May 14, 1940. J. C. WOODSON 2,200,731

HEATING APPARATUS

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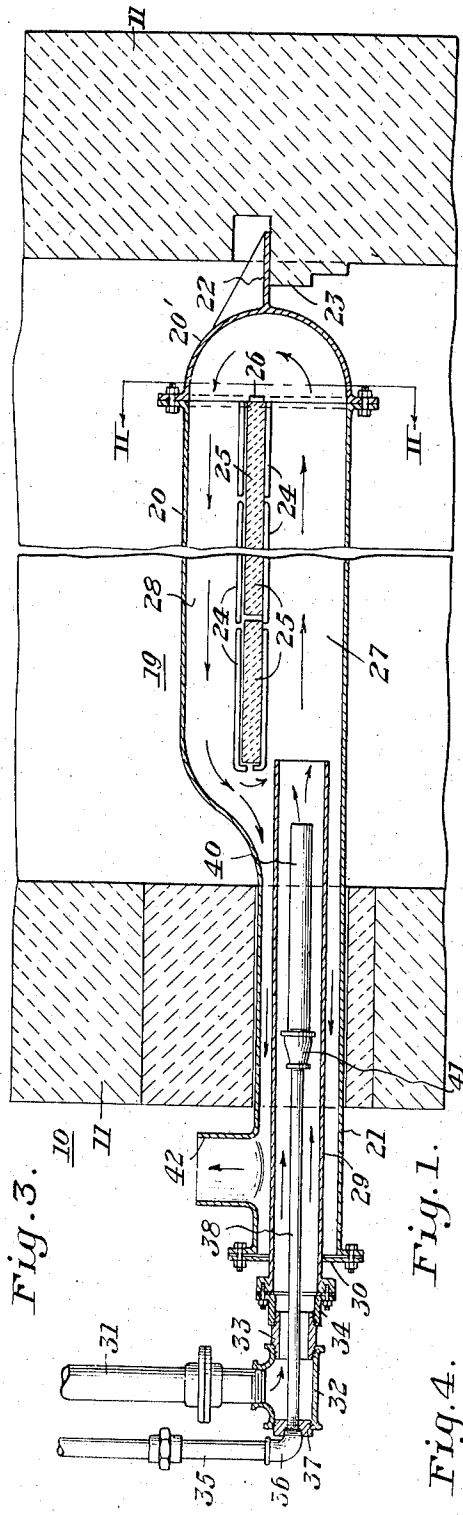

Fig. 3.

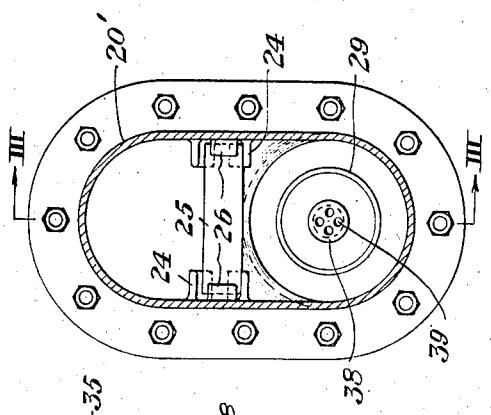

Fig. 2.

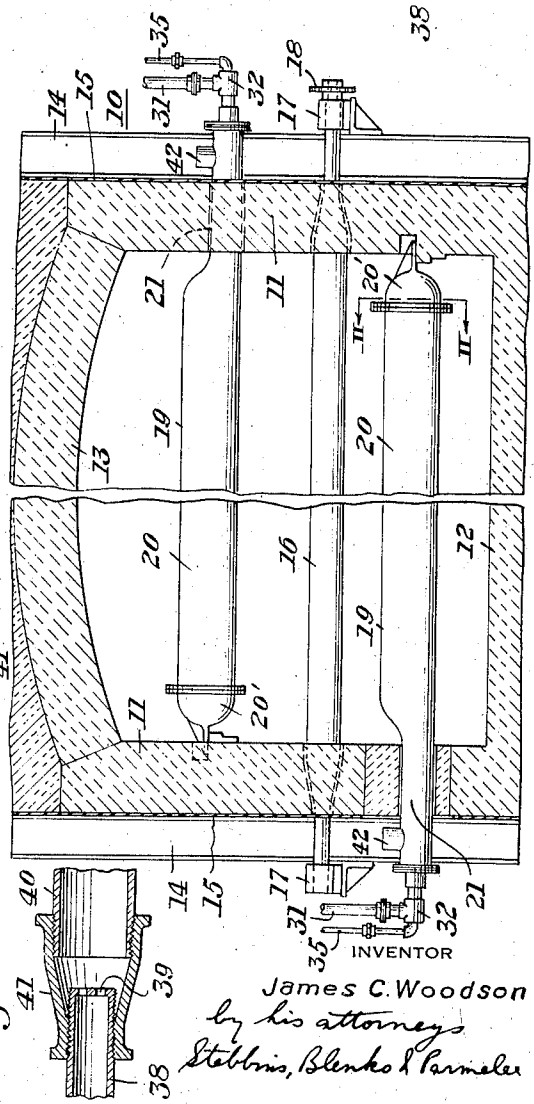

Fig. 1.

Fig. 4.

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HEATING APPARATUS

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6 Claims. (Cl. 126—91)

This invention relates generally to heating and, particularly, to a heating element of that type known as radiant tube heaters.

Various types of radiant tube heaters have been employed in numerous applications. The heating element of my invention is an improvement over those previously known in respect to thermal efficiency and simplicity of structure. It is intended particularly for heating by the combustion of fuel at relatively low pressure. As will be apparent from the following detailed description, the invention provides a heating element applicable to a wide variety of uses and the application thereof disclosed herein is, therefore, to be considered purely illustrative.

Briefly stated, the heating element of my invention comprises a tubular shell or body portion having a neck, preferably of reduced cross section, extending from one end thereof. I provide means such as a transverse baffle extending along the tubular shell to divide it into outward and return combustion passages communicating with the neck. An inlet pipe for supplying a combustible mixture to the outward combustion passage extends into the latter through the neck. The result of this construction is that after traversing the length of the shell twice, i. e., once in each direction, the combustion gases are discharged through the neck in close proximity to the entering components of the combustible mixture, whereby the latter are pre-heated.

Further details of the construction and operation will be explained hereinafter with reference to the accompanying drawing illustrating a preferred embodiment and practice.

In the drawing:

Fig. 1 is a transverse sectional view through a more or less conventional tunnel type or conveyor hearth furnace showing, in elevation, heating elements according to my invention installed therein;

Fig. 2 is a transverse sectional view through one of the heating elements taken substantially along the plane of line II—II of Fig. 1;

Fig. 3 is a sectional view through the heating element and furnace, taken substantially along the plane indicated by line III—III of Fig. 2, with parts in elevation; and

Fig. 4 is a section along the same plane as Fig. 3, showing a portion illustrated in elevation in the latter to enlarged scale.

Referring now in detail to the drawing, a furnace 10 comprises side walls 11, a floor 12, and a roof 13 assembled within a structural frame including buckstays 14 and sheathing plates 15. The furnace 10 may be of any desired type but is herein illustrated as of the continuous tunnel type, being provided with a roller conveyor or hearth composed of a plurality of conveyor rollers 16 journaled in suitable bearings 17 carried on the furnace frame, and driven by any suitable means such as a chain and sprocket drive indicated at 18.

Heating elements 19 embodying my invention may conveniently be mounted above or below the conveyor roller 16 or both and, if the latter, are preferably staggered above and below the conveyor rollers. As shown, each heating element comprises a tubular shell or body portion 20 having generally the shape of a flattened bottle with a neck 21 of reduced cross section extending from one end thereof through one of the side walls of the furnace. The opposite end of the tubular shell is closed by a cover 20'. The cover 20' has a foot 22 thereon adapted to rest on a shoulder 23 formed in one of the side walls of the furnace to receive it.

The tubular shell 20, as shown in Fig. 3, is of substantially oval section and the side walls thereof are provided with spaced inwardly extending ribs or guides 24. Refractory blocks or slabs 25 are inserted in the guides 24 by sliding them inwardly therealong while the cover 20' is removed. Inwardly extending lugs 26 on the cover hold the blocks 25 in place when the cover is positioned on the shell.

The blocks 25 form a transverse baffle extending along the body portion 20 of the shell, defining entering and return passages 27 and 28 respectively, on opposite sides thereof. By establishing a flow of combustible gases through the passages 27 and 28, the shell 20 is heated by the combustion thereof to a temperature at which it radiates heat to the interior of the furnace 10 and the work traversing the conveyor rollers 16.

I supply a combustible mixture to the outward passage 27 through an inlet pipe 29 extending through a suitable opening in a cover plate 30 secured to the end of the neck portion 21 of the heating element. Air for combustion is supplied to the pipe 29 from a pipe 31. The pipe 31 is threaded into a T 32 connected to the pipe 29 by a nipple 33 and a flanged sleeve 34, and is connected to any suitable source of air under relatively low pressure, such as a blower. Fluid fuel from any convenient source, preferably under low pressure, is supplied to the pipe 29 by a pipe 35 having an elbow 36 threaded into a plug 37 in one end of the T 32. A fuel pipe 38

is threaded into the plug 37 and extends along the axis of the pipe 29. As shown in Fig. 4, the furnace end of the pipe 38 is closed but is provided with holes 39. A fuel nozzle 40 is mounted on the end of the pipe 38 by an expander coupling 41.

As will doubtless be apparent from the foregoing description, when air is supplied to the pipe 29 from the pipe 31 and fuel from the pipe 35 to the nozzle 40 through the pipe 38, a combustible mixture will issue from the furnace end of the pipe 29. On ignition of this mixture as it issues from the pipe 29, combustion takes place in the entering passage 27 and the return passage 28, thereby heating the shell 20 and cover 20' to radiant temperature. After traversing the passages 27 and 28 the combustion products pass out through the neck 21 and outwardly therefrom through an exhaust stack 42. The course of the components of the combustible mixture and the combustion gases is indicated in Fig. 3 by arrows. The neck portion 21 of the heating element communicates with both the passages 27 and 28. This results in a small portion of the combustion products being injected into the stream of combustion gases by the jet issuing from the pipe 29. Thus, a portion of the combustion products is re-circulated with the fresh combustible mixture during combustion of the latter as it progresses through the passages 27 and 28.

The combustion gases discharged through the neck 21 are obviously brought into intimate contact with the pipe 29, thereby serving to preheat the air flowing through the latter toward the discharge end thereof for mixture with the fluid fuel issuing from the nozzle 40. The effect of this pre-heating, obviously, is to increase both the thermal efficiency of the entire heating element and the extent of combustion of the fuel supplied thereto.

It will be apparent from the foregoing description and explanation that the invention provides a heating element of the radiant tube type which is very simple in construction and highly efficient in operation, thus making it possible to construct and operate it at relatively small expense. The structure of the heating element, furthermore, is such as to adapt it for mounting in a variety of positions and locations, to suit the requirements of almost any installation.

The shell 20 and other metallic portions of the element subjected to high temperatures are preferably composed of heat-resistant alloy.

Although I have illustrated and described but a preferred embodiment and practice of the invention, it will be evident that changes in the construction and operation disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A radiant heating element comprising a tubular body portion having a transverse baffle therein terminating short of both ends of said portion and dividing it into entering and return passages for combustion gases, said element also having a neck portion substantially smaller in sectional area than the body portion and extending from one end of the latter substantially in alinement with said entering passage, a combustible-mixture supply pipe smaller in sectional area than said neck portion and extending through the latter, and a stack communicating with the space between said tube and said neck portion.

2. A radiant heating element as defined in claim 1 characterized by the end of said tubular body portion remote from the neck portion having generally the shape of a spherical segment.

3. A radiant heating element as defined in claim 1 characterized by said baffle comprising refractory slabs supported on ribs projecting inwardly from the inner surfaces of said tubular body portion.

4. A radiant heating element as defined in claim 1 characterized by said tubular body portion being substantially oval in cross section.

5. A radiant heating element as defined in claim 1 characterized by a clear space between the inner end of said tube and the walls defining said entering passage, to permit recirculation of part of the combustion gases.

6. A radiant heating element comprising a tubular body portion having a transverse baffle therein terminating short of both ends of said portion and dividing it into entering and return passages for combustion gases, said element also having a neck portion substantially smaller in sectional area than the body portion and extending from one end of the latter, a combustible-mixture supply pipe smaller in sectional area than said neck portion and extending through the latter, and a stack communicating with the space between said tube and said neck portion.

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