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(54) Wall-mounted boiler with a sealed chamber

(57) Within the sealed casing of the boiler there is provided for the combustion air an air chamber (5) acting as a plenum chamber connected to manifold means (10, 11) which uniformly distribute the combustion air to two ducts (13, 18) positioned on the two sides of the sealed combustion chamber (14) of the boiler.

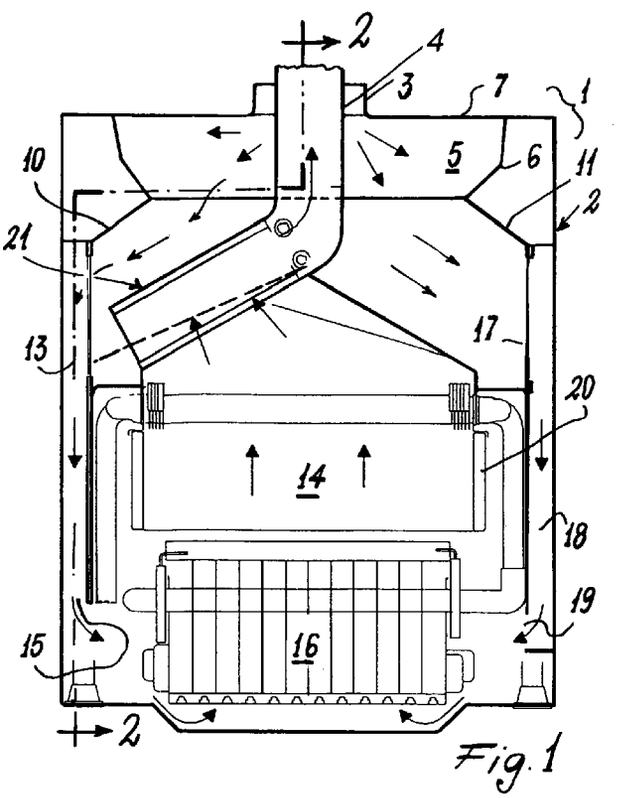

Fig. 1

EP 0 811 811 A2

Description

This invention relates to a forced-draught wall-mounted boiler provided with an an atmospheric gas burner, a fan and a sealed combustion chamber.

Traditional wall-mounted boilers are characterised by the use of a boiler of atmospheric type. This boiler burns the gas by combination with the combustion air in two stages:

1. Premixing all the gas required for combustion with a part of the necessary air drawn in by the gas flowing through a venturi. This air forms the primary air.
2. Combining the remaining air required for complete gas combustion directly at the combustion head. This remaining air forms the secondary air.

Burners of atmospheric type are used both on natural-draught boilers and on forced-draught boilers provided with a fan and a sealed combustion chamber. The particular design of atmospheric boilers operating with primary and secondary air requires the combustion to take place with an excess of secondary air and a consequent high combustion temperature. This excess air, when in the presence of a high temperature, causes the nitrogen molecules contained in the air to split during combustion, so that they combine with the oxygen and lead to an undesirably high emission of NOx.

One method for reducing NOx emission is to provide an atmospheric burner operating mainly with primary air. This type of burner operates correctly if applied to natural-draught boilers, in that the combustion air reaches the venturi slowly and uniformly. However if such a burner is applied to forced-draught boilers of sealed chamber type, these latter may not operate correctly because the combustion air drawn in by the fan enters on the opposite side to that housing the burner venturi, so that it is compelled to graze all the surfaces of the components present within the sealed casing of the boiler, with consequent creation of high turbulence regions opposed by excessively calm regions. This unbalance means that the combustion air reaches the burner in a disordered, excessively turbulent and non-uniform manner. This makes its entry into the burner venturis difficult, leading to poor combustion and a disordered flame face.

An object of the present invention is to improve forced-draught boilers provided with an atmospheric gas burner, fan and sealed combustion chamber, in such a manner as to improve combustion and obtain an ordered flame face stable under the various conditions, and with substantially reduced NOx emission.

This and further objects which will be more apparent from the detailed description given hereinafter are attained by a boiler of the indicated type, the inventive character of which is defined in the accompanying claims.

The invention will be more apparent from the detailed description of two preferred embodiments thereof provided by way of non-limiting example and illustrated on the accompanying drawings, in which:

Figure 1 is a schematic vertical section through a first embodiment of the boiler;
Figure 2 is a schematic section therethrough on the line 2-2 of Figure 1;
Figure 3 shows how the boiler of the preceding figures is installed;
Figures 4 and 5 correspond to the views shown in Figures 1 and 2 but of a further embodiment of the boiler, which is installed as shown in Figure 6.

In Figures 1 to 3, the reference numeral 1 indicates overall the wall-mounted boiler of the invention. It comprises a sealed body or casing 2 with a connector 3 for combustion air entry and a connector 4 for burnt gas discharge positioned centrally on its upper side.

Within the boiler, the connector 3 opens into a plenum chamber 5 bounded by walls 6 (extending towards the interior) and by the upper wall 7 and rear wall 8 of the casing.

In the base of the chamber 5, on the side towards the wall 8, there is provided an aperture 9 which leads to two mutually diverging manifolds 10, 11.

The manifold 10 opens at 12 into a duct 13 which, as can be seen in Figures 1 and 3, is substantially box-shaped and extends along one side of the conventional sealed combustion chamber 14 to open at the bottom at 15, at the level of the atmospheric burner unit 16.

The manifold 11 opens at 17 into a duct 18, symmetrical to the duct 13 and extending along the opposite side of the combustion chamber 14 to open at 19 at the level of the burner unit 16.

For completeness of description, the reference numeral 20 indicates a conventional heat exchanger and 21 indicates a conventional suction fan unit, the delivery side of which is connected to the burnt gas discharge connector 4.

As can be seen from Figure 3 the described boiler is connected via the connectors 3 and 4 to concentric pipes 22 leading to the outside via the wall 23 of a building, to open externally via spaced-apart exits 24, 25, the more outer 25 of which is for burnt gas discharge.

The boiler 1A shown in Figures 4 to 6 (in which identical or corresponding parts are indicated by the same reference numerals plus the letter A) differs from the preceding merely in that the combustion air entry connector 3A is not concentric with but separated from the burnt gas discharge connector 4A, to allow the combustion air to be drawn in, and the products of combustion to be discharged, via two separate pipes 30, 31 respectively, which open at different points in the example shown in Figure 6, namely in the external environment and in a chimney or the like 32.

The solution to the initially stated problems is achieved by providing within the sealed casing or body 1 of the boiler a plenum chamber 5 for the entering com-

bustion air, this chamber being connected to two ducts (left 13 and right 18) positioned on the sides of the sealed combustion chamber 14.

Via the ducts 13, 18, the combustion air flows in an ordered and uniform manner into the region in which the burner unit 16 is located.

With this arrangement the boiler, which operates mainly on primary air, operates under the same conditions as a natural-draught boiler.

In a boiler with a sealed chamber provided with a fan, if it is required to maintain the combustion efficiency constant as the thermal power varies, the combustion air throughput must be able to vary in accordance with the variation in the gas flow rate, this being achieved by varying the fan velocity.

However in order to satisfy emission regulations, in case a fault should occur in the fan velocity control device, the boiler must be provided with special safety devices which prevent it operating with emissions exceeding the allowable value.

The described combustion air plenum, conveying and distribution devices not only create an environment suitable for the operation of an atmospheric burner with mainly primary air, but also, in the case of a fault developing in the fan velocity control device, prevent emissions exceeding the allowable limits, without the use of additional safety systems.

Finally, the sealed chamber boilers can generally be arranged for connection to the following discharge and suction systems.

1. Coaxial system (Figure 3)
2. Split system (Figure 6)

Generally, known boilers with a sealed chamber provided with an atmospheric burner operating mainly with primary air can operate adequately only with the coaxial discharge-suction system, after mounting suitable registers on the gas discharge or on the combustion air feed, of size depending on the system length.

In contrast, the split discharge-suction system does not allow correct operation of known boilers because there may be unbalance between the combustion air inlet pressure and the outlet pressure of the products of combustion, with consequent poor combustion air distribution to the burner venturis.

Instead, the means of the present invention enable a boiler with a sealed chamber and atmospheric burner operating mainly with primary air to be formed which can be connected to either coaxial or split discharge-suction devices of the normal length used for traditional boilers and without mounting registers.

Claims

1. A wall-mounted boiler provided with a sealed casing (1), an atmospheric gas burner unit (16), a fan (21), a sealed combustion chamber (14), combustion air entry means and burnt gas exit means, characterised in that within the casing (1) there is provided a chamber (5) for the combustion air entering through the relative means (3, 3A), said chamber acting as a plenum chamber and being connected to ducts (13, 18) positioned along two sides of the combustion chamber (14) and opening substantially at the level of the burner unit (16).

2. A boiler as claimed in claim 1, wherein the plenum chamber (5) is connected to the two ducts (13, 18) via manifold means (10, 11).

3. A boiler as claimed in claim 1 or 1 and 2, wherein the combustion air entry means (3) and the burnt gas discharge means (4) are coaxial.

4. A boiler as claimed in claim 1 or 1 and 2, wherein the combustion air entry means (3A) and the burnt gas discharge means (4A) are separated.

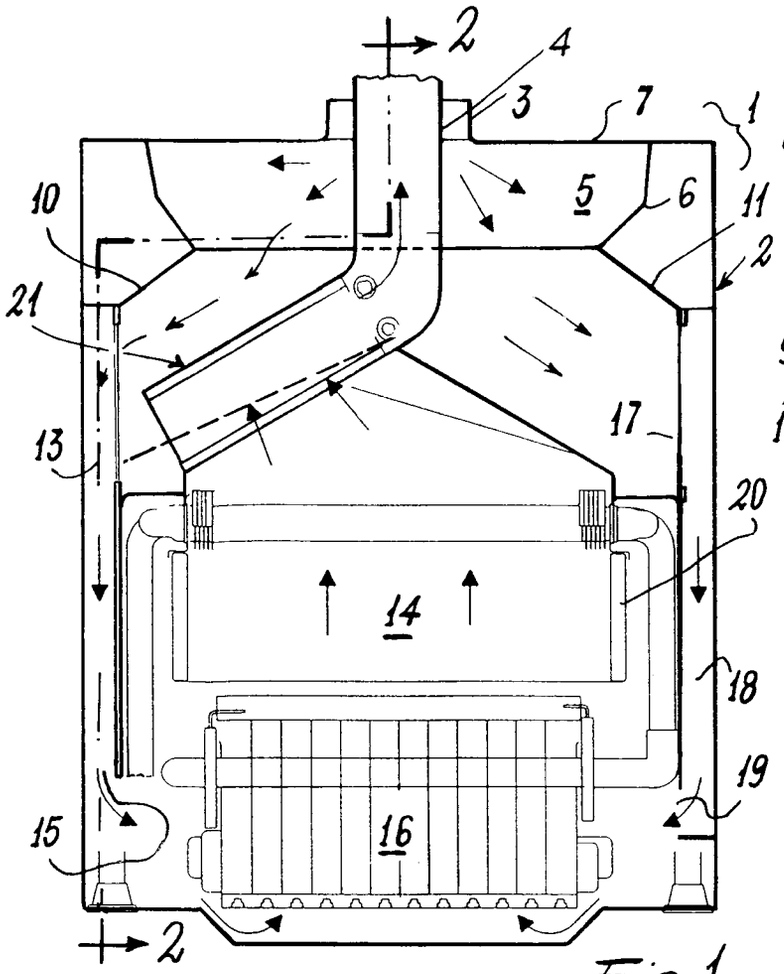

Fig. 1

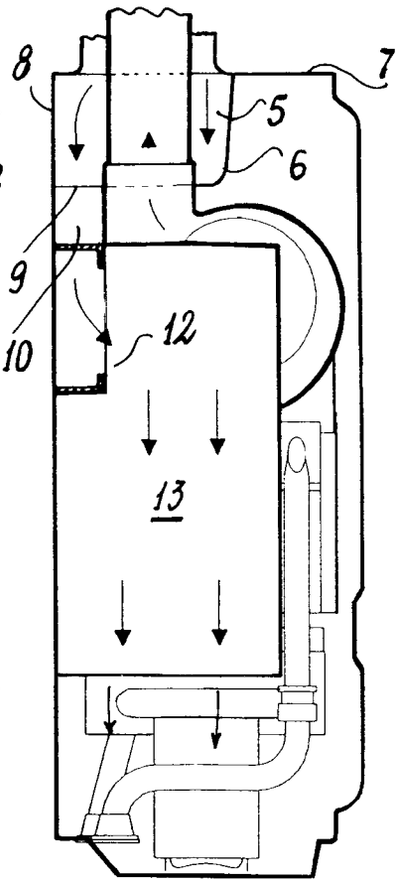

Fig. 2

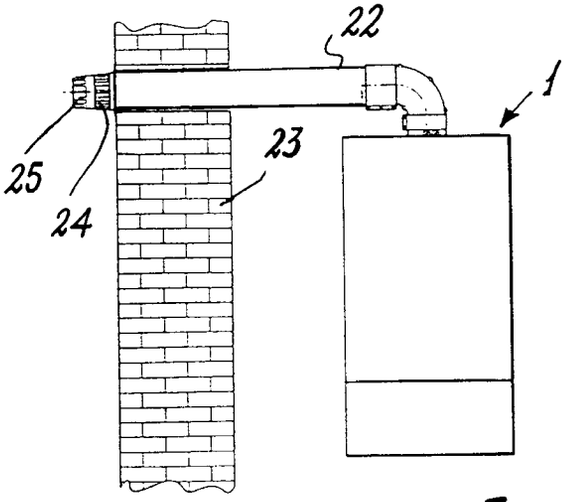

Fig. 3

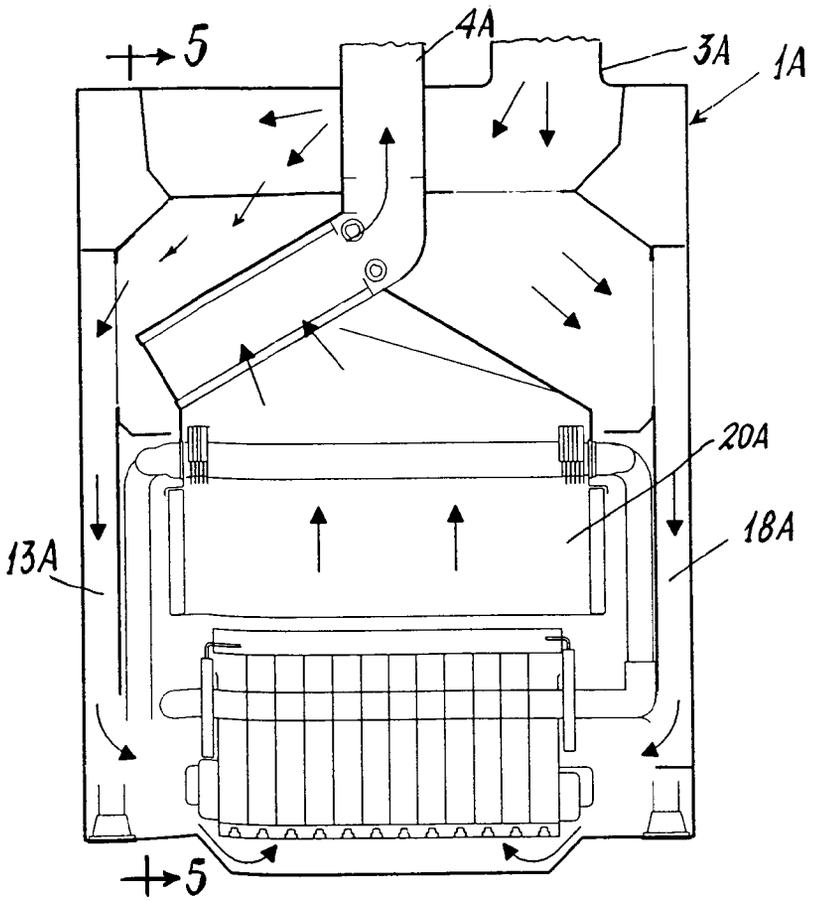

Fig. 4

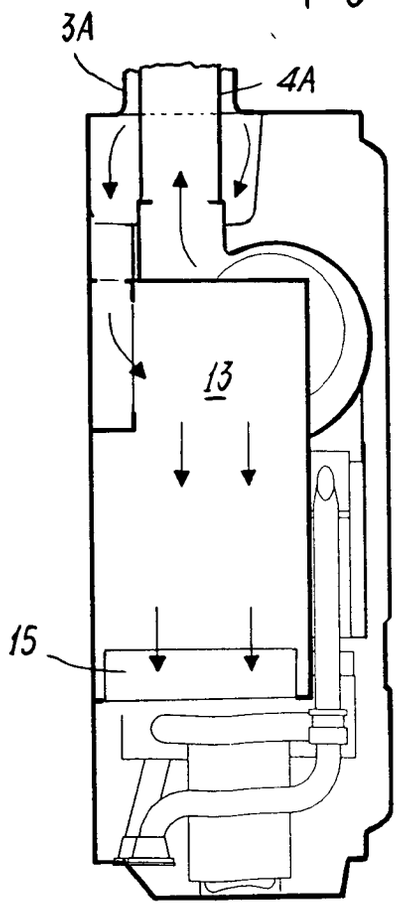

Fig. 5

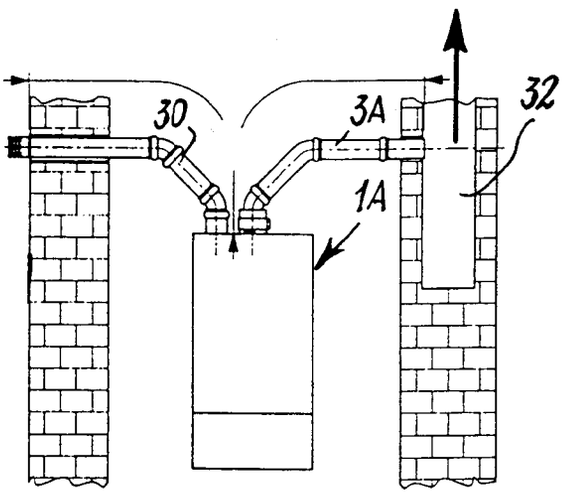

Fig. 6