Dec. 31, 1940. W. M. HEPBURN 2,226,816

HEATING APPARATUS

Filed Nov. 11, 1937 2 Sheets-Sheet 1

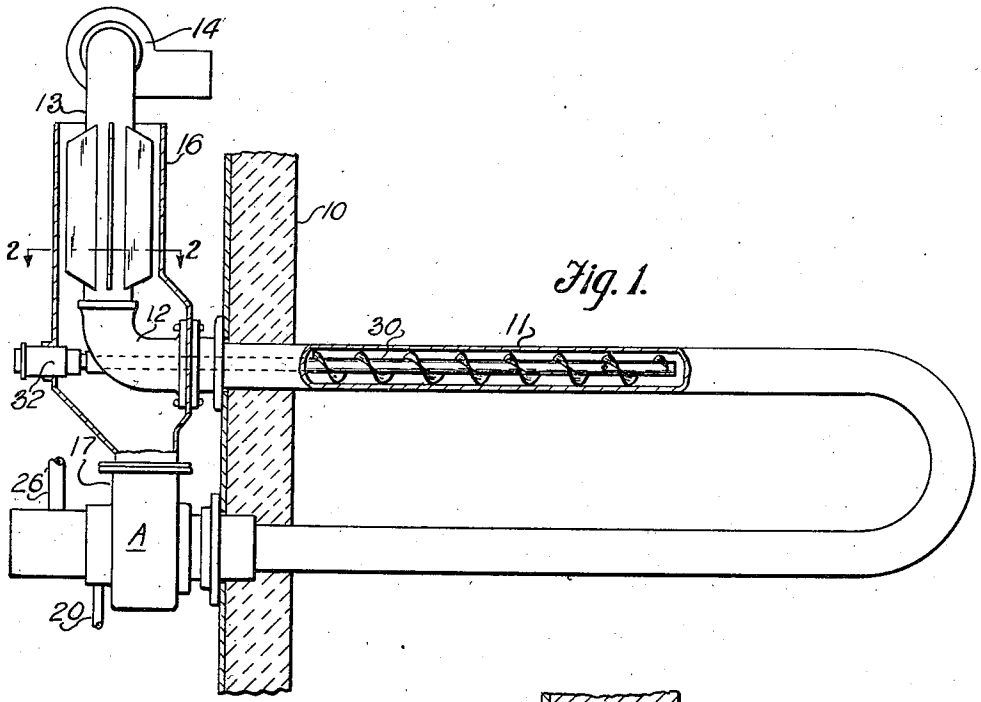


Fig. 1.

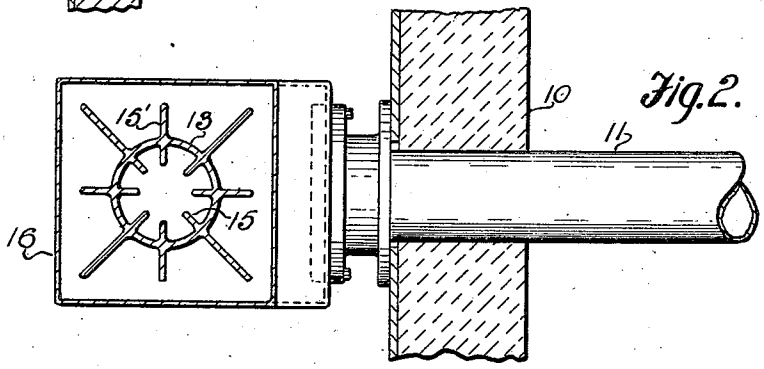


Fig. 2.

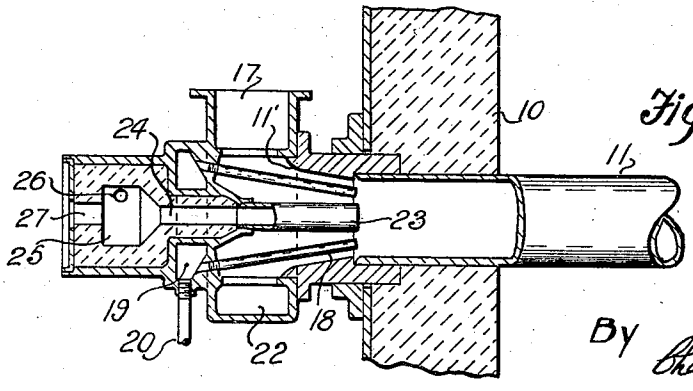


Fig. 3.

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Filed Nov. 11, 1937 2 Sheets-Sheet 2

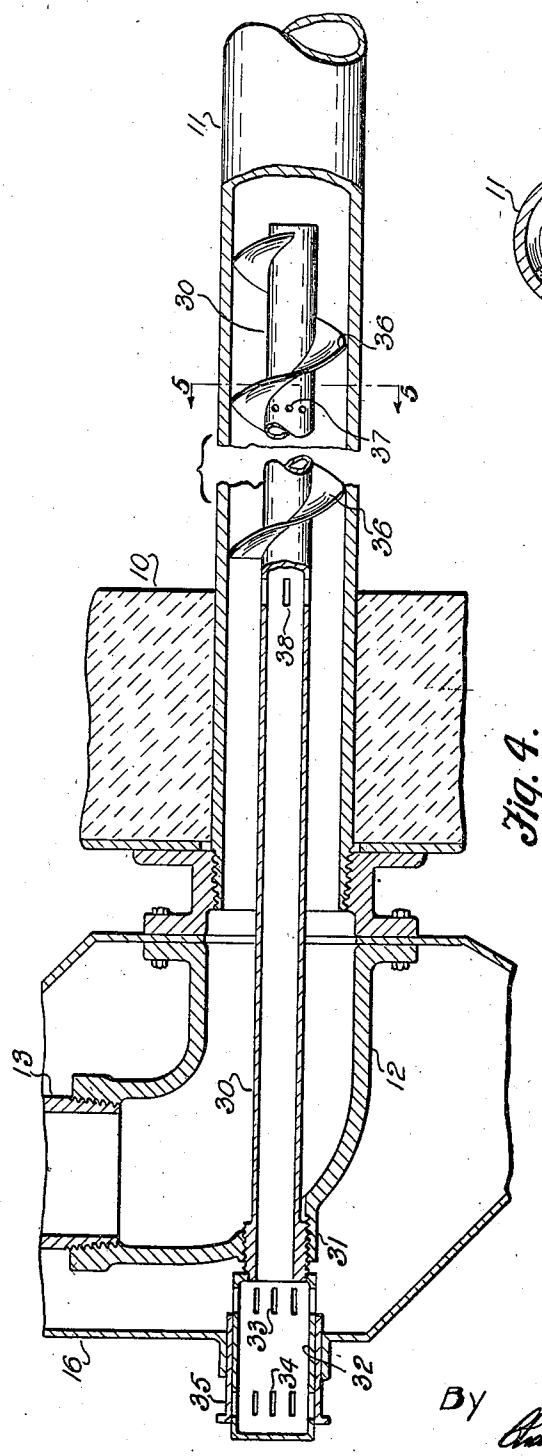


Fig. 4.

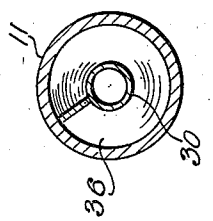


Fig. 5.

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UNITED STATES PATENT OFFICE

2,226,816

HEATING APPARATUS

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Application November 11, 1937, Serial No. 174,086

1 Claim. (Cl. 126—91)

This invention relates to heating apparatus comprising a fuel-fired radiator tube for producing radiant heat in a furnace chamber; and the object of the invention is to increase the utility of such heating apparatus by the improvements hereinafter described.

In the accompanying drawings wherein the preferred form of the invention is shown,

Fig. 1 is a side elevation, with parts in section, of the improved heating apparatus;

Fig. 2 is a fragmentary sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is a sectional view of a burner associated with the intake end of the radiator tube;

Fig. 4 is a fragmentary sectional view of parts shown in Fig. 1, and

Fig. 5 is a cross-sectional view on line 5—5 of Fig. 4.

In the drawings, 10 indicates a portion of a wall of a furnace chamber wherein is positioned a fuel-fired radiator tube 11 for producing radiant heat in the chamber. For convenience of illustration, the radiator tube is shown as of the hairpin type with its free ends extending out of the chamber through said wall. The tube is fired by a burner generally indicated at A. Coupled to the exhaust end of the radiator tube is an exhaust conduit comprising an elbow 12, a pipe 13, and an exhaust fan 14.

The exhaust pipe 13 is internally and externally provided with heat conducting fins 15 and 15' respectively. Extending around the exhaust pipe is a casing 16 which at its upper end is open to the atmosphere and which at its lower end is in open communication, by way of a duct 17, with the burner A.

For illustrative purposes the burner A has been shown as comprising a plurality of gas discharge tubes 18 which project into the mouth 11' of the radiator tube from an annular gas chamber 19 to which fuel gas is supplied by a supply pipe 20. Air for supporting combustion of the fuel discharged in the tubes 18 is delivered to the radiator mouth by means including the aforementioned duct 17 which constitutes the inlet end of an air chamber 22 through which said fuel tubes 18 extend. The ignition of the fuel issuing from the tubes 18 is maintained by means including an open ended tube 23 through which highly heated gases flow by way of a connecting passage 24 from a chamber 25 whereinto a premixed burner 26 fires, the burner 26 being arranged to fire tangentially into the said chamber 25. The pipe for supplying premixed air and gas to the burner 26 is indicated at 26' in Fig. 1. To minimize the effect of puffing in the radiator tube 11 on the premix burner 26, the chamber 25 is provided with a relatively restricted passage 27 which is open to the atmosphere. Since the air and fuel gas which enter the mouth of the radiator tube are not premixed, the flame of combustion will, therefore, be relatively long. The burner thus briefly described forms, per se, no part of the present invention.

Referring now more particularly to Fig. 4, 30 indicates an open ended pipe which projects into the return leg of the radiator tube from the exhaust end thereof, the pipe passing through a wall of the elbow 12 as indicated at 31. Coupled to the outer end of the pipe is a tubular extension 32 which extends out of the casing 16 through an opening in the adjacent wall thereof. Adjacent each end of the extension 32 are elongated ports 33 and 34 respectively, and surrounding the extension is an adjustable sleeve 35 for controlling the effective inlet area of said ports, the sleeve being of such length that both sets of ports may be partially opened, it being noted that the ports 33 are within the casing 16 and that the ports 34 are outside of the same. At this point it should be explained that the function of the suction fan 14 is to produce a draft through the radiator tube 11 from the burner end thereof in order not only to withdraw gases of combustion from the radiator tube but also to induce a flow of combustion supporting air to the burner A. Since the inner end of the pipe 30 which extends into the return leg of the radiator tube is in open communication with the interior of said tube, it follows that suction which is effective in the return leg is also effective in the pipe 30 and consequently that air will flow into the outer end of the pipe 30 either by way of the ports 33 or the ports 34, depending on the position of the adjusting sleeve 35. As shown in Fig. 1, the pipe 30 extends a substantial distance into the return leg of the radiator tube from the inside face of the furnace wall 10. The air which enters the radiator tube from the discharge end of the pipe 30 will support combustion of the residual fuel in the gases coming from the intake leg of the radiator tube.

Surrounding the pipe 30 from its discharge end to a point adjacent the furnace wall 10 is a spiral web 36 for defining a spiral flow passage for the gases of combustion flowing out of the return leg of the radiator tube. By causing the gases to flow in a spiral path they will be thoroughly stirred up and thus more effectively insure both combustion of the residual fuel and transfer of

heat from the gases to the radiator tube. Instead of allowing all of the secondary air to discharge from the inner of the pipe **30**, some of the air may be introduced intermediate the ends of the spiral web from a series of holes **37** in the pipe. It is desirable to cool the gases of combustion after they leave the radiator tube in the furnace and to this end the pipe **30** is provided with openings shown as slot type holes **38** at a point relatively close to the inside face of the furnace wall **10**. Since the air which flows through the casing **16** is preheated by indirect heat exchange with the waste gases of combustion, it will be readily appreciated that by proper adjustment of the sleeve **35** the air which flows into the tube **30** may be either all preheated air or partially preheated air or all air at atmospheric temperature, depending on the adjustment of the sleeve **35**. The heating effect of the residual fuel in the gases in the return leg of the radiator tube may, therefore, be controlled to a nicety.

The advantages of supplying preheated air to the fuel flowing into the intake end of the radiator tube will be readily apparent without explanation. However, it is believed to be novel to preheat the air by a heat exchanger around the exhaust conduit at a point between the exhaust fan and the point of emergence of the radiator tube from the furnace chamber. An important result obtained by this arrangement is that the temperature of the exhaust gases is materially reduced before reaching the exhaust fan, thereby not only prolonging the life of the fan but also increasing its efficiency.

What I claim is:

In apparatus of the class described, the combination of a tube type radiator, a burner firing into one end of the radiator, an exhaust pipe leading from the other end of the radiator, means for producing a controlled suction effect in said exhaust pipe, means for utilizing said suction effect for introducing secondary air into the radiator at a point remote from the burner end thereof and comprising a tube extending through a wall of the exhaust pipe and part way into the radiator, means comprising a casing around said exhaust pipe for supplying preheated air to the burner, and means operable to divert some of the preheated air to said tube.

WILLIAM M. HEPBURN.