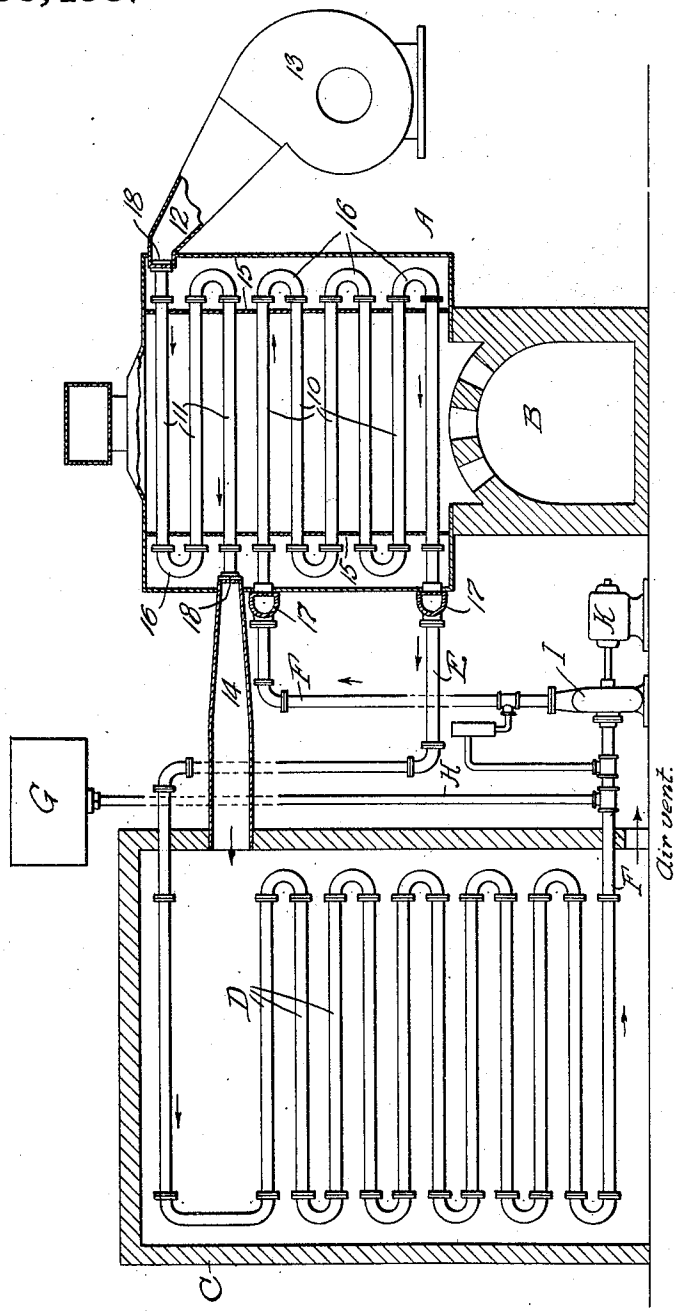
B. S. HARRISON.

HIGH TEMPERATURE HEATING SYSTEM.

APPLICATION FILED SEPT. 18, 1920.

1,408,458. Patented Mar. 7, 1922.



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HIGH-TEMPERATURE HEATING SYSTEM.

1,408,458. Specification of Letters Patent. Patented Mar. 7, 1922.

Application filed September 18, 1920. Serial No. 411,344.

To all whom it may concern:

Be it known that I, BURT S. HARRISON, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a new and useful Improvement in High-Temperature Heating Systems, of which the following is a specification.

This invention relates to high temperature heating systems for various commercial processes, such, for example, as the heating of high temperature drying ovens, varnish baking ovens, etc., which require temperatures from about 300° F. to 500° F., and more particularly to systems of the direct radiation type wherein the ovens are heated by coils or tubes conveying oil or other suitable medium at the required temperature, the heating medium being in forced circulation in a closed system.

In systems of this type, the oil or other oven heating medium is heated to the required temperature, usually between 400° F. and 600° F., in a tube heater or absorber of the counter-flow type, in which the tubes are disposed in a furnace over the fire and the heating medium first enters the upper tubes of the absorber and thence passes downwardly through the several rows of tubes and out of the lowermost tubes and to the oven at the required delivery temperature.

It is desirable in systems of this type to ventilate the ovens in order to obtain proper oxidation, uniform distribution of heat, and to expel gases, vapors, or fumes generated in the ovens incident to the drying or baking process and, in order to maintain constant temperatures in the ovens, the air or other ventilating fluid must be heated to the oven temperature. Heretofore, this has been most commonly accomplished by raising the temperature of the air used for ventilating by means of a separately fired and maintained air heater—by the installation of an indirect air heating coil utilizing hot oil or other heating medium from the absorber—or by enlarging the coil or tube surface in the oven so that the heat radiated therefrom is sufficient to maintain the required temperature in the oven and in addition to raise the temperature of the incoming air to oven temperature. The first of these methods requires an additional and separate heater or heating unit for the air; the second necessitates an absorber of greater capacity and a separate indirect air heater; and the third requires greater absorber capacity and additional coils in the ovens. In such systems, when the oil returns from the oven at say 500° F., and leaves the absorber at 600° F., it is obvious that the gases of combustion must enter the absorber at a high temperature, for example at a combustion temperature of about 2800° F. and must pass over the top row of tubes at considerably more than 500° F., or there would be no heat transmission through the tubes to the oil. This thermic head, or difference in temperature between the gases at uptake and at the top row of tubes, is usually about 300° F., that is a smoke temperature in the above case of 800° F. The thermal efficiency of the absorber under these conditions is only about 71.4 per cent. Since the gases escape from the absorber at a temperature approximately 300° higher than that of the returning oil, they can be, and by this invention are, utilized to heat the air for ventilation of the oven.

The objects of this invention are to increase the efficiency of direct radiation heating systems whereby the heat of the fuel used for heating the absorbers will be more fully utilized; also to improve the absorber structure whereby the system shall be more readily adaptable to meet conditions requiring different absorber capacities; also to cheapen the cost of construction of the systems; and also to improve high temperature heating systems in the other respects hereinafter described and set forth in the claims.

The accompanying drawing is a diagrammatic view of a high temperature heating system embodying the invention.

A represents a heater for the oil or other dense heating fluid, B the combustion chamber of the heater, C a drying oven or the like, D the radiator tubes in the oven and connected to the absorber tubes of the heater by supply and return flow mains E and F respectively. G is an expansion tank connected by a suitable riser H with the return flow main F, and I represents a pump interposed in the system for circulating the heating medium, the pump shown being driven by a motor K.

The system illustrated is adapted to circulate oil as a heating medium and to utilize

air as the ventilating and oxidizing medium, but it is to be understood that any suitable dense and light fluids may be used for the heating and ventilating mediums respectively.

According to the invention, the heater A is equipped with a suitable number of absorber tubes 10 in circuit with the oven heating tubes D through the supply and return flow mains E and F, and whereby oil or other medium is heated as it is passed through the absorber. Above the tubes 10, preferably in the same chamber therewith, are a plurality of air heating tubes 11 in communication with an air intake duct 12 in which is positioned a fan 13 for supplying air to the tubes 11. The heated air is delivered from the tubes 11 to the oven through a main or pipe 14. There may be any suitable number of absorber tubes provided for heating the oil or other oven heating medium and for heating the air, depending upon the kind and quantity of fuel burned in the combustion chamber, size of the oven, oven temperature required, character of oven heating medium used, etc.

In the system illustrated, the oil and air heating tubes are of like diameter and set in tube sheets 15, and the ends of adjacent tubes connected in their proper circuits by end-connectors 16 and headers 17 and 18. This construction is preferred as it permits of variations in the relative volumes and temperatures of the air and the oil by changing the header and end connections so as to change the number of passes of the different media through the heater. Thus, for example, when it is desired to raise the temperature of the oil and lower the temperature of the air, the lowermost air heating tubes may be disconnected from the other air heating tubes and connected in the oil heating circuit. In case it is desired to raise the temperature of the air supplied to the oven and lower the temperature of the oil, some of the upper oil heating tubes may be disconnected from their circuit and connected in circuit with the air heating tubes.

By heating the air or ventilating fluid in an absorber or tubes in the same heater in which the oil or oven heating medium is heated, effective heating of the air or ventilating fluid is obtained from the hitherto wasted heat of the products of combustion leaving the oil heating absorber, thereby substantially reducing the quantity of fuel consumed in the system. In the particular type of system shown, for example, assuming that the air enters the air heater at 70° F. and that the temperatures of the products of combustion and of the heated air and oil are as stated above, the products of combustion will pass out of the upper part of the heater at a teperature of approximately 370° F. instead of at 800° F., and the efficiency of the heater is increased to about 86.8 per cent. It is also apparent that by placing the air or light fluid heating tubes in the upper part of the heater above the oil or dense fluid heating tubes, the latter tubes absorb most of the radiant heat of the fire, and the life of the air tubes, which are normally exposed to temperatures of not more than 800° F., is considerably prolonged.

I claim as my invention:—

1. In a high temperature heating system, the combination with an oven or the like, a closed circulating system through which an oven heating medium is circulated and which is arranged to heat said oven, a heater, and an absorber in said heater and in circuit with said closed system whereby the medium in said system is heated in said heater and heats said oven, of means for passing a ventilating fluid through said heater, whereby the fluid is heated by the heat unutilized for heating said absorber and after heating the absorber, and means for passing the ventilating fluid so heated to the oven.

2. In a high temperature heating system, the combination with an oven or the like, a heater, and a closed circulating system for an oven-heating medium including a radiator in said oven and a heat absorber in said heater whereby the medium in said circulating system is heated by products of combustion in said heater and heats said oven, of means in the upper part of said heater whereby a ventilating fluid may be heated by the products of combustion after they have passed over said absorber, and means for passing the ventilating fluid so heated to the oven and for supplying the same to said fluid heating means.

3. In a high temperature heating system, the combination with a heater, and a closed circulating system through which an oven heating medium is circulated for heating said oven, of a plurality of tubes in said heater, the lower of said tubes constituting absorbers for heating the medium in said closed system and the upper of said tubes serving as heating tubes for a ventilating fluid, means for passing said fluid through said last named tubes and to the oven, and means for connecting said tubes together and to their respective circuits.

4. In a high temperature heating system, the combination with an oven or the like, a heater, and a closed circulating system through which a heating medium is circulated for heating said oven, of means for supplying a ventilating fluid to said heater to be heated and for delivering the heated fluid from said heater to said oven, a plurality of tubes in said heater and means for selectively placing said tubes in communication with said ventilating fluid supply and delivery means or said circulating system.

5. In a high temperature heating system,

the combination with an oven or the like, a heater, and a closed circulating system through which a heating medium is circulated for heating said oven, of means for supplying a ventilating fluid to said heater to be heated and for delivering the heated fluid from said heater to said oven, a plurality of tubes in said heater, and headers for selectively placing said tubes in communication with said ventilating fluid supply and delivery means or in said circulating system.

6. In a high temperature heating system, the combination with an oven, of a circulating system adapted to contain an oven heating medium and having an oven heating portion and a heat absorbing portion, a heater for suppying heat to the heat absorbing portion of said system, and ventilating fluid carrying means for supplying ventilating fluid to said oven, said fluid carrying means having a portion positioned to be acted upon by the heat unutilized in heating said oven heating medium, whereby said ventilating fluid is heated.

Witness my hand this 14th day of Sept., 1920.

BURT S. HARRISON.

Witnesses:
WM. H. GEE,
R. T. TREE.