

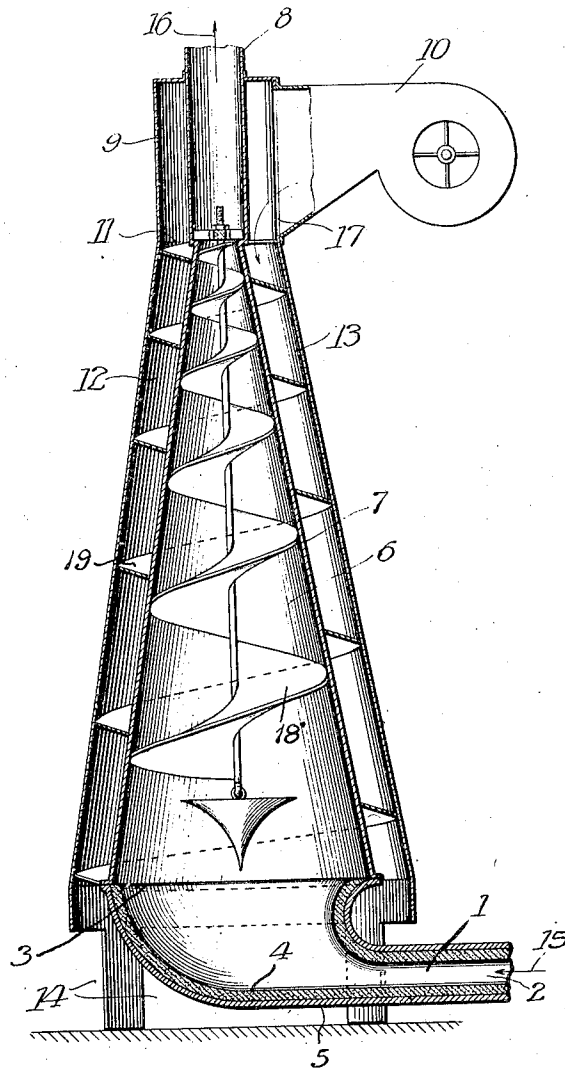
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FURNACE

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UNITED STATES PATENT OFFICE.

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FURNACE.

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This invention relates to furnaces particularly suitable for heating air and suitably arranged for combustion of gaseous or liquid fuel.

5 The objects of the invention are to provide an improved method and means suitable for transferring heat from products of combustion to a heat receiving medium, such as air, within a very limited space, considering the
10 rate at which the heat is developed and transferred.

The objects of the invention may be accomplished by the use of apparatus, as shown in the drawing, which is a longitudinal, vertical section of a combustion chamber and conduit or chamber for the products of combustion surrounded by a conduit in which the heated medium flows oppositely to the direction of flow of the products of combustion.

The construction by which the invention may be put into practice comprises an insulated combustion chamber which is designed to increase the capacity from end to end thereof in proportion to the expansion of the burning gases, and a heat transferring compartment communicating with the combustion chamber having walls of good conductivity and of conical form so that the carrying capacity of the heat transferring compartment substantially decreases according to the contraction of the products of combustion upon cooling and also for the purpose of fairly uniformly maintaining the rate of heat transference at different points along the wall of the heat transferring compartment. A similarly tapered jacket surrounds and is spaced from the heat transferring compartment and air or other heated medium is caused to travel through this space oppositely to the products of combustion providing increasing space for such air as it expands according to the rise in temperature.

45 The combustion chamber 1 is shown as enlarging in area from the inlet end 2 to the discharge end 3. This combustion chamber is suitably lined with a refractory material 4, which, as usual, assists in the process
50 of combustion by properly insulating the flame from the outer metallic wall 5 of the combustion chamber. The products of combustion, in leaving the combustion chamber

1, enter a frusto-conical heat transferring compartment 6 formed by uninsulated metallic wall 7. This compartment communicates at its opposite end with an outlet flue 8. Surrounding the outlet flue 8 is a drum 9 communicating with a blower 10 and having a discharge opening 11 communicating with a space 12 surrounding the wall 7, and formed by this wall, and an outer jacket 13 spaced therefrom. At its lower end the jacket 13 is provided with openings 14 for the discharge of air passing from the blower through the space 12.

With this arrangement, the capacity of the combustion chamber 1 increases substantially as the expansion of the burning gases, while the capacity of the heat transferring compartment 6 decreases from its inlet end to its opposite end substantially as the products of combustion contract upon delivery of heat through the wall 7. The carrying capacity of the space 12 likewise varies from end to end of the wall 13 to be substantially proportional to the expansion of the heated air or other medium pumped through the space 12 oppositely to the direction of travel of the products of combustion.

In order to very greatly lengthen the path of travel of both the products of combustion and the heated medium, within the dimensions of a device of this shape, direct travel of the gases from end to end of the furnace is prevented by means of a helical rib 18 within the combustion chamber, and extending from side to side thereof throughout its length. The space for the heated medium surrounding the combustion chamber is likewise divided by a helical deflector 19 extending from end to end thereof.

In operation of the furnace, the burning fuel travels in the direction indicated by arrow 15. Products of combustion traveling from the combustion chamber 1 in a helix of gradually decreasing radius and outwardly as indicated by arrow 16. The air to be heated is pumped through compartment 12 in the direction indicated by arrow 17 in a helical path of gradually increasing radius. Thus the air is permitted to expand in proportion to the rate at which it is receiving heat to complement the contraction of the products of combustion.

tion according to the loss of heat by the latter.

Although but one specific embodiment of this invention has been herein shown and described, it is to be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims:

10 I claim:

1. The method of transferring heat from products of combustion to another medium, which consists in causing the products of combustion to travel in a helix of gradually decreasing radius and causing the heated medium to travel in an opposite path around the products of combustion in a helix of gradually increasing radius.

20 2. A furnace of the class described, comprising a wall structure forming a combustion chamber of gradually increasing dimensions from its inlet to its outlet end, and a heat transferring compartment communicating with the outlet end of said combustion chamber and formed to gradually decrease in carrying capacity from the discharge end of said combustion chamber to the discharge end of said heat transferring chamber.

30 3. A furnace of the class described, comprising a wall structure forming a combustion chamber of gradually increasing dimensions from its inlet to its outlet end, and a heat transferring compartment communicating with the outlet end of said combustion chamber and formed to gradually decrease in carrying capacity from the discharge end of said combustion chamber to the discharge end of said heat transferring chamber, said heat transferring chamber being provided with a helical deflector extending substantially from end to end thereof and adapted to increase the normal contact of the products of combustion with the wall of said heat transferring compartment.

40 4. A furnace of the class described, comprising a wall structure forming a combustion chamber of gradually increasing dimensions from its inlet to its outlet end, a heat transferring compartment communicating with the outlet end of said combustion chamber and formed to gradually decrease in carrying capacity from the discharge end of said combustion chamber to the discharge end of said heat transferring chamber, and a jacket spaced from and surrounding said heat transferring compartment, said jacket cooperating with the wall of said heat transferring compartment to form a conduit varying in carrying capacity in accordance with the varying carrying capacity of said heat transferring compartment.

5. A furnace of the class described, comprising a wall structure forming a combustion chamber of gradually increasing dimensions from its inlet to its outlet end, a heat

transferring compartment communicating with the outlet end of said combustion chamber and formed to gradually decrease in carrying capacity from the discharge end of said combustion chamber to the discharge end of said heat transferring chamber, and a jacket spaced from and surrounding said heat transferring compartment, said jacket cooperating with the wall of said heat transferring compartment to form a conduit varying in carrying capacity, in accordance with the varying carrying capacity of said heat transferring compartment, said jacket being provided with an outlet at its large end, and inlet at its small end, and means for forcing air into the small end of said conduit.

6. A furnace of the class described, comprising a wall structure forming a combustion chamber of gradually increasing dimensions from its inlet to its outlet end, a heat transferring compartment communicating with the outlet end of said combustion chamber and formed to gradually decrease in carrying capacity from the discharge end of said combustion chamber to the discharge end of said heat transferring chamber, and a jacket spaced from and surrounding said heat transferring compartment, said jacket cooperating with the wall of said heat transferring compartment to form a conduit varying in carrying capacity, in accordance with the varying carrying capacity of said heat transferring compartment, and a helical deflector extending along the passageway between said jacket and said heat transferring compartment.

7. A furnace of the class described, comprising a wall structure forming a combustion chamber and a heat transferring compartment, said heat transferring compartment being tapered from the combustion chamber toward its opposite end, a jacket surrounding said heat transferring compartment and tapered to correspond therewith, a deflecting helix on the interior surface of said heat transferring compartment and a deflecting helix on the exterior surface of said heat transferring compartment in the space between said compartment and the surrounding jacket.

8. A furnace of the class described, comprising a wall structure forming a combustion chamber and a heat transferring compartment, said heat transferring compartment being tapered from the combustion chamber toward its opposite end, a jacket surrounding said heat transferring compartment and tapered to correspond therewith, a deflecting helix on the interior surface of said heat transferring compartment, and a deflecting helix on the exterior surface of said heat transferring compartment in the space between said compartment and the surrounding jacket, and means for

pumping air from end to end of the space formed by said heat transferring compartment and the surrounding jacket in a direction opposite to the normal direction of flow of the products of combustion within said transferring compartment. one fluid to another by causing oppositely directed currents of the two fluids, at different temperatures, through adjacent spiral or helical paths. 10

Signed at Chicago this 5th day of June 1924.

9. The method of transferring heat from

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