J. M. W. KITCHEN.

HEATING APPARATUS.

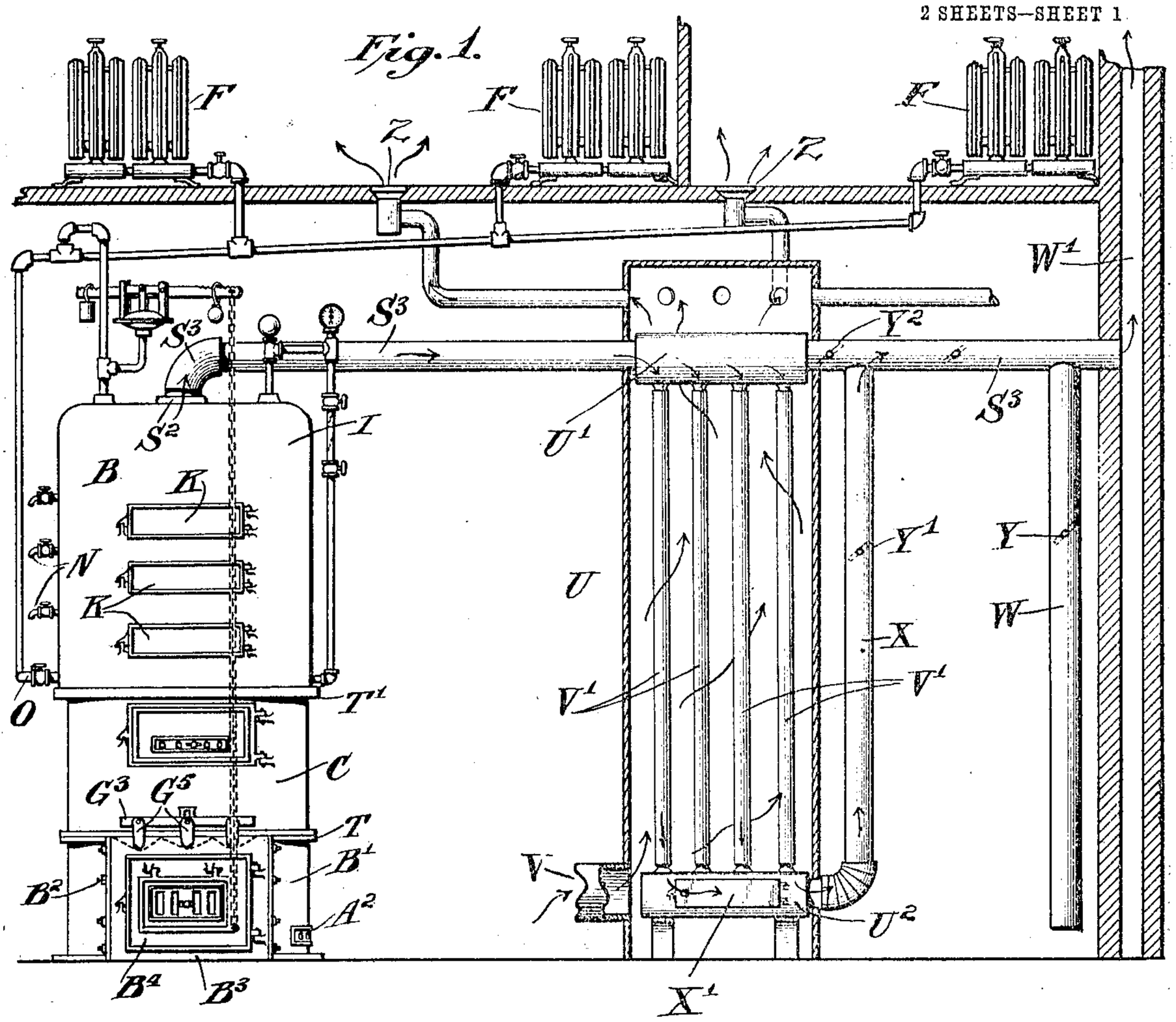
APPLICATION FILED APR. 17, 1907.

943,832.

Patented Dec. 21, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS--SHEET 2.

Fig. 2.

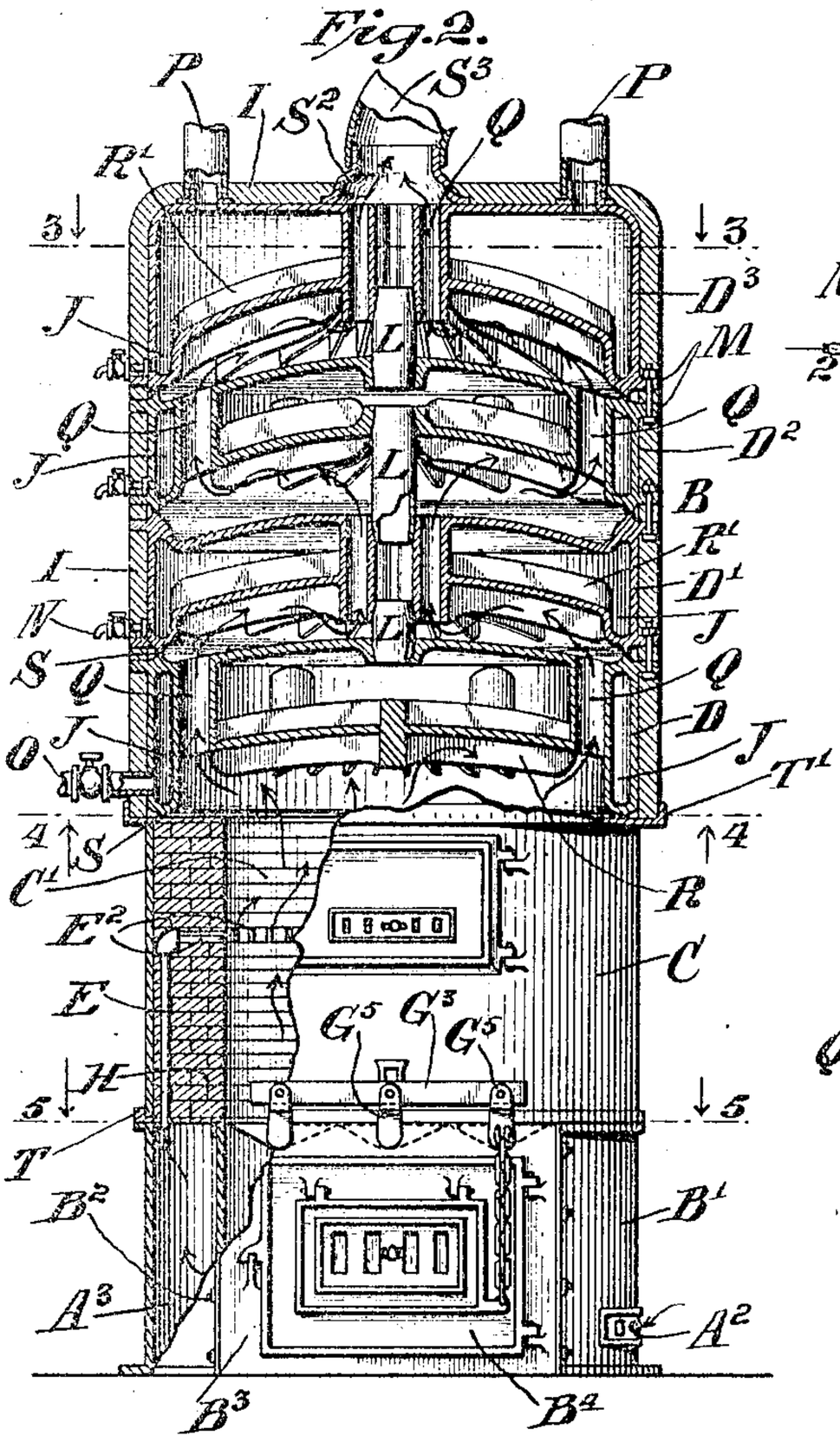


Fig. 3.

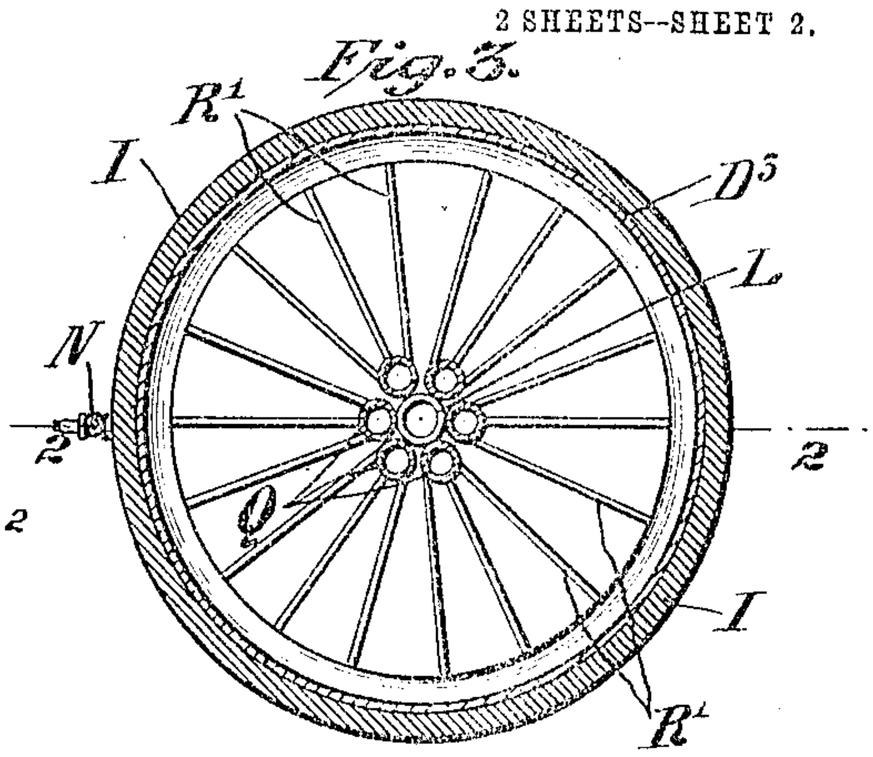
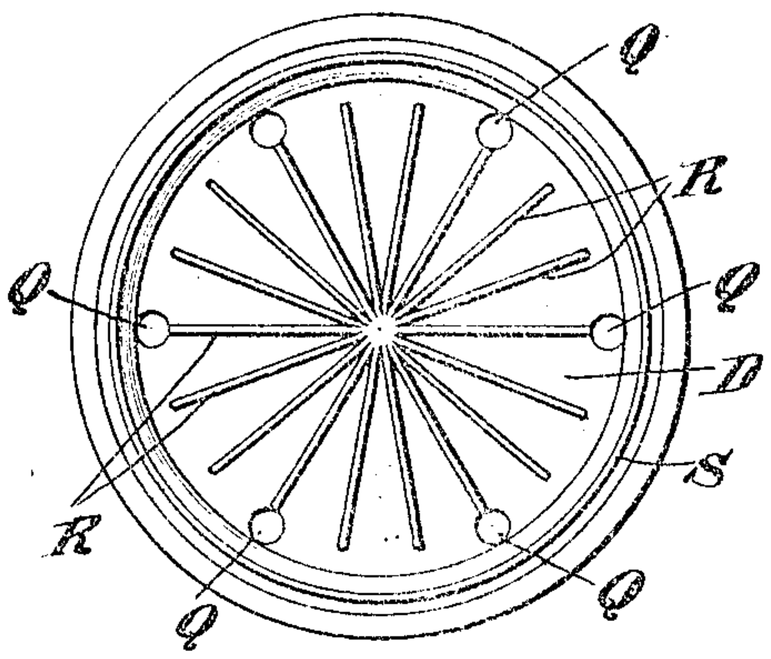


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOSEPH MOSES WARD KITCHEN, OF EAST ORANGE, NEW JERSEY.

HEATING APPARATUS.

943,832. Specification of Letters Patent. Patented Dec. 21, 1909.

Application filed April 17, 1907. Serial No. 368,636.

To all whom it may concern:

Be it known that I, JOSEPH MOSES WARD KITCHEN, a citizen of the United States, residing in the city of East Orange, county of Essex, State of New Jersey, have invented new and useful Improvements in Heating Apparatus, of which the following is a specification.

The object of my invention is to secure a reasonable amount of health, comfort and economy in heating at a moderate cost for installing the heating apparatus. It is particularly designed for those installations in which a low primary cost is a necessity, as in small two and three family houses; in which case each section of the house is heated by a separate heating appliance.

Inasmuch as heating by steam is usually the most feasible means of heating, I incorporate in this apparatus, and make the central feature of it, a steam boiler; and as the cast iron sections of a steam boiler are expensive, I adopt the circular disk-form as the most economical. Having the disks in sections, and in duplicate, provides for the enlargement of the heating area of the boiler to meet varying requirements, both as to first cost and as to efficiency in meeting radiating requirements. In connection with this type of boiler I provide a circular furnace, conforming in shape to the boiler-disks. Inasmuch as a boiler of this type does not provide for absorption of the low degrees of heat in the heating gases, I provide an inexpensive economizer-attachment through which to run the waste heating gases, the heat from which is radiated to an air supply, which conveys the economized heat to places in which it can be utilized for heating and for respiration.

In connection with the before mentioned features, I use special means for regulating the draft of the apparatus, and for securing an unusually perfect combustion, and an equalized rate of combustion.

In the drawings:—Figure 1 represents an elevational view of my heating apparatus as it would be ordinarily installed, parts being broken away and in section. Fig. 2 is a sectional view of the boiler and furnace of my heating apparatus, on the line 2—2 Fig. 3, part of which is in elevation. Fig. 3 is a cross sectional view on the line 3—3 Fig. 2 of the upper dome or disk-section of the boiler, looking from above downward. Fig. 4 is a plan view of the bottom of the lower disk-section of the boiler on the line 4—4 Fig. 2, looking from below upward.

The foundation on which the boiler B rests comprises a circular base B^1 which is composed of several cast iron sections joined by bolted flanges B^2. At the front of this base there is a part B^3, which forms the front of the base, and which contains the ash pit door B^4. The front B^3 also forms the front of the ash pit A. This ash pit has walls A^1 which sustain the ends of the grate bars G. This ash pit can be drawn forward and outside of the base B^1 to allow for repairs and replacement of grate bars. There is an annular air space A^3 between the ash pit wall A^1 and the walls of the base B. This annular space does not extend in front where the ash pit door is placed, but it is separated from the ash pit by the walls A^1. Air for over-fire combustion is introduced in this air space through the draft slide A^2, and is conveyed through the air tubes E to a level over the fuel-mass, and is there conveyed centripetally at distributed intervals from around the incasement of the fire pot C. Resting on the base B^1 is a circular tray T, which has a circular opening conforming to the size and shape of the grate bars G. These grate bars have a supporting ventilated truss G^1, and side spurs G^2, and with the grate bar shafts G^4, extend from the rear of the ash pit to and through the part of the ash pit where they are connected with the shaker-link or bar G^3. G^5 is the grate bar rocking crank. The fire pot C is also cylindrical, conforming to the shape of the boiler B, and is composed of several sections bolted together as in the base. This fire-pot comprises the fire-pot proper, and the lower part of the combustion chamber C^1. The fire pot has a thick heat refractory lining H, which rests on the tray T. The object of this thick lining is to prevent any conveyance of heat laterally from the burning fuel until after combustion has been substantially perfected, thus obviating a defect usual in apparatus of this kind, where more or less imperfect combustion is common, owing to a premature absorption of heat from the burning fuel. The air tubes E are embedded in the nonconducting lining close to the metallic incasement of the fire pot, and discharge air through the lining in crevices E^2 in the lining at distributed intervals around the interior surface of the lining.

The air tubes E are fastened in the tray T, in the apertures E^1, through which the over fire air for combustion passes from the annular space A^3. It is essential in ordinary methods of neglected and infrequent fuel-feeding in domestic heating practice to have a very considerable amount of air for combustion introduced over the fuel-mass in order to secure an equable rate of combustion and a complete burning of the volatilized gases which usually escape being burned as soon as the clogging of the fuel mass with ashes prevents sufficient air from passing through the fuel mass. Furthermore, in order to provide enough fuel to carry on combustion for ten or twelve hours, a thicker fuel mass must be provided than will allow a sufficient air supply to pass through the fuel-mass. But, in previously designed domestic heaters, air for combustion introduced over the fuel has been introduced inaccurately, in too large amounts, and too much in one location, the result being defects in the combustion process due to air dilution and reduction in the average temperature of the gases passing through the boiler. In the arrangement here shown the over-fire means of air supply distributes the air equably in moderate amounts, and the metallic tubes are protected from destructive action of the heat of the fire, a provision, the lack of which has prevented in the past a successful over fire air introduction.

It will be seen that in this apparatus I do not bring any heat absorbing surfaces of my boiler in contact with burning fuel or heating gases at a lower level. By keeping such heating surfaces at a level above the point at which combustion has become substantially perfected, I avoid the defect common in most other heating apparatuses of absorbing heat prematurely from the fuel and heating gases. Such premature absorption of heat reduces the critical ignition temperature of the gases and fuel to a degree which prevents the entire consumption of gases and solid fuel, and which produces many cinders in so-called dead-spots or corners.

In this apparatus it will be seen that I aim to first secure a substantially perfect combustion before transmitting any of the heat generated, and that the boiler part of the apparatus is constructed and disposed in relation to the furnace part of the invention in harmony with this aim.

Over the cylinder C is placed a second annular ring or tray T^1. This extends exteriorly from the peripheral side surfaces of the boiler in order to provide a support for the non-conducting covering I of the disk sections D, D^1, D^2 and D^3.

The disk-section D is the primary base-disk and is superimposed over the furnace part. A concavity in the lower part of the section D composes the upper part of the combustion chamber of the apparatus, but which combustion chamber being of unusual vertical extent, I consider should be described as a combustion perfecting chamber. Each of the disks has a dome shaped concavity in its inferior surface for the purpose of catching and holding the hot gases and to secure their quicker transmission to the water of the boiler. These gases being under the levitating influences of gravity, are held against the heat absorbing surfaces above them, thus securing a measurable increase of pressure of the gases against the heat absorbing surfaces of the inferior surfaces of the disks, and to secure a measurable increase of time to effect the absorption of the heat from the gases. Each section has an annular water leg J, the depth of which separates the disks sufficiently to allow for the travel of the gases between the disks, and which space is sufficient to allow access between the sections through the clean-out doors K (see Fig. 1) for the removal of dust and ashes. The interiors of the disks are joined at the centers by push nipple or other connections L, and are held rigidly in place by the bolted lugs M. Water cocks N, are in each section to empty the sections. Feed water is introduced in the lower disk through the inlet O, and steam or water finds emission from the boiler through the outlets P in the top of the uppermost disk. Gas apertures Q are provided in the sections, these passages being provided alternately at the periphery of the primary disk D (see Fig. 4), and then at the center of the next section (see Fig. 3).

The gases rising vertically in the combustion chamber, stratify horizontally over the interior surface of the disk-section D; and then are conveyed centrifugally to the peripherally located gas passages. The gases are distributed and lose most of their heat traveling over long horizontal distances in thin equably distributed layers or currents. As many pairs of disks are introduced in the boiler as may be necessary to secure the adequate absorption of the heat generated. The equable distribution of the gases is helped by the radially disposed ridges R, which are cast integral with the inferior surfaces of the disk-sections. Appositely to the ridges R are the ridges R^1, which extend upwardly into the water traveling through the disks. This provision helps to distribute the gases equably to the several gas passages as well as increases the heat absorbing powers of the heating surfaces; more heat being transmitted in this method of construction than in ordinary forms. In the center of the undersides of the disks that have the gas passages at the center of the disks, these ridges are constructed around the apertures of the

gas passages so as to prevent the hot gases passing through the gas apertures at a level above the lower edges of the ridges. In other words, I provide for collecting and holding the gases in the concavities of all the disk-sections through the upward pressure of gravity. There are no ridges on either the under or upper surfaces of the tops of the disks, inasmuch as the gases are held upwardly against the under sides of the disks by gravity, and because the upper surfaces of the disks need to be smooth to provide for the removal of dust or soot through the clean-out doors. The disks are provided with a bead S to prevent the injurious effect of accumulation of iron rust between the sections at their points of contact.

S^2 is a smoke-nozzle through which the gases find admission into the smoke pipe S^3.

U is an economizer for absorbing the heat of the waste gases. It consists of an upper cast iron box U^1 and a lower cast iron box U^2 connected with thin sheet metal heating tubes V^1.

X is a smoke and waste gas by-pass conduit.

Y is a damper for controlling the chimney check-draft W.

W^1 is the chimney flue.

Y^1 is the by-pass damper.

Y^2 is the damper for diverting the waste gases downward through the economizer from the smoke pipe.

X^1 is a clean-out door.

Z are apertures for the emission of warmed air.

V is a fresh air conduit inlet.

Inasmuch as in a boiler of the type here shown, which has only horizontal and up draft travel of the gases, and in which the water in the boiler is substantially of the same temperature throughout all its parts owing to heat being first absorbed at a low level of the boiler, the heating gases pass through the boiler without losing heat of a temperature lower than the temperature of the water in the boiler. Hence I provide the economizer U to absorb the low degrees of heat which would otherwise pass into the chimney flue W^1 and be lost. The air entering the conduit inlet V passes upwardly through and around the heating surfaces of the economizer, and is heated progressively in its upward travel by the downward travel of the heating gases through the tubes of the economizer. The warmed air is conveyed into and distributed in the building heated, for the purpose of respiration and as an adjunct means of heating to the heat directly radiated from the radiators F.

I apply very much the same principles of economizing in this case as I do in the invention disclosed in application Serial Number 351,540, with the exception that I here use the waste heat of the gases of combustion for heating air, and thus economizing heat, instead of economizing the heat of water of condensation. In this case I save heat that has escaped from the boiler; while in the case cited I economize the low degrees of heat in the boiler itself.

The boiler herein shown and described, but not herein claimed, is claimed in co-pending application, Serial No. 439,581, filed June 20th, 1908.

What I claim as new is:—

1. In a heating apparatus, the combination of (1) a boiler, (2) a furnace for generating heat for said boiler, (3) a pipe distributing and heat radiating system for distributing the heat absorbed into said boiler, (4) an economizer of waste heat, said furnace, boiler and economizer being constructed and arranged to secure an up draft for gases through said furnace and boiler and a horizontal draft from said boiler to said economizer, and for the downward travel of said gases through said economizer, and for the exit of the gases through a waste gas conduit at the bottom of said economizer, (5) a chimney, (6) a smoke pipe connecting said boiler, economizer and said chimney, (7) means for securing the conveyance of the heating gases from said boiler, either directly to said chimney or for diverting said gases through said economizer, (8) means for absorbing the heat of the gases passing through said economizer by heating air passing through said economizer, and (9) means for distributing the heated air to places where said air may be used for respiratory or adjunct heating purposes, the gas passages of said apparatus being arranged in relation to each other to secure an equilibrious balance of the gases in said apparatus and to prevent the escape of said gases against the pressure of the atmosphere.

2. In a heating apparatus, the combination of (1) an up draft furnace, (2) a boiler, (3) an economizer of the lower degrees of heat generated in said furnace, (4) a chimney for said apparatus, (5) a dependent chimney check draft for reducing the chimney draft acting through said apparatus, and (6) a smoke pipe connecting said boiler, economizer and chimney, said furnace, economizer and check draft being constructed and arranged in such relation one to the other as to secure an equilibrious balance of gases of relatively equal temperatures at equal levels in the passages of said furnace, economizer and check draft, and to prevent the undesired escape of said gases from the passages of said apparatus.

3. In a heating apparatus, the combination of (1) a boiler, (2) an air heating heat economizer for economizing low degrees of heat generated in the furnace of said apparatus which pass out from the boiler of said apparatus, said economizer comprising

means for transferring heat from waste gases to fresh air traveling vertically upward in said economizer, said waste gases traveling in a downward plunging travel in said economizer, (3) means for controlling the passage of gases through said economizer, and (4) means for regulating the intensity of chimney draft acting in said apparatus.

4. In a heating apparatus, the combination of (1) a boiler, (2) a system of pipe conduits and radiating surfaces for radiating the heat generated in said boiler, (3) a chimney, (4) an economizer located in the line of the travel of the heating gases between said boiler and said chimney, said economizer being located outside of said boiler, and having for its purpose the heating of air with the heat remaining in the heating gases that have passed through and out of said boiler, and (5) means for utilizing the heated air for purposes of respiration and heating.

5. In a heating apparatus, the combination of (1) a boiler, (2) a system for distributing the heat transmitted by said boiler, (3) a chimney, (4) a smoke pipe connecting said boiler and said chimney, and (5) a combined air heater and economizer of the heat of the gases passing through said smoke pipe and said boiler to said chimney, said economizer being located between said boiler and said chimney, said economizer being constructed to pass the gases therethrough from a high level to a low level, and for passing therethrough the air to be heated from a low level to a high level in counter-current to the travel of the gases passing through said economizer.

6. In a heating apparatus, the combination of (1) a boiler, (2) a heat radiating system for radiating the heat transmitted by said boiler, (3) an economizer of the heat in the heating gases that have passed through said boiler to a chimney, (4) said chimney, said economizer comprising a chambered cast iron head-piece having on one side a smoke inlet and on the other side a smoke outlet for the direct passage of smoke and gases through said head-piece, and outlets for the downward exit of smoke and gases from said head piece, (5) means for controlling at will the direct passage of smoke and gases horizontally through said head piece at a high level or downward through said outlets, said economizer having a chambered cast-iron foot-piece at the bottom of said economizer having on the upper surface of said foot-piece smoke and gas inlets, and having a smoke and gas outlet, (6) a conduit for conveying smoke and gases from said foot-piece to said chimney, said economizer having movable tubing for forming means of communication between said foot-piece and said head-piece, said economizer having a casement for confining air closely to the heating surfaces of said economizer and means for the introduction of fresh cool air at the bottom of said economizer and for the exit of heated air at the top of said economizer, and (7) means for conveying the air heated in said economizer to habitable spaces for purposes of respiration and heating.

7. In a heating apparatus, the combination of (1) a furnace for the combustion of fuel, said furnace comprising means for the introduction of air for combustion in proper quantities above and below the fuel mass in said furnace, (2) a boiler comprising a water containing section, and gas passages through said boiler and a high level exit for gases, all the heating surfaces of said boiler being arranged and located at a higher level than the highest level of the fuel-mass in said furnace, (3) an air heating economizer for heating air with the heat of the gases that pass through said boiler, (4) a chimney, (5) a smoke conduit for connecting said boiler and said chimney, said economizer being in the line with said smoke conduit, (6) means for diverting the gases passing through said smoke conduit through said economizer for heating the air passing through said economizer or for conveying said gases directly to said chimney, said furnace, boiler and economizer being constructed and arranged at such levels that heated air or gases under the influence of the draft of said chimney will pass first upwardly through said furnace, then over the heating surfaces of said boiler, then horizontally or in a substantially horizontal travel through said smoke conduit and through said economizer to said chimney without the escape of gases from said apparatus.

Signed at New York, N. Y., this 15th day of April, 1907.

JOSEPH MOSES WARD KITCHEN.

Witnesses:
GEO. L. WHEELOCK,
OLIVE B. KING.