baffle plates 23, 24, 25, and 26 which are supported with respect to the load platform by any suitable means such as rod rivets 30 and spacers 31 which may be short lengths of tubing surrounding portions of the rod rivets 30. The bottom deflector plate 26 is located closely adjacent the level of the water seal shown at 27, and the other plates are separated in spaced relation, the widest spacing occurring between baffle plate 23 and platform 11.

Adjacent the bottom of the retort lining 7 I provide an annular plate 29 which is suspended by means of straps or supports 33 attached to the respective parts by any suitable method such as by welding. The annular plate 29 is preferably formed with an upturned inner edge shown at 29*a* which cooperates with flues 20 formed between lining 7 and retort 5, as will be hereinafter explained.

On top of stack 6 is located a fitting having a flapper valve 12 which may be opened to a position at 12*a* to thereby release any excessive steam as exists when the charge is plunged into the water seal below the furnace in the process of withdrawing the charge from the furnace. At 13 I have shown a centrifugal fan having vanes 13*a*, all suitably mounted on the bottom end of a shaft 14 by means of a hub or coupling 14*a*. Shaft 14 passes through a suitable bearing 15 having an outer collar 17 attached to stack 6 by any suitable means such as riveting or welding. The bearing 15 is connected to the outer collar 17 by webs 16, thus leaving apertures through which excessive steam may escape through valve 12 as heretofore outlined. Shaft 14 has a suitable top bearing such as a radial thrust ball bearing 18, above which is mounted on the same shaft any suitable driving means shown as a V grooved sheave 19. In place of sheave 19 a sprocket may be used receiving a driving chain from any source of power, such as an electric motor, not shown.

Revolution of centrifugal fan 13 creates an air circulation resulting in the upward suction of air indicated by arrows 21, and downward flow through flues 20 with the directional flow indicated by arrows 22. The discharge of heating air is deflected from flues 20 by the annular plate 29 and also is further deflected slightly upward and away from the baffle plates 23, 24, 25 and 26 by upturned edge 29*a*. The diameter, or size, of baffle 24 with respect to the size of baffle 23 and with respect to the size of the opening in the deflector plate 29 is such as to cause the greatest suction or siphoning of air between baffle plates 23 and 24 as indicated by arrows 22*a* and 28. The velocity of circulation from flues 20 is most effective in suction of air strata in such nearest or adjacent spaces; therefore to a less extent from the air stratum between deflector plates 24 and 25, as indicated by arrow 28*a*. Due to the remote location of the air stratum below deflector plate 25 and the air stratum below deflector plate 26, there is practically no disturbance of the latter air strata by the discharge of heated air past deflector plate 29. There is, of course, a further tendency for the cool air adjacent to the water level to remain adjacent to the cooling effect of the water.

The forced upward flow of heat, chilled by absorption of the heat into the load inside the retort helps in the equal distribution of heat extracted by the downward flow of air in the flues inside the retort. By this forced directional flow of air caused by the fan and flues, I can obtain the same quantity of heat inside the retort from a lower temperature in the furnace chamber than exists in a retort without the forced circulation. In the

present day practice, it has been the custom to release from the bottom of the furnace chamber as much as 100% more heat per square foot of heat releasing surface than in the upper zone of the furnace chamber. This has been necessary to attempt to drive the heat to the bottom of the charge. With this forced circulation and the discharge of highly heated air to the bottom of the load, I overcome these undesirable characteristics.

Furthermore, it will be readily recognized that with the forced circulation of the heat, with the discharge ports venting to the underside of the charge, it will result in a quicker distribution of heat with a simultaneous better uniformity of heat saturation, and at the same time reduce the time cycle of effecting a complete uniformity of temperature.

While the corrugated form of retort shown at 5 is a preferred form as it gives additional heat absorbing and heat releasing surface while at the same time it is affording an easy means of forming flues 20, I show in Figs. 4 and 5 a modified form of the retort wherein the lining 35 is of the corrugated type and the retort 34 is of the plain cylindrical type forming flues 20 with other parts similar to those more fully described in the foregoing.

In Figs. 6 and 7 I show still another form of a retort 36 of a plain cylindrical type having a plain cylindrical lining 37 forming a return flue 20, with other parts similar to those heretofore described.

In Figs. 8 and 9 I show a modified form in which both the retort and lining 38 and 39 are of a modified fluted or corrugated type, forming flues 20. Thus it will be seen that the construction may be adapted also to an oval type retort, or any similar shape more suitable for the purpose intended. In this rectangular form of Figs. 8 and 9 the top plate 8 has two annular openings 40, and two fans 13. In order to assist in the directional flow of air from the fan ports, I preferably use baffle plates 41 so that the air discharged from either fan will not interfere with the directional flow of air from the other fan.

I have shown in the several forms of the retort furnace the flues 20 extending vertically. It is obvious that corrugations may be formed in the retort or lining with the flutings running transversely or horizontally instead of vertically as shown. In this case I form a flue by the proper relationship as to distance between the retort and the lining. In some cases I prefer the horizontal fluting in the retort for the purpose of strengthening the side of the retort, as for instance in Figs. 8 and 9, where obviously horizontal flutings in the retort would strengthen the side of the retort. Furthermore, with the horizontal flutings thus projecting inwardly toward the flues there is obtained a preferred stirring or swirling action to the air when passing down through the flue.

The modified form of retort wall having horizontal flutings has been illustrated in Figs. 10 and 11 where the lining 44 is provided with vertically extending flutings shown at 45 while the retort 42 is provided with horizontally extending flutings 43 spaced from the flutings 45 by a gap 46, thus permitting the circulation of gases or air therebetween while obtaining increased strength in the retort walls.

In Figs. 12 and 13, I have shown views of the baffle plates 41 which I employ between the fans 13 in the structure of retort furnace shown in Figs. 8 and 9 for preventing interference in the circulating air currents.

While I have not shown the method of placing load on the platform and removing it therefrom, such work can be accomplished in several ways. For example, I have built furnaces where the complete furnace structure is mounted on wheels, traveling on rails. With such a device, the furnace is remote laterally from the elevator, and while the elevator is in the upward position the load is placed on the platform. Operation of the elevator then brings the platform and load below the bottom of the retort. The furnace is then rolled into position and the elevator raises the load to its operative position as shown in Fig. 1.

In some instances, I may prefer to construct the furnace without baffle plates below the load platform but with flues formed by the retort and the lining in one or more of the forms shown.

While I have described my invention in certain preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A retort furnace comprising a housing, a retort having an open bottom positioned within said housing, a lining for said retort, flues formed by said retort and said lining, a liquid seal at the base of said retort, and an elevator supporting a load, said elevator being movable through the open bottom of said retort and carrying a multiplicity of baffle plates thereon adapted to be aligned normal to the aforementioned flues for directing the circulation of air currents within said retort.

2. In a retort furnace, a furnace housing, a retort having an open bottom disposed in said housing, a liquid seal for the base of said retort, a lining disposed within said retort and forming a multiplicity of flues with said retort for the circulation of air currents through said retort, and a load elevator

adapted to carry the load under heat treatment, said load elevator being movable to a position into and out of said retort, and a multiplicity of horizontally disposed baffle plates carried by said elevator normal to the extremities of said flues for directing the circulation of air currents to a position within said retort.

3. In a retort furnace, a furnace housing, a retort having an open bottom positioned within said housing, a lining for said retort, flues formed by said lining and said retort, means for creating a forced circulation of air through said flues, said flues terminating short of the lower extremity of said retort, a load elevator movable to a position within or out of said retort, said load elevator having a multiplicity of horizontally disposed baffles thereon arranged to register with the lower extremities of said flues for directing the circulation of air within said retort when the load is moved to a position for heat treatment within the retort.

4. In a retort furnace, a furnace housing, a retort having an open bottom disposed in said housing, a lining for said retort, a multiplicity of flues formed by said retort and said lining, means for creating a forced circulation of air through said flues, an annular plate carried by said retort adjacent the end of said flues, a load elevator movable to a position within or out of said retort, said load elevator carrying a multiplicity of horizontally disposed baffle plates thereon, said baffle plates being spacially related one with respect to the other and being movable to a position above and below said annular plate for directing the circulation of air within said retort during the process of heat treatment of a load supported by said elevator.

5. In a retort furnace, a housing, a retort having an open bottom disposed within said housing, a liquid seal for the base of said retort, a lining within said retort, flues formed by said lining and said retort, means positioned within the head of said retort for creating a forced circulation of air between said flues and through said retort, an annular plate member extending from the inner wall of said retort normal to the lower extremities of said flues and below to the lower extremity of said lining, a load elevator movable to a position through said annular plate member for supporting a load within said retort, said elevator having a multiplicity of horizontally extending baffles thereon parallel to said annular plate member for substantially closing the base of said retort.

6. In a retort furnace, a furnace housing, a retort having an open bottom mounted within said housing, a liquid seal for the base of said retort, a lining within said retort, flues formed by said lining and said retort, means for creating a forced circulation of air through said flues and through said retort, an annular plate member carried by said retort in a plane substantially normal to the extremities of said flues, said plate member being positively spaced from the lower extremity of said lining and having an upwardly directed inner edge portion thereon, a load elevator arranged to be moved to a position within said retort through said annular plate member for supporting a load for heat treatment within said retort, and a multiplicity of baffles carried by said elevator, said baffles being movable to a position above and below the upwardly directed inner edge portion on said plate member for directing the circulation of air within said retort.

7. In a retort furnace, a furnace housing, a retort having an open bottom mounted within said housing, a liquid seal for the base of said retort, a lining within said retort, flues formed by said lining and said retort, means for creating a forced circulation of air through said flues and through said retort, an annular plate member carried by said retort in a plane substantially normal to the extremities of said flues, said plate member being positively spaced from the lower extremity of said lining and having an upwardly directed inner edge portion thereon, a load elevator arranged to be moved to a position within said retort through said annular plate member, said elevator having a platform thereon and a multiplicity of baffle plates disposed in horizontal planes below said platform, said platform being apertured for the circulation of air discharged by said flues under the guidance of the upwardly directed inner edge portion of said plate member, said baffle plates operating to direct the circulation of air within said retort and around the load under heat treatment.

8. In a retort furnace, a furnace housing, an open bottomed retort mounted within said housing, a liquid seal for the base of said retort, a lining within said retort, flues formed by said lining and said retort, means for creating a forced circulation of air through said flues and through said retort, an annular plate member carried by said retort in a plane substantially normal to the extremities of said flues, said plate member being positively spaced from the lower extremity of said lining and having an upwardly directed inner edge portion thereon, a load elevator arranged to be moved to a position within said retort through the upwardly directed inner edge portion of said plate member, said elevator comprising a platform for supporting a load under heat treatment, and a multiplicity of spaced baffle plates of successively increasing diameters suspended below said platform, said platform being apertured for the passage of air currents discharged from said flues when said elevator is moved to a position within said retort.

9. In a retort furnace, a furnace housing, an open bottomed retort disposed within said housing, a liquid seal for the base of said retort, a lining within said retort, said retort and lining being spaced by corrugations forming flues therebetween, means disposed in said retort for creating a forced circulation of air through said flues, a deflector plate located adjacent the lower extremity of said flues, and a load elevator movable to a position adjacent to said deflector plate for supporting a load for heat treatment within said lining subject to a forced circulation of air through said flues.

10. In a retort furnace, a furnace housing, an open bottomed retort disposed within said housing, a liquid seal for the base of said retort, said retort having a double wall, corrugations formed in one of said walls and forming flues extending between said walls, means disposed adjacent said walls for creating a forced circulation of air, a deflector plate disposed substantially normal to one of said walls and spaced from the lower extremity of the other of said walls, a load platform movable to a position through said deflector plate to said retort for supporting a load for heat treatment within said retort in a position where the load is subjected to the circulatory passage of air currents through said flues and through said retort.

11. In a retort furnace, a furnace housing, an open bottomed retort disposed within said housing, a liquid seal for the base of said retort, a lining within said retort and spaced apart therefrom for forming a flue therebetween, means disposed in said retort for creating a forced circulation of air through said flues, a deflector plate located adjacent the lower extremity of said flues, and a load elevator movable to a position adjacent to said deflector plate for supporting a load for heat treatment within said lining subject to a forced circulation of air through said flues.

12. In a retort furnace, a furnace housing, an open bottomed retort disposed within said housing, a liquid seal for the base of said retort, a lining within said retort and spaced apart therefrom for forming a flue therebetween, means disposed in said retort for creating a forced circulation of air, a deflector plate disposed substantially normal to one of said walls and spaced from the lower extremity of the other of said walls, a load platform movable to a position through said deflector plate to said retort for supporting a load for heat treatment within said retort in a position where the load is subjected to the circulatory passage of air currents through said flue and through said retort.

13. In a retort furnace, a furnace housing, an open bottomed retort mounted within said housing, a liquid seal for the base of said retort, a lining within said retort, said retort and said lining being spaced by corrugations forming flues for the passage of air alternately in contact with said lining and the wall of said retort about the circumference thereof, a deflector plate located adjacent the lower extremities of said flues for directing air currents through said flues and into said retort, and a load elevator movable to a position adjacent said deflector plate for supporting a load for heat treatment within said retort.

14. In a retort furnace, a furnace housing, an open bottomed retort disposed in said housing, a lining for said retort, said lining and retort being spaced by corrugations for forming flues therebetween for the circulation of air, a deflector plate carried by the inner wall of said retort and disposed adjacent the lower extremities of said flues for directing air discharged by said flues to the interior of said retort, and a load elevator having a platform adapted to be moved adjacent to said deflector plate for supporting a load within said retort subject to the circulation of air through the flues adjacent the sides thereof.

15. In a retort furnace, a furnace housing, an open bottomed retort disposed within said housing, a liquid seal for the base of said retort, a lining within said retort, said lining and retort being spaced apart by corrugations forming flues therebetween for the longitudinal passage of air in contact with the wall of said retort, a fan member disposed adjacent the upper extremities of said flues for forcing air through said flues, a deflector plate carried by said retort and located adjacent the lower extremities of said flues, and a load elevator having a platform adapted to be moved adjacent said deflector plate for supporting a load within said retort subject to the circulation of air through said flues and over said deflector plate within said retort.

16. A retort furnace comprising a heating chamber, an open bottom retort positioned within said chamber, a lining for said retort, flues formed by said retort and said lining, means for causing a forced circulation of air in the said retort and flues, a liquid seal for said retort, and an elevator having a perforated platform supporting a load in heat operative position within said lining, said elevator being movable with respect to said retort, said elevator carrying a multiplicity of baffle plates thereon, adapted to be cooperative with the said circulation from the aforementioned flues and said perforations, for directing the circulation of air currents within said retort.

In testimony whereof I affix my signature.

FRED A. HANSEN.