

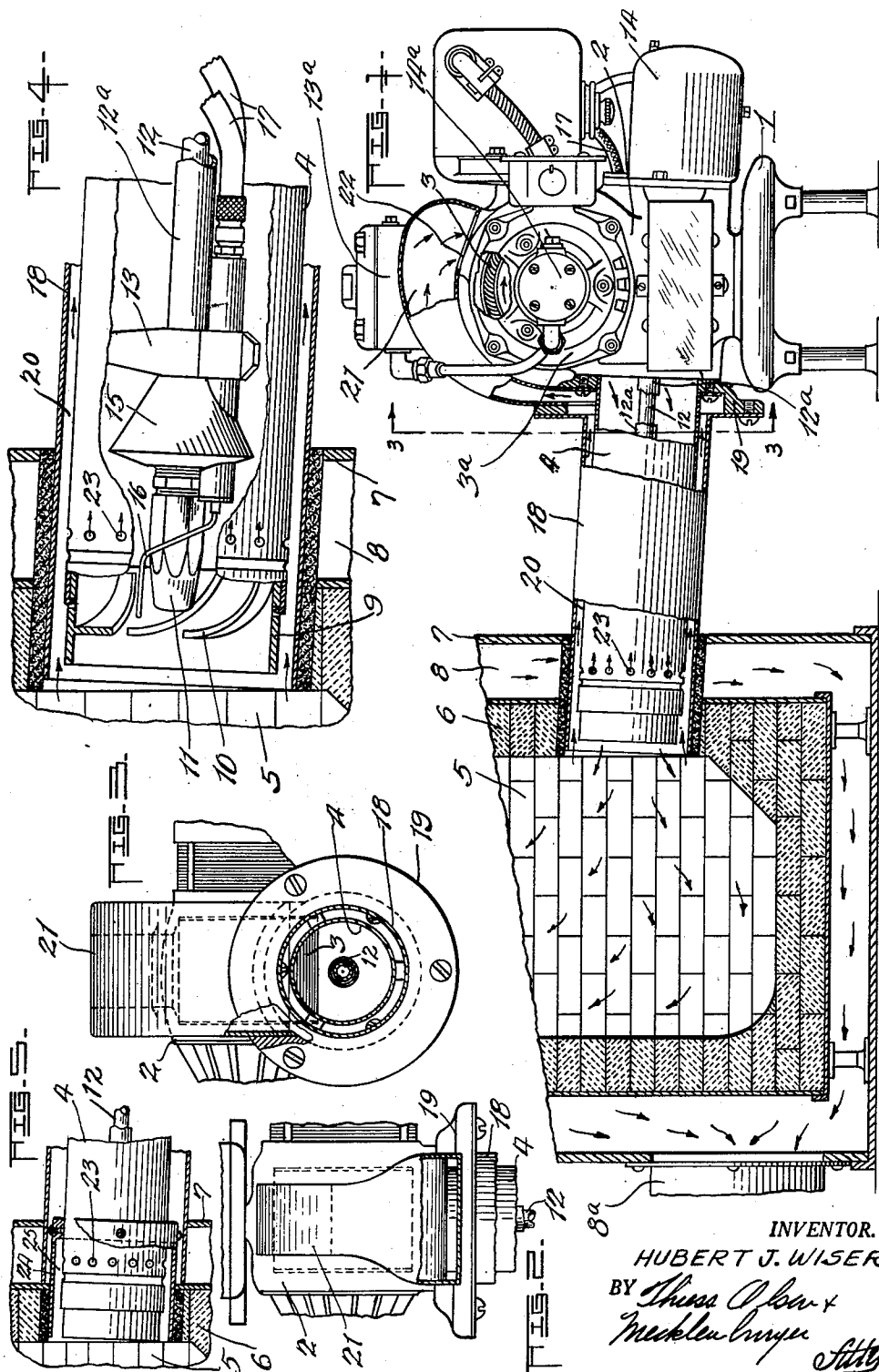
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H. J. WISER

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PULSATION RELIEF DEVICE

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INVENTOR.
HUBERT J. WISER
BY *Thos. Olson & Meeklenburger*
Attys.

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PULSATION RELIEF DEVICE

Hubert J. Wiser, Bloomington, Ill., assignor to
Williams Oil-O-Matic Heating Corporation,
Bloomington, Ill., a corporation of Illinois

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This invention relates to liquid fuel burners and is particularly adapted for use in connection with domestic heating plants, although it may successfully be used with other types of burner installations. In installations of this type it is difficult to control the air supply to the combustion chamber in a manner to prevent pulsation therein and at the same time control the combustion so that the escape of fumes from the combustion chamber is prevented.

In liquid burner installations considerable difficulty is experienced with pulsation in the combustion chamber, the formation of soot in furnaces or boilers, dirty electrodes in the ignition system, a noisy fire, and a high percentage of excess air. It is therefore an object of the present invention to provide an air control and pulsation relief device whereby the above-mentioned difficulties are overcome and efficient combustion is assured with a material reduction in the excess air required. In other words, the pulsation pressure ordinarily due to back draft is relieved in such a manner that the fumes do not escape into the furnace room from the burner installation and at the same time the excess air is reduced, the carbon dioxide is increased, and the stack temperature lowered. These advantages are all obtained by a proper back draft circulating system which is automatic in its action and does not require the use of any additional operating devices and may easily and economically be applied to the usual burner so as to meet any ordinary requirements.

Further objects will be apparent from the following disclosure.

In the drawing:

Fig. 1 is a side elevation partially in section of a standard oil burner and stack and illustrates one embodiment of the invention associated therewith.

Fig. 2 is a top view of the pulsation relief housing associated with the usual draft fan.

Fig. 3 is a sectional view taken on a line substantially corresponding to line 3—3 of Fig. 1.

Fig. 4 is an enlarged detail view partially in section of the burner end of the draft pipe with parts broken away to show the interior construction.

Fig. 5 illustrates another embodiment of the invention adapted to equalize the static pressure between the fuel nozzle and the combustion chamber.

Referring to the drawing in detail, the embodiment illustrated in Figs. 1 to 4 comprises a standard oil burner of the domestic type in-

stalled in connection with the usual combustion chamber. The burner comprises a support 1 on which is mounted a fan casing 2. The usual blade fan 3 is enclosed in the fan casing and operated in the usual manner by a motor 3a. The fan has the usual central air inlet and a peripheral outlet for directing air through a draft pipe 4 into the usual combustion chamber 5 of a furnace or the like. The furnace is provided with the usual inner wall 6 of refractory material and an outer casing 7 to provide a space 8 therebetween to provide a means for passing the flue gases to the boiler stack 8a. The draft pipe 4 is supported on the casing 2 and may be of the usual construction and provided at its forward end with the usual air cylinder 9 secured therein and having spiral fins 10 forming baffles arranged to provide a whirling motion of the air around the tip of an oil nozzle 11.

The oil nozzle 11 is supported on the outer end of an air supply pipe 12a, which latter is axially positioned around an oil tube 12. The air supply pipe 12a is axially positioned in the draft pipe 4 by means of a support 13. The fuel supply pipe 12 and the air supply pipe 12a extend through the fan casing 2 and are connected in the usual manner with an oil supply from which oil is delivered to the nozzle by means of an oil suction pump 14a, an oil valve assembly 13a, and a diffuser 14, which are automatically controlled in accordance with fuel requirements in the usual manner. A cone-shaped air spreader 15 is mounted on the pipe 12a adjacent the nozzle and is preferably formed of porcelain or the like. This spreads the air from the fan against the inside wall of the draft pipe adjacent the nozzle 11. The oil is atomized in the nozzle 11 by the primary air entering through the air tube 12a and it is thoroughly mixed with the whirling secondary air delivered through the draft tube 4, thereby producing a readily combustible mixture. For purposes of ignition, suitable electrodes 16 are positioned adjacent the nozzle tip and connected to the usual ignition system by means of high tension cables 17.

Heretofore it has been common practice to insert the draft pipe 4 directly into the wall of the combustion chamber and to cement it securely therein so that no gases from the combustion chamber could escape around the draft pipe. In the present invention an airtight casing 18 is provided around the draft pipe and mounted on a bracket 19 secured to the fan casing 2. The casing 18 is of sufficient size to provide an annular air passage 20 around the draft

pipe 4 and leading from the combustion chamber into a so-called pulsation relief chamber 21 above the fan and communicating with the fan chamber through an opening 22.

The opening 22 into the fan chamber is at a neutral point in the fan housing. That is, the pulsation relief chamber 21 communicates with the interior of the fan housing at a point along the periphery where there is no material pressure or draft. The pulsation chamber, therefore, communicates, through the fan casing and draft pipe 4, with the combustion chamber, although, on account of the opening 22 being at a neutral point of the fan, air will not circulate through the passage 22 except when at least some pulsation pressure exists in the pulsation relief chamber 21. It will be apparent that any back pressure from the combustion chamber will be relieved through the annular passage 20 into the pulsation relief chamber and through the fan and draft pipe to the burner.

The outer casing 18 is, of course, securely cemented into the furnace walls as shown. The annular space between the draft pipe 4 and the draft pipe casing 18 may be about $\frac{1}{8}$ of an inch in ordinary practice, and a series of holes 23 is provided through the draft pipe 4 between the spreader 15 and the tip of the nozzle 11. These holes 23 may be spaced as required and are in practice usually about $\frac{1}{4}$ inch in diameter. The series of holes is preferably located just back of the air cylinder 9. When the device is in operation, the porcelain air spreader 15 spreads the air from the fan against the inside wall of the draft pipe 4. This forces a certain amount of air through the portholes 23 and, due to the back draft in the combustion chamber, the air from the portholes flows rearwardly through the annular passage 20 into the pulsation relief chamber 21, then through the fan and draft pipe 4 to the combustion chamber. When the burner starts, pressure is set up in the combustion chamber and this pressure is immediately relieved in the manner described.

The pulsation relief device successfully operates under practically all normal working conditions, that is, when there is pressure in the combustion chamber, when there is a balanced condition (with no draft at all), or under substantially any draft conditions in the combustion chamber. It operates successfully in connection with either low or high pressure burners. It prevents resonant peaks of pressure and reduces the excess air required to a more economical point and a greater combustion efficiency is therefore obtained. It also eliminates the high static pressure usually used to overcome pulsation with larger fans. It tends to increase the CO_2 and to lower the stack temperature. The air flow between the draft pipe and the draft pipe sleeve has a tendency to cool the air pipe, thereby prolonging its life. The air flow also acts to prevent burning of the air cylinder vanes and the nozzle and furnishes air for combustion as well.

Fig. 5 illustrates an embodiment in which the pulsation relief chamber 21 may be eliminated and an additional sleeve 24 is mounted on the forward end of a draft pipe 4 to provide an annular chamber 25 around the series of holes 23 and communicating with the combustion chamber 5. In this construction the holes 23 provide means for equalizing the pressures in the combustion chamber and in the draft pipe 4 behind the spiral fins 10. Thus in normal operation, air passes through the holes 23 into the annular

chamber 25 and into the combustion chamber 5. This circulation provides a cooling effect which prevents burning of the air cylinder 9 and the oil nozzle 11. On the other hand, when there is an excess pressure in the combustion chamber 5, the pressure is relieved back into the draft pipe 4 through the holes 23.

It is intended, of course, that the invention should not be limited to the specific embodiment or embodiments disclosed herein, since modifications may be made, and it is contemplated, therefore, by the appended claims to cover any such modifications as fall within the true spirit and scope of this invention.

Having thus described this invention, what is claimed and desired to be secured by Letters Patent is:

1. In a liquid fuel burner having a draft pipe and a fuel discharge nozzle in said pipe adjacent the outlet end thereof and directed toward said outlet end, means for providing a forced draft through said pipe and into a combustion chamber, and a pulsation relief conduit from said combustion chamber and communicating with said draft pipe adjacent said nozzle and also communicating with said forced draft means through an inlet constructed and positioned relative to said draft means to normally maintain a substantially neutral pressure in said conduit.

2. In a liquid fuel burner having a draft pipe and a burner nozzle therein, said draft pipe at its outlet communicating with a combustion chamber, means for providing a forced draft through said pipe and into the combustion chamber, and an annular pulsation relief conduit extending from said combustion chamber around the nozzle end of said draft pipe and spaced therefrom and communicating with said draft pipe closely adjacent said nozzle through a series of small passages through the wall of said draft pipe.

3. In a liquid fuel burner having a draft pipe and a burner nozzle therein, said draft pipe at its outlet communicating with a combustion chamber, means for providing a forced draft through said pipe and into the combustion chamber, an air spreader in said draft pipe adjacent said nozzle, and an annular pulsation relief conduit extending from said combustion chamber around the nozzle end of said draft pipe and spaced therefrom and communicating with said draft pipe through a series of small passages positioned between said air spreader and said nozzle.

4. A burner construction of the character described comprising a combustion chamber, a draft pipe opening into said chamber, a burner nozzle positioned within said draft pipe, spiral fins within said draft pipe interposed between the end thereof opening into the combustion chamber and the burner nozzle, an annularly spaced casing around said draft pipe providing a pressure relief passageway communicating with said combustion chamber, and means for providing a forced draft through said draft pipe, said draft pipe having apertures therein providing direct communication for the flow of gases between said draft pipe and said pressure relief passageway.

5. The burner construction recited in claim 4 wherein the forced draft providing means is a blower of the centrifugal type and wherein the pressure relief passageway also communicates with said blower through a peripheral blower casing inlet constructed and positioned relative to the blower rotor to normally maintain a substantially neutral pressure at said inlet.

6. In a liquid fuel burner, a draft pipe having the outlet end thereof communicating with a combustion chamber, a burner nozzle in said draft pipe adjacent the outlet end thereof, a fan blower having a casing with its outlet connected to one end of said draft pipe to provide a forced draft therethrough and into the combustion chamber, and a pressure relief conduit connected to said blower casing through an inlet positioned and constructed relative to said blower to normally maintain a substantially neutral pressure in said pressure relief conduit, said conduit terminating closely adjacent the outlet end of said draft pipe for communication with said combustion chamber.

7. In a liquid fuel burner having a draft pipe communicating with a combustion chamber and a fuel nozzle in said pipe adjacent said chamber, an air spreader in said pipe back of said nozzle and adjacent thereto for directing the draft current toward the wall of said pipe, said pipe having an annular series of relatively small perforations through the wall thereof between said spreader and the outlet end of said nozzle, a centrifugal type blower having its casing outlet communicating with said draft pipe, and a casing forming an annular passage around said pipe

and communicating with said combustion chamber and also communicating with said blower through a casing inlet constructed and positioned relative to said blower to normally maintain a substantially neutral pressure in said annular passage.

8. In a liquid fuel burner, a draft pipe having the outlet end thereof communicating with a combustion chamber, a burner nozzle in said draft pipe adjacent the outlet end thereof, said draft pipe having a restricted passage therein adjacent said burner nozzle and back of the tip thereof, a fan blower having a casing with its outlet connected to said draft pipe to provide a forced draft therethrough and into the combustion chamber, and a pressure relief conduit connected to said blower casing through an inlet positioned and constructed relative to said blower to normally maintain a substantially neutral pressure in said pressure relief conduit, said draft pipe being apertured to afford direct communication between said draft pipe and said relief conduit, the apertured portion of said draft pipe being closely adjacent the outlet end thereof for communication of said relief conduit with said combustion chamber.

HUBERT J. WISER.