April 5, 1938. C. D. WALDON 2,113,070

SMOKE CONDENSING AND FUEL SAVING DEVICE

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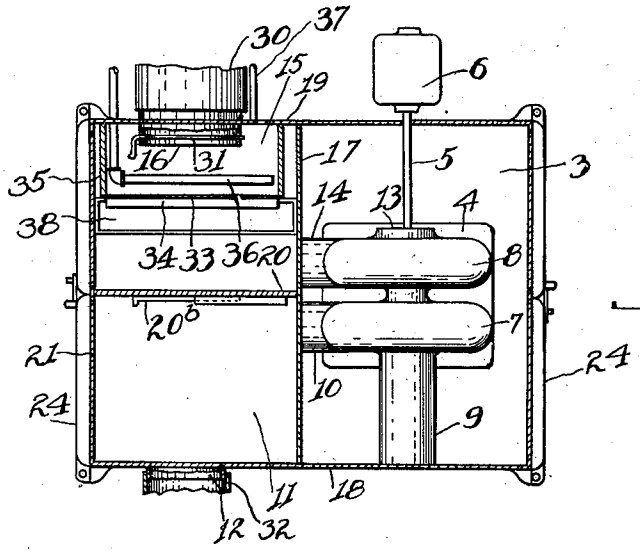


Fig. 2.

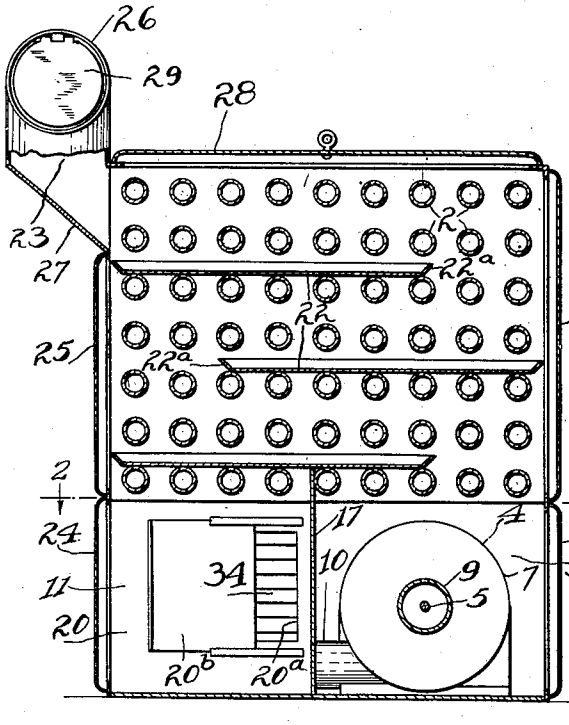


Fig. 1.

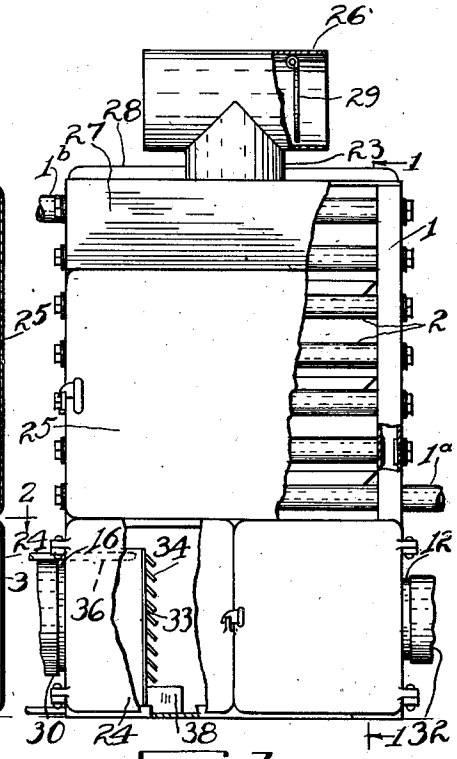


Fig. 3.

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SMOKE CONDENSING AND FUEL SAVING DEVICE

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3 Claims. (Cl. 122—20)

This invention relates to smoke condensing and fuel saving devices, and the object of my invention is to devise such a device which will permit the use of low grade fuels; which will eliminate or reduce the solid and gaseous content of the products of combustion; which is unitary in construction; which may be readily cleaned; which may be readily adjusted for use with smoke pipes of different sizes and for different types of fuel used in the heating device or furnace; which is operable by a forced draft which not only draws the smoke through the unit, but also delivers fresh air for the heating device or furnace; and which may be used for re-circulating the smoke gases through the furnace.

I achieve my object in the manner hereinafter described and illustrated in the accompanying drawing, in which

Fig. 1 is a vertical longitudinal section on the line 1—1 in Fig. 3.

Fig. 2 a horizontal cross-section on the line 2—2 in Fig. 1; and

Fig. 3 a rear elevation partly broken away.

In the drawing corresponding numerals of the different figures refer to corresponding parts.

The unit comprises headers 1, the inner walls of which are preferably copper, and having a plurality of copper tubes 2 extending therebetween. A water inlet 1a is located in one of the headers preferably adjacent the bottom thereof and a water outlet 1b is located in the other header preferably adjacent the top thereof. The inlet and outlet may be connected to the return from a steam or hot water system, or to a separate hot water supply system. By preference, the tubes are two inches in diameter and spaced two inches apart, although tubes of greater or less diameter may be used spaced apart a distance equal to the diameter of the tubes. Any number of rows of tubes may be used, depending upon the size of the unit, and in Figure 1, I show seven rows of such tubes. Beneath the tubes in the base of the unit is a chamber 3 in which is mounted a double fan 4, operated through a shaft 5 from a variable speed motor 6 mounted on the outside of the unit. Each part of the fan is mounted in a separate casing 7 and 8 respectively.

A conduit 9 communicates between the outside of the unit and the fan casing 7 for the admission of fresh air, and the fan casing 7 communicates through a conduit 10 with a fresh air chamber 11 in the base of the unit. An outlet 12 from said fresh air chamber 11 leads to the ash pit or some other point below the grate or fire box of a furnace or other heating device (not shown).

An opening 13 in the fan casing 8 communicates with the chamber 3 and a conduit 14 leads from said fan casing 8 to a chamber 15 called for convenience the exhaust chamber in the base of the unit. An outlet opening 16 in the side of the unit leads to an outside vent, chimney or smoke pipe.

The chambers 11 and 15 are formed by a wall 17 which extends across the base from a side wall 18 to a side wall 19, and a partition 20 extending from the wall 17 to one end 21 of the unit. The partitions or walls 17 and 20 extend upwardly to the underside of the lowermost condensation pans or plates 22 which rest upon the lowest row of tubes 2. The space above the said lowermost pan may for convenience be called the condensation chamber. In the partition 20 is an opening 20a which serves as a by-pass between the fresh air chamber 11 and the smoke chamber 15, and which may be opened or closed or regulated by a sliding damper 20b which may be operated manually by opening one of the doors 24 which are mounted at each end of the base.

The condensation pans or plates 22 are mounted on the pipes 2 in staggered relationship so as to direct the smoke which enters through a smoke inlet 23, at the top of the unit in a circuitous passage through the unit. In Figures 1 and 3, three of these pans are shown with two rows of tubes 2 between each pan and a single row of pipes below the lowest plate, but the arrangement of the pans may be altered as desired. The pans have upturned edges or sides 22a. The sides of the unit between the headers are open and doors 25 are provided at each end of the unit for inserting the condensation pans 22 and for cleaning the plates and the tubes. The top 28 of the unit is a removable copper plate, adapted to permit access to the interior from the top for cleaning between the tubes. The pans are preferably formed of copper sheet, and extend fully across the unit from one header to the other, but do not extend the full length of the unit, a space being left for the passage of the smoke downwardly through the unit. The length of the pans 22 may be varied to provide greater or less space between the end thereof and the end of the unit, depending upon the size of the smoke pipe 26 and the nature of the fuel used.

The smoke inlet 23, comprises a smoke hood 27 which extends across the end of the unit and communicates with the interior thereof and a T-shaped pipe or casting 26 mounted thereon and forming part thereof, the stem or vertical portion of said pipe or casting communicating with the interior of the smoke hood and the cross piece or horizontal portion being adapted to be connected in a smoke pipe (not shown) which runs from the furnace to a heating device (not shown) to a chimney or other smoke outlet (not shown). The cross-sectional area of the opening between the smoke hood 27 and the interior of the unit or condensation chamber is preferably substantially the same as the cross-sectional

area of the smoke pipe 26 and the cross-sectional area of the space between the top 28 of the unit and the upper condensation pan 22 and between the end of each pan and the end of the unit, and between the other pans is substantially the same as the cross-sectional area of the smoke pipe 26.

A damper 29 is provided in the cross piece or horizontal portion of the pipe or casting 26 between the stem or vertical portion thereof and the chimney. This is preferably a swinging damper, sometimes called a velocity damper, which when the smoke condensing unit is in operation will not open, but which will be swung open by the natural draft in the smoke pipe when the smoke condensing unit is not in use, thus permitting the smoke to pass directly out the chimney without going through the smoke condensing unit.

A pipe 30 communicates between the smoke outlet 16 of the exhaust chamber 15 and a vent, chimney or to the smoke pipe 26 at a point between the condenser unit and the chimney. A rotatable damper 31 (shown in Fig. 2) is provided in the smoke outlet 16. The pipe 32 extends from the fresh air outlet 12 to a point beneath the firebox or grate of the furnace or other heating device. The amount of smoke which passes up through the pipe 30 to the chimney and the amount which may be by-passed through the by-pass opening 20^a and returned to the furnace is controlled by the damper 31 and the slide 20^b.

The operation of the device is as follows: smoke from the furnace passes through the smoke pipe and the smoke inlet 23 to the interior of the smoke condensing unit and passes between the tubes 2 over the upper condensation pan 22, downwardly between the end of the condensation pan and the end of the unit, and back over the second condensation pan, around the end thereof and in the reverse direction over the lowermost pan and finally into the chamber 3 in the base of the unit. The smoke then passes into the fan casing 8 through the opening 13 and is forced out through the conduit 14 into the smoke chamber 15 and then through the smoke outlet 16 through the pipe 30 and out through a vent or chimney or back to the smoke pipe at a point between the smoke inlet 23 and the chimney. At the same time fresh air is sucked in through the conduit 9 into the fresh air chamber 11, out through the fresh air outlet 12 and through the pipe or conduit 32 to the furnace. If it is desired to re-circulate some of the smoke gases, the by-pass 20^a is opened to the desired extent to permit the gases to pass into the fresh air chamber 11 and mix with the air.

As the smoke is cooled in its passage between the water tubes, solids and liquids are condensed or deposited on the pans and on the condensation pans 22, and may be removed when desired. The heat in the smoke is absorbed by the water in the tubes 2, which serves to increase the efficiency of the heating device. In addition to the pans 22, screens which may or may not be treated with chemicals, chemical sprays or other devices for further treating and purifying the smoke may be inserted in the unit at convenient places, preferably in the smoke chamber 15.

In Figs. 1 and 3, I have shown a baffle screen 33, located in the smoke chamber 15 between the outlet of the smoke conduit 14 and the smoke outlet 16 from the smoke chamber. The baffles comprise a plurality of fins 34, and the screen is mounted on a removable frame 35. Between the screen 33 and the smoke outlet 16 is a perforated pipe 36 located adjacent the top of the frame 35 and adapted to provide a liquid screen, water or chemical, through which the smoke must pass. A drain pipe 37 is provided at the bottom of the smoke chamber 15 for carrying off the liquid, which may, if desired, be recirculated. Beneath the fins 34 is located a drip pan 38.

What I claim as my invention is:—

1. A smoke condensing and fuel saving unit for use with but separate from a furnace or other heating device, comprising substantially vertical water headers having an inlet and outlet adapted to be connected to the return from a heating system or a separate hot water system; a plurality of rows of substantially horizontal spaced apart tubes extending between the headers; a smoke inlet communicating with the interior of the unit for admitting thereto smoke from the furnace; a smoke outlet; means for causing a circulation of smoke through the unit from the inlet to the outlet; a plurality of substantially horizontal condensation plates removably mounted in the unit between rows of tubes and adapted to direct the smoke in a circuitous passage through the unit; and clean-out doors extending between the headers for inserting and removing said plate, and cleaning the interior surface.

2. A smoke condensing and fuel saving unit for use with but separate from a furnace or other heating device, comprising substantially vertical water headers having an inlet and outlet adapted to be connected to the return from a heating system or a separate hot water system; a plurality of rows of substantially horizontal spaced apart tubes extending between the headers; a smoke inlet communicating with the interior of the unit for admitting thereto smoke from the furnace; a smoke outlet; means for causing a circulation of smoke through the unit from the inlet to the outlet; a plurality of substantially horizontal condensation plates removably mounted in the unit between rows of tubes and adapted to direct the smoke in a circuitous passage through the unit; clean-out doors extending between the headers for inserting and removing said plates and cleaning the interior surfaces; and a removable top adapted to permit access to the interior from the top for cleaning between the tubes.

3. A smoke condensing and fuel saving unit for use with but separate from a furnace or other heating device, comprising substantially vertical water headers having an inlet adjacent the bottom thereof and an outlet adjacent the top thereof, the said inlet and outlet adapted to be connected to the return from a heating system or a separate hot water system; a plurality of rows of substantially horizontal spaced apart tubes extending between the headers; a smoke inlet communicating with the interior of the unit adjacent the top thereof for admitting thereto smoke from the furnace; a smoke outlet adjacent the bottom of the unit; means for causing a forced circulation of smoke through the unit from the inlet to the outlet; a plurality of substantially horizontal condensation plates removably mounted in the unit between rows of tubes and adapted to direct the smoke in a circuitous passage through the unit; and clean-out doors extending between the headers for inserting and removing said plates and cleaning the interior surfaces.

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