

Description

The invention concerns an oil burner configuration for outdoor stoves with a fuel container, with a supply device conveying the fuel to a main burner and with a heatable vaporizer located in the fuel supply device, whereby a spraying nozzle which introduces the oil in the form of oil mist is located at the inlet end of the vaporizer.

An oil burner configuration is proposed as specified (DE-A-31 18 644, published on 25th Nov., 1982). This oil burner possess a spraying nozzle at the inlet end of the vaporizer, which introduces the oil into the vaporizer in the form of oil mist. When diesel oil is employed as a fuel, this configuration enables this also to be vapourized to such a degree that practically soot-free burning is possible. It further results in a high level of burner performance and a stable flame. It has been established, however, that ignition of the burner in cold condition can cause difficulties.

A further burner configuration for paraffin is also known, with a vaporizer and a starter-mixing nozzle which heats up the vaporizer upon commencement of operation (FR-A-745 687). With this known burner, however - at least when diesel oil is used as a fuel - residue-free burning and a subsequent high level of burning efficiency cannot be attained; this can be achieved only when a spraying nozzle which introduces the diesel oil in the form of oil mist is located at the inlet end of the vaporizer. Furthermore, the starter-mixing nozzle employed with the known burner does not provide an optimal mix of fuel and air, as a result of which residue-free burning is not achieved, and for this reason the performance of the known starter mixing nozzle is not optimal. Ignition of the fuel mixture issuing from the starter mixing nozzle also causes difficulties.

The invention is based on the task of designing an oil burner configuration of the type mentioned at the beginning in such a way that the vaporizer can be heated up to a temperature of over 360°C within a short time, by means of a stable, efficient flame. In accordance with the invention, this is achieved by assigning a starter-mixing nozzle to the vaporizer, which heats up the vaporizer upon commencement of operation, and which contains a burner nozzle, a fuel chamber located before the inlet to the burner nozzle, an air nozzle located concentrically to the burner nozzle, which leads into the fuel chamber, and a perforated burner pipe which surrounds the burner nozzle.

As a result of the configuration of a fuel chamber and an air nozzle located concentrically to the burner nozzle and leading into this fuel chamber, when air is supplied an air jet is produced, which passes through the fuel chamber and carries the fuel in the form of a mist through the fuel nozzle. This fuel mist, which is supplied with additional combustion air in the burner pipe surrounding the burner nozzle through the air holes contained in the pipe, produces a stable and efficient flame which is also able to heat up the up-line vaporizer to a temperature of over 360°C within a short time. This fuel mist can be ignited easily with a match, a lighter, a fuse or similar.

In accordance with practical requirements, the fuel supply unit to the starter-mixing nozzle is designed as a capillary tube with an internal diameter of 0.6 to 0.8 mm and with an adaptable length in accordance with the admission pressure and the flow volume of the fuel. This capillary tube acts as an attenuator and as a flow-limiter.

In accordance with practical requirements, a central distributing and regulating valve is included, which controls the air supply and fuel supply to the starting-mixer nozzle, with the following main settings:

- a) a setting connecting the air supply to the starter-mixing nozzle with a compressed air source and the fuel supply to the starter-mixing nozzle with the main fuel line;
- b) a setting connecting the air supply and the fuel supply to the starter-mixing nozzle with the compressed air source and the fuel supply to the vaporizer with the main fuel line;
- c) a setting connecting the fuel supply to the vaporizer with the main fuel line; in this setting, the fuel supply to the vaporizer can be throttled from a maximum to a minimum level;
- d) a setting connecting the fuel supply to the starter-mixing nozzle and to the vaporizer with the compressed air source, and
- e) a shut-off setting.

In accordance with practical requirements, the vaporizer is provided with double casing which surrounds the evaporating chamber, forming a cavity, whereby at the lowest point of the cavity a heating pipe filled with a vaporizable liquid is located, which is connected to the cavity and which the flame of the main burner is able to act upon.

The distributing and regulating valve included in the invention results in an efficient oil burner configuration for outdoor stoves which is easy to operate.

In accordance with practical requirements, water is employed as the vaporizable liquid.

The vaporizer can be arranged in such a way that the condensing liquid runs back into the heating pipe.

The casing cavity is evacuated.

The invention is described in further detail in the examples of design shown in the drawing. The drawing shows the following:

Fig. 1 Diagram of the overall structure of the burner configuration with appropriate devices;

Fig. 2 Individual diagram of the vaporizer provided with double casing;

Fig. 3 Individual diagram of the starter-mixing nozzle in longitudinal section;

Fig. 4 A side view of the central distributing and regulating valve in section;

Fig. 5 to 5e Diagrams of the individual settings of the distributing and regulating valve shown in Fig. 4;

Fig. 6 A view of a capillary tube in accordance with the invention.

In Fig. 1 the combustion chamber of an outdoor stove is marked 1, 5 is a main burner, 6 is a Venturi tube upon which the flame of the main burner acts. Located above the main burner, 5, is the vaporizer, 2, which is heated by the flame of the main burner, 5, during operation. The vaporizer, 2, is supplied with fuel from a fuel tank, 14, via a fuel line, 16, a central distributing and regulating valve, 8, and a further fuel line, 20. This fuel is evaporated in the vaporizer, 2, and the fuel vapour is supplied to the main burner, 5.

10 is an air tank with a pressure-limiter, 11, with pressure indicator. 12 is a pressure-reducing valve with pressure indicator for the fuel tank. This compressed air conveys the fuel from the fuel tank, 14, into the vaporizer, 2, and into the starter-mixing nozzle.

13 is a pressure-reducing valve with pressure indicator for the starter-mixing nozzle, 7, which is supplied with fuel via fuel lines 16 and 19 and via the central distributing-regulating valve, 8, and with air via lines 17 and 18 and the distributing-regulating valve, 8.

The vaporisation of diesel oil at temperatures over 360°C requires a high level of uniformity of temperature over the entire surface of the vaporizer. If the temperature is not distributed evenly, the oils and similar groups of distillates which are in use today have a tendency to crack. The crack residues form deposits in nozzles, lines and control slits and result in faulty operation. A further difficulty results from the need to control the output of an evaporation burner,

i.e. the temperature acting on the vaporizer is substantially higher at high output levels than when output is throttled.

Fig. 2 shows a special design of the vaporizer, 2, provided here with a double casing which surrounds the actual evaporation chamber, 2b, and forms a casing cavity, 2b, to the lowest point of which a heating pipe, 2c, is connected, filled with a vaporisable liquid, e.g. water. The heating pipe, 2c, leads into the area of the heating flame of the main burner, 5. Its cavity forms a closed system with the casing cavity, 2b, of the vaporizer. As soon as the water, 2d, vaporizes, uniform temperature prevails in the system at uniform pressure. As long as liquid is present in the heating pipe, 2c, heat transfer is extremely intensive, as the high level of condensation heat is transferred to the cooler points of the system when the vapour condenses.

The system must, of course, be designed in such a way that the condensate which forms is able to flow back into the heating pipe, 2c, by means of an inclination. When the heating liquid has been completely evaporated heat transfer ceases, i.e. the system is balanced and there are no areas in the vaporizer which are overheated or too cold. If the heating pipe, 2c, is heated further, its temperature will increase, but the temperature of the vaporizer will not increase, as heat transfer no longer takes place. The system must be designed in such a way that a temperature of approx. 400°C is attained at a minimal output level. This eliminates to a large extent the undesirable cracking of diesel oil or paraffin.

Fig. 3 shows a large-scale drawing of the starter-mixing nozzle. 30 is a burner unit with an air connection, 35, for the air-line, 13, from which an air supply line, 33, leads to an air nozzle, 34. 36 is a fuel connection point for the fuel line, 19. This fuel connection point, 36, is connected via a fuel-supply borehole, 37, to a fuel chamber, 38, which is contiguous with a burner nozzle, 39a, in a nozzle nut, 39. The air nozzle is adjacent - opposite the burner nozzle, 39a - to the fuel chamber. When air is supplied, an air jet is thus produced which passes through the fuel chamber and conveys fuel through the burner nozzle, 39a, in the form of a mist. This fuel mist, which is supplied with additional combustion air in the burner pipe, 31, through the air-holes, 32, can easily be ignited with the aid of a match, a lighter, a fuse or similar. The resulting flame is stable and is sufficiently efficient to heat the vaporizer, 2, to a temperature of over 360°C in a relatively short period of time (3 - 4 minutes).

Fig. 4 shows the central distributing and regulating valve, 8, at a point of intersection. The valve consists of a fixed base, 22, with boreholes and control slits, a rotatable control disc, 23, with a shaft, 23a, to which an operating lever, 9, is attached, an upper part, 24, and a spring, 25, which presses the rotatable disc, 23, against the base, 22.

Boreholes and corresponding control channels are incorporated into the upper side of the base, 22, and the underside of the rotatable control disc, 23. The facing sides of the control disc, 23, and the base, 22, are lapped so that the individual boreholes and control channels are sealed off from one another.

Fig. 5a shows the individual settings of the distributing and regulating valve. The boreholes and control slits in the base, 22, are shown as full lines, while the boreholes and control slits in the rotatable control disc, 23, are shown as broken lines. Fuel is directed via borehole 26, which is located at the centre of the base, through the control channel, 27, which is defined in width and milled into the rotatable control disc, 23 - represented by broken line - in position I borehole 28 for the starter-mixing nozzle, 7, in positions II and III to shortly before position IV in control channel 29, which is incorporated into the base, through the fuel line, 20, and into the vaporizer, 2.

In position IV control channel 27 connects the air inlet borehole, 30, with control channel 29 and the fuel inlet borehole, 26.

The second control channel which is milled into the rotatable disc, 23, control channel 31, connects the air inlet borehole, 30, with the air outlet borehole, 32, in position I, and releases air for the starter-mixing nozzle, 7. In position II the control channel connects the air inlet borehole, 30, with the air outlet borehole, 32, and with borehole 28, thereby conveying air and the fuel which is still located in line 19 into the start-mixing nozzle, 7. In the other positions, control channel 31 has no further influence.

The burner configuration is operated as follows:

When the distributing and regulating valve is in position 0 all lines are shut off from one another. When valve, 8, is set to position I, air lines 17 and 18 are connected, and air is supplied to the start-mixing nozzle, 7. At the same time, fuel lines 16 and 19 are connected in position I, so that the fuel is also conveyed to the starter-mixing nozzle, 7, enabling the latter to be ignited.

After approx. 3 minutes pre-heating time, the valve, 8, is set to position II. Airlines 17 and 18 remain connected, i.e. air continues to be supplied to the starter-mixing nozzle, 7. At the same time, air line 17 is connected with fuel line 19, so that the starter-mixing nozzle is supplied with fuel until the fuel line and the starter-mixing nozzle have been blown empty and cleaned of residual fuel (approx. 20 seconds). In position II, however, fuel lines 18 and 20 are also connected, so that fuel enters the pre-heated vaporizer immediately at the time of switching and vaporizes there.

The fuel vapour is conveyed directly through vapour line 21 to the main burner, 5. The vapour jet emitted from this main nozzle conveys the necessary combustion air through the Venturi tube, 6, mixes with it and ignites on the flame of the starter-mixing nozzle, which is still burning.

In accordance with practical requirements, the vaporizer is not supplied with the maximum output in position II, as the combustion chamber would be momentarily overloaded at maximum flame output, which would result in brief soot and smoke formation.

As soon as the flame of the starter-mixing nozzle, 7, goes out, the unit is switched to position c. In this position, fuel lines 16 and 20 only are connected, i.e. only the vaporizer, 2, is supplied with fuel. The central distributing and regulating valve, 8, allows the maximum flow of fuel in this position, i.e. the burner operates at full load in this position. In this phase the items to be cooked are heated.

The central distributing and regulating valve, 8, is designed in such a way that the output of the burner can be steplessly adjusted from position c, "full load" to shortly before position b, "minimum load". Fuel lines 16 and 20 only are connected over the entire range of settings.

In position d, lines 17, 19 and 20 are connected. Lines 20 and 19 are blown empty by the pressure from line 17 and the burner is subsequently switched off. In this position, the entire system, all lines, the fuel tank and the air tank can be deaerated. When the system has been deaerated, the valve lever, 9, is set to its normal position, e.

In accordance with practical requirements, the fuel line, 20 (Fig 1), is designed as a capillary tube with an internal diameter of 0.6-0.8 mm, primarily 0.8 mm, whereby the length of the capillary tube, 30, is adapted in accordance with the fuel pressure and the required flow volume. Such a capillary tube is shown in Fig. 2.

31 shows the inlet end and 32 shows the outlet end. In order to be able to provide the capillary tube, 30, with any length, independently of its connection points, it is provided with a loop-shaped turn, 33.

In the same manner as fuel supply line, 20, fuel supply line 21 (Fig. 1) can also be designed as a capillary tube with an internal diameter of 0.6-0.8, primarily 0.8 mm, leading to the starter-mixing nozzle, whereby the length of the capillary tube is again adapted to the fuel pressure and the flow volume of the fuel.

The above is hereby certified to be a true and complete rendering into the English language of the German original.

Gary Cox (B.A.), authorized translator for the English and German languages.

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