July 4, 1939. T. J. STEPHENS 2,164,954

COMBUSTION AND GAS MIXING ASSEMBLY FOR GAS CIRCULATING SYSTEMS

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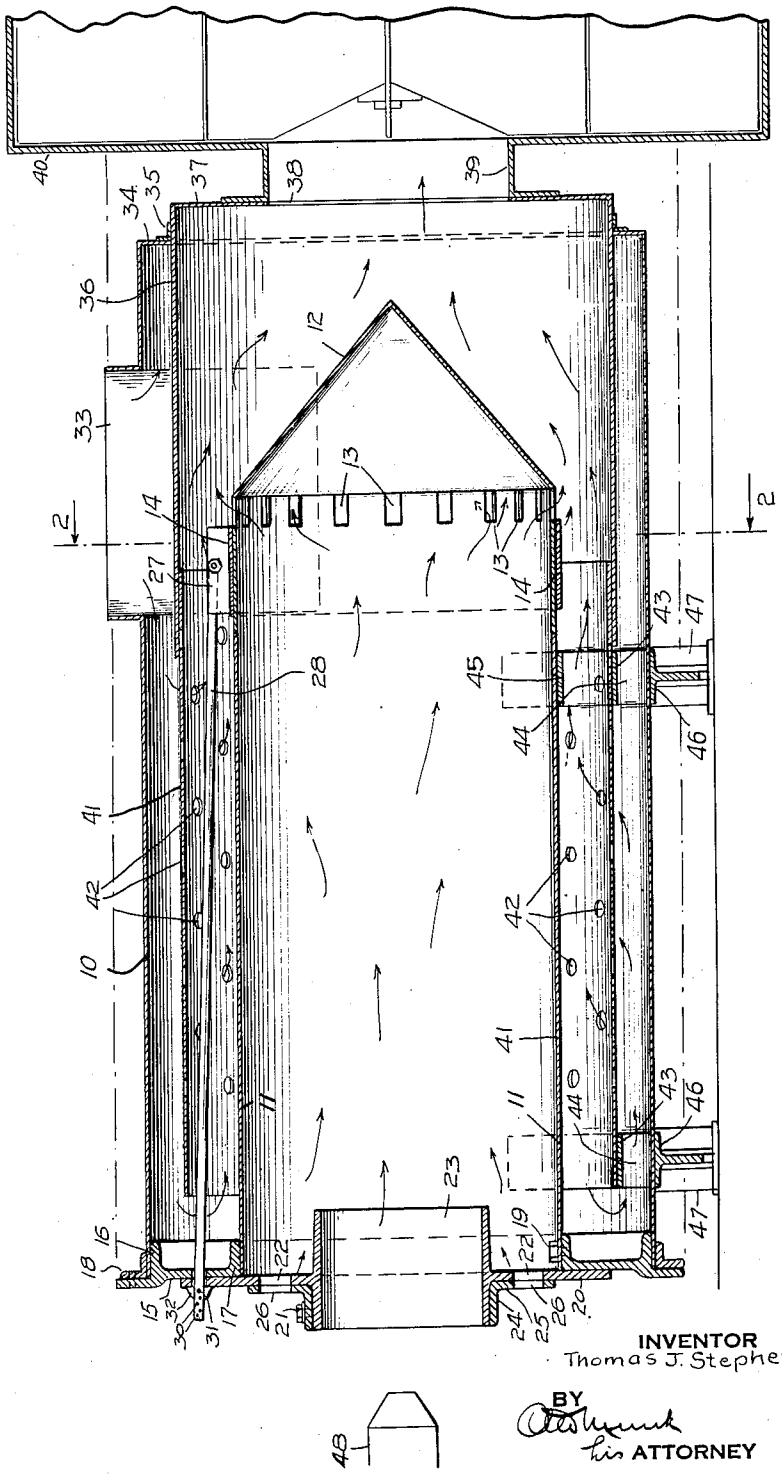


FIG. 1.

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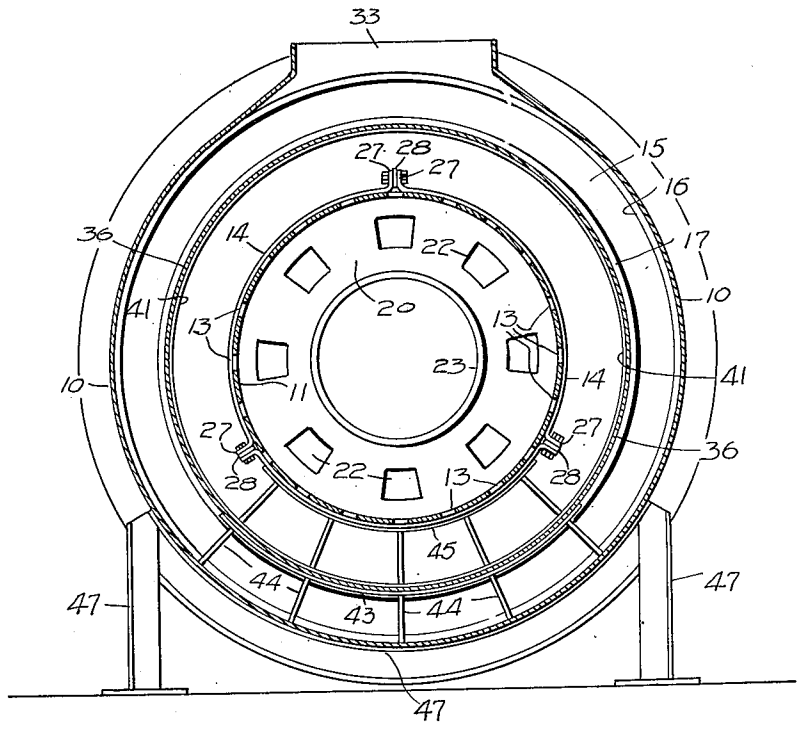
BY
his ATTORNEY

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Fig. 2.



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Patented July 4, 1939 2,164,954

UNITED STATES PATENT OFFICE

2,164,954

COMBUSTION AND GAS MIXING ASSEMBLY FOR GAS CIRCULATING SYSTEMS

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Application October 6, 1936, Serial No. 104,275

6 Claims. (Cl. 158—1)

This invention relates to new and useful improvements in combustion chambers, which are designed to use oil or gas as a fuel, and which are adapted especially for use in connection with bake ovens and the like.

It is the object of the present invention to provide a combustion chamber of the cylindrical type, which will insure the injection of thoroughly burned hot gases into an oven or other device containing foodstuffs and materials otherwise spoiled if subjected to the products of partial combustion, and which is constructed to effectively guard the firing cylinder against excessive heating without sacrificing fuel efficiency.

With the foregoing in mind, I provide a firing cylinder in which cool gases sucked from an oven or other baking arrangement are heated, preferably by an oil flame, a controlled amount of fresh air being admitted into the firing cylinder to insure complete combustion and a controlled outlet for the products of combustion out of the firing cylinder.

According to the present invention the cool gases withdrawn from the oven are not discharged direct into the firing cylinder but are led along a circuitous path in contact with the outer wall of the firing cylinder to insure cooling of the cylinder and pre-heating of the gases.

A further object of the invention is to control the temperature of the gases being discharged from the combustion chamber so as to keep the temperature low enough to prevent burning out of the fan which is used to circulate the hot gases being drawn from the chamber. I accomplish this object by utilizing a nest of cylindrical walls and arranging the perforations in the intermediate walls to set up cross currents of heated air to cause an even temperature at the intake port of the fan.

These features of my invention are described in more detail in the following specification, set forth in the appended claims and illustratively exemplified in the accompanying drawings, in which, Figure 1 is a substantially longitudinal sectional view of the combustion chamber; and Figure 2 is a substantially transverse sectional view taken on line 2—2 of Figure 1.

Referring to the drawings, the firing assembly consists of spaced outer and inner steel cylinders 10 and 11, the inner cylinder being the firing cylinder and terminating at its free inner end in a cone shaped cap 12. Just short of the cap 12 the wall of the cylinder 11 is provided with peripherally disposed uniform slots 13, the effective openings of which are adjustable by means of a sleeve valve 14 encircling the cylinder 11 and moving axially thereof over said openings. The forward ends of the inner and outer cylinders 10 and 11 are mounted in a header 15 which comprises a circular plate having laterally spaced concentric flanges 16 and 17 to receive the ends of the cylinders 10 and 11, respectively. The outer cylinder 10 is secured to the flange 16 by means of a ring 18 and the firing cylinder is secured to its flange 17 by means of bolts 19. The header 15 is open inside the inner flange 17 and a circular plate 20 closes the opening, the plate overlapping the inner peripheral portion of the header. The plate 20 is provided with a series of circularly arranged openings 22 and a centrally disposed tubular and axially projecting portion 23. The outer wall of the portion 23 outside the plate 20 supports a rotary sleeve 24 having an annular flange 25 in which a series of openings 26 is disposed, the openings 26 being arranged to register with the openings 22. Rotary adjustment of the sleeve 24 may be effected to either completely close or to partly open the openings 22 and a bolt 21 is carried by the sleeve and is moved against the portion 23 to fix the sleeve in position.

The valve 14 is made up of a plurality of arcuate sections, preferably three such sections, each thereof having radially disposed ends 27, which are bolted or otherwise attached to the ends of the other sections, and which embrace the inner ends of rods 28 running longitudinally of the device and projecting through openings in the header 15 and overlying portion of the plate 20. The projecting ends of the rods 28 are provided with spaced openings 30 to receive pins 31 which are inserted in openings in wings 32 of the plate 20. Axial adjustment of the rods 28 will cause the collar valve 14 to move over the openings 13 to open or close the latter in any degree.

The outer cylinder 10 is provided with an intake flue 33 adjacent its end opposite the header and the end is closed by an annular plate 34, flange 35 and cylindrical shell 36. The shell 36 is attached to the flange 35 and projects beyond the plate 34 to receive an annular plate 37, the opening 38 of which opens into the intake 39 of a fan casing 40. The shell 36 projects inwardly and axially of the inner and outer casings 10 and 11 and into the space between the same to a point inside the valve collar 14. The open end of the shell 36 is mounted on the inner end of a cylindrical baffle 41 which projects towards the header 15 to a point short thereof. The baffle 41 is provided with a series of peripheral perforations 42

and is supported at opposite ends on cradles 43 which consist of arcuate strips embracing the under side of the baffle and having radial arms 44 resting on the inside of the outer cylinder 10. A similar cradle 45 supports the inner end of the firing cylinder 11 inside the valve collar 14.

The entire device is supported on cradles 46 arranged under opposite ends of the outer cylinder 10, consisting of curved beams supported on legs or standards 47 at their opposite ends.

A burner 48 of any suitable type is arranged in the axis of the tubular portion 23.

The construction described above constitutes a means of transferring heat from the confines of a combustion area rapidly, systematically and uniformly for the purpose of effectively protecting such confines against being subjected to temperatures which would otherwise injure high temperature metals and alloys, while heat is being rapidly generated within said confines, the heat being given off from said confines in an atmospheric vehicle which is subsequently mixed with the products of combustion as they issue from the confined area of combustion, thereby reducing the temperature of said products of combustion to a degree which is determined by the rapidity of heat removal from said confines together with the relative quantity of heat being generated within the same.

In actual operation ignited fuel and sufficient air to support combustion enter the firing cylinder 11 through tubular portion 23. Part of the heat taken up by the cylindrical wall 11 is dissipated into the gases outside said cylinder and the remainder discharges through the slots 13 into the chamber in the closed end of the baffle cylinder 41. In the meantime gases returning to the combustion chamber enter the flue 33 and pass between the outer cylinder 10 and the baffle 41 towards the header 15. Some of these gases traverse the full length of this space and turn about at the end of the baffle to follow along the space between the baffle and inner cylinder 11, while the remainder of the gases enter the latter space through the perforations 42. It is in these gases passing through the space between baffle and inner cylinder that part of the heat in the latter is dissipated. It will be understood of course that a current of the heated gases is being set up by the fan to draw the gases into the mixing chamber at the delivery end of the baffle where they mix with the more highly heated gases discharging from the slots 13 before entering the fan casing 40.

Accordingly the heat of the inner cylinder 11 is tempered by the amount of heat being absorbed in the gases outside its wall and the degree to which the temperature of the cylinder 11 is reduced or increased depends upon the intensity of the flame and the adjustment of the sleeve valve over the slots 13. The flow of gases outside said inner cylinder 11 is more rapid than the rate of flow of the gases within the firing chamber which allows the inner gases to flow at atmospheric pressure. This arrangement results in practically two pathways for the gases, one outside the inner cylinder 11 and the other at the inside thereof.

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

1. A combustion and gas mixing assembly for gas-circulating systems, comprising a firing cylinder having an open end and a closed end and being provided with circumferential discharge openings adjacent its closed end, means to fire said firing cylinder from the open end thereof, a second cylinder enclosing said firing cylinder so as to leave a cylindrical space therebetween, and a cylindrical baffle between said cylinders.

2. A combustion and gas mixing assembly, as claimed in claim 1, in which said baffle is provided with perforations to permit the passage of gases entering the outer cylinder.

3. A combustion and gas mixing assembly for gas circulating systems, comprising a substantially circular head carrying two cylinders, one within the other, and a central sleeve forming a firing port for the inner cylinder and being provided with openings to admit fresh air to the inner cylinder, means to fire said inner cylinder through said firing port, said inner cylinder having its discharge end axially closed and being provided with circumferential openings adjacent said closed end, an intake port for said outer cylinder provided adjacent the end thereof remote from said head, and a cylindrical baffle between said cylinders, said baffle projecting beyond the closed end of said inner cylinder and terminating in an axial discharge opening.

4. A combustion and gas mixing assembly, as claimed in claim 3, including a shutter valve over said air inlet openings in the header to vary their capacity.

5. A combustion and gas mixing assembly, as claimed in claim 3, in which the baffle is provided with perforations to permit gases entering the outer cylinder to pass through the baffle.

6. A combustion and gas mixing assembly, as claimed in claim 3, including a cone-shaped end for the inner cylinder and a suction fan and in which said baffle comprises a cylindrical shell projecting to a point short of the head at one end and communicating at its opposite end with said suction fan to draw the directly heated and preheated gases from the mixing chamber formed by said inner cylinder and said baffle.

THOMAS J. STEPHENS.