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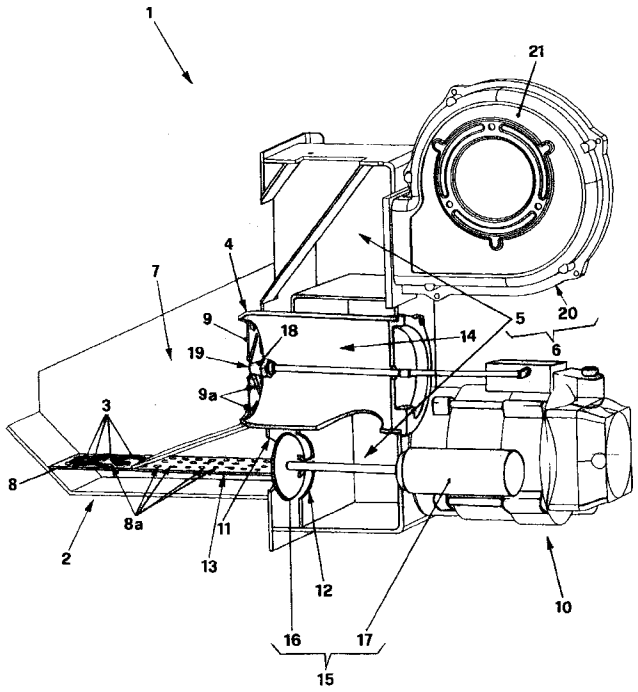
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(57) Abstract: A burner unit (1) comprising a first solid fuel (3) burner (2) and a second fluid fuel burner (4) operating in a combined manner and both connected to the exterior by means of a comburent air feeder circuit (6). The first burner (2) and the second burner (4) share a single common combustion chamber (7) wherein the flames of both burners are generated.

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BURNER UNIT AND COMBUSTION DEVICE USING SAID BURNER UNIT

DESCRIPTION

The invention relates to a burner unit of the type comprising a first solid fuel burner and a second fluid fuel burner, acting in a combined manner, particularly suited for installation in a combustion device for internal heating in buildings.

The invention also relates to a combustion device for internal heating in buildings using the aforesaid burner unit.

The use of combustion devices is a well-known concept for internal heating in both domestic and public buildings using solid fuel in very small pieces, preferably composed of cylindrical items obtained through pressing wood chips, commonly referred to as "pellets".

Said combustion devices comprise a burner unit composed of a support grid for the pellets, set at the base of a combustion chamber, commonly called a "hearth", wherein the flame is generated.

The hot fumes generated in the combustion chamber are conveyed into a heat exchange unit wherein they yield their heat to a thermal carrier fluid that, according to the situation, can be either air or water, and that is then conveyed into the room to be heated.

A well-known drawback connected with these combustion devices is linked with the difficulty in igniting the pellets which must be brought to a high temperature in order for combustion to take place.

Commonly known systems used to obtain pellet ignition foresee the use of electrical resistances to heat the support grid holding the pellets, which in turn are heated until they

ignite.

Other well-known ignition systems use electrical resistances to heat an air flow which is directed at the pellets.

With the aforesaid systems, combustion begins a few minutes after switch-on, the period necessary to heat the pellets to their ignition temperature.

This aspect causes the first drawback, in that the pellets begin to supply heat with a considerable delay in relation to the switch-on of the combustion device, creating problems for the user.

A further drawback with these ignition systems is the production of harmful gases, among which unburnt hydrocarbons and carbon monoxides, which are generated during the period in which the pellets are heated before ignition.

Another drawback connected with these ignition systems is that they require a considerable amount of electrical energy in order to supply the electrical resistances.

Yet another drawback connected with this type of combustion device is that regular pellet reloading is necessary, and if delays in reloading occur, this provokes a lack of pellets, interrupting the heat supply.

The aforesaid drawbacks also occur in a similar manner when other solid fuel is used to replace the pellets, such as coal, pieces of wood, or solid fuel of plant origin.

The present invention proposes to overcome all the aforesaid drawbacks.

In particular, a first aim of the invention is to provide a burner unit of the type comprising a solid fuel burner and a combustion device using said burner unit wherein the ignition time for the solid fuel is considerably less than that of prior art.

Another aim of the invention is to prevent prolonged flame interruption, even in cases of possible temporary lack of solid fuel.

The aforesaid aims are achieved by means of a burner unit according to the description provided in the enclosed principle claim, to which reference can be made for the sake of brevity.

The aforesaid aims are also achieved by a combustion device including the burner unit of the invention.

Other detailed characteristics of the invention are described in the subordinate claims.

According to the preferred embodiment which is described, the burner unit of the invention comprises a first solid fuel burner and a second fluid fuel burner, that share a single common combustion chamber wherein the flames of both fuels are generated.

Advantageously, the flames of the second fluid fuel burner provoke the ignition of the solid fuel within a very short time and less than the time according to prior art systems, as will be described further on.

Advantageously, the shorter ignition time also provokes a corresponding reduction in the quantity of harmful gas produced during the stage preceding ignition.

More advantageously, the energy in the form of fluid fuel required to ignite the solid fuel is less and thus less costly than the electrical energy used in systems according to prior art.

Again, more advantageously, the flames generated by the fluid fuel are more stable than those of solid fuel, above all when said fuel is of low quality, and therefore can contribute towards maintaining the total thermal power supplied by both flames, substantially constant.

Again, more advantageously, the fluid fuel burner can contribute towards compensating possible thermal peak needs.

The said aims and advantages will be explained more clearly in the following description which is provided as a non-limiting example with reference to the enclosed drawings wherein:

- figure 1 shows the burner unit of the invention, in an axonometric view;
- figure 2 shows a cross-section of the burner unit in fig. 1, in an axonometric view;
- figure 3 shows a cross-section of the combustion device of the invention, in an axonometric view.

The burner unit of the invention is shown in fig. 1, wherein it is identified throughout by the numeral 1, and it comprises a first solid fuel burner 2 and a second gas oil burner 4 operating in a combined manner.

The following description refers to a solid fuel composed of pellets 3 although, in other embodiments of the invention, any other type of small sized solid fuel could be used, such as coal, pieces of wood, or solid fuel of plant origin.

In the same manner, the gas oil burner 4 can be replaced by a different type of burner using

any type of fluid fuel, whether liquid or gaseous.

The second burner 4 shares the same combustion chamber 7 with the first burner 2, and which therefore coincides with the "hearth" of the first burner 2, wherein the flames of both burners are generated.

As can be seen in more detail in fig. 2, the burners 2, 3 are connected to a comburent air feeder circuit 6, composed of a feeder chamber 5 connected to a supply means 20 of comburent air to the said feeder chamber 5.

The aforesaid supply means 20 comprise a centrifugal fan 21 provided with a suction inlet 21a communicating with the exterior and shown in fig. 1.

The feeder chamber 5 is provided with a first opening 11 in communication with a header chamber 13 connected to the first burner 2 and with a second opening 12 in communication with a feeder pipe 14 connected to the second burner 4.

With regards to the first burner 2, it comprises a combustion grate 8 on which the pellets 3 are placed for burning, positioned between the combustion chamber 7 and the aforesaid header chamber 13, and provided with a plurality of slots 8a to permit the through-flow of the comburent air.

The second burner 4 is composed of a diaphragm element 9, positioned between the combustion chamber 7 and the feeder pipe 14 and provided with a plurality of slots 9a for the through-flow of the comburent air, and a gas oil supply unit 10.

The latter includes a nozzle 18 for gas oil distribution, positioned in the feeder pipe 14 in proximity to a central slot 19 of the diaphragm element 9.

As is common in well known aspects of burner technology, the configuration of the slots 9a of the diaphragm element 9 determines the form of the comburent air flow into the second burner 4 and therefore, the form and direction of the flame generated by the burner, as well as the efficacy of the mixing of the gas oil with the comburent air in order to maintain the flame burning.

In the preferred embodiment of the invention, diaphragm element 9 is provided with peripheral and radial slots, configured in a manner to create the flame in a substantially horizontal direction, and generated in order to form a volume which also includes the area of the pellets 3.

In this manner, the flame generated by the second burner 4 is used to ignite the pellets 3 when this is required.

Obviously, in other embodiments, the diaphragm element 9 can be configured in such a manner so that the flame follows a direction other than the horizontal direction, on condition that it is incident with the direction of the flame generated by the first burner 2, in a manner to also include the area of the pellets 3.

With regard to the feeder circuit 6, it comprises valve means 15 that distribute the comburent air flow from the feeder chamber 5 at the aforesaid openings 11, 12, to permit modulation of the thermal power produced in the burners 2, 4.

The valve means 15 comprise a mobile shutter element 16 associated with an actuator means 17 that defines the position of said shutter element 16.

The aforesaid actuator means 17 enable the shutter element 16 to be placed in a first closure position of the first opening 11 or in a second closure position of the second opening 12.

Other embodiments can provide for actuator means 17 conceived to also place the shutter element 16 in any intermediate position whatsoever between the two end positions described herein.

Furthermore, in the preferred embodiment of the invention, the two openings 11, 12 and the shutter element 16 are configured so that the shutter element never closes the two openings 11, 12 completely, thus guaranteeing a constant, although minimum air through-flow.

Firstly, this makes it possible to supply the first burner 2 with enough comburent air to provoke the ignition of the pellets 3.

Furthermore, advantageously, the constant through-flow of fresh air obtained in this manner through the combustion grate 8 and the diaphragm element 9 cools both elements preventing overheating.

The burner unit 1 also comprises a control unit for the actuator means 17, not shown, which controls the position of the shutter element 16.

Preferably, but not necessarily, the control unit includes an ignition timer, not described herein, which makes it possible to perform automatic start-up operations on the burner unit

1.

Other embodiments of the invention can also include automatic control means for the burner unit 1, possibly connected to various sensors, such as temperature sensors in the combustion chamber 7 to optimise burner unit 1 operation and/or sensors to signal depletion of pellets 3, for automatic start-up of the second burner 4 in the case of pellet lack.

A wide range of the aforesaid control means and the relative sensors, not described herein, are available in technical fields dealing with control systems for burners and combustion devices in general.

As stated previously, and illustrated in fig. 3, the burner unit 24 of the invention is housed in the specifically shaped casing 23 of a combustion device 22.

The combustion device 22 is provided with pellet supply means 28 to the first burner 25 of the burner unit 24, and composed of a conveyor means 29 for the pellets 3 from a pellet storage container 30 to the first burner 25.

Preferably, the pellet 3 conveyor means 28 are composed of a screw feeder device having one end associated with the storage container 30, and the opposite end operationally connected to the first burner 25.

Naturally, in embodiments of the combustion device 22 of the invention, the second burner 26 of the burner unit 24 can be of a type different from that described herein, able to use any kind of fluid fuel, whether liquid or gaseous.

The combustion device 22 of the invention also foresees a means of heat exchange 31 between the hot fumes generated in the combustion chamber of the burner unit 24 and a fluid to heat the rooms which, as stated previously, is composed of any type of thermal carrier fluid such as air or water.

Naturally, in other embodiments the burner unit 1, 24 of the invention can also include one or more auxiliary electrical resistances, able to intervene to ignite the pellets 3 in emergency conditions, such as lack of fluid fuel, for example.

In said emergency conditions, the burner unit 1, 24 operates in the same manner as conventionally known burner units.

Operatively speaking, the burner unit 1, 24 is started up manually by the user, or by

conventional automatic control means, to command the ignition of the second gas oil burner 4, 26.

During this stage, the control unit operates the actuator means 17 of the shutter element 16 to place the latter in the closure position of the first opening 11 in communication with the header chamber 13 of the first burner 2, 25.

Therefore, the only flame present in the combustion chamber 7, 27 is that produced by the combustion of the gas oil.

Said flame is configured in a manner to hit the pellets 3 and therefore to provoke rapid ignition.

Ignition times of approximately 10-20 seconds were measured during tests performed on the burner unit of the invention, as opposed to the 5-10 minutes obtained using conventional means.

Therefore the aim has been achieved to create a burner unit 1, 24 that provides pellet 3 ignition times considerably shorter than those obtainable using conventional ignition means.

After an established time following the start-up of the burner unit 1, 24, sufficient to guarantee the pellet ignition and measured by the ignition timer, the control unit places the shutter element 16 in the closure position of the second opening 12.

In this manner, the flame of the second burner 4, 26 is extinguished and the only flame which remains alight in the combustion chamber 7, 27 is that produced by the pellet 3 combustion.

Advantageously, the presence of the ignition timer permits the automatic extinguishing of the second burner 4, 26 as well as the ignition of the first burner 2, 25, in this way eliminating any need for intervention by the user.

Naturally, if required, it is possible to start up the second gas oil burner 4, 26 at any time manually or automatically, by using it to replace the first burner 2, 25 for example, in the case of pellet 3 depletion.

This method achieves the aim of avoiding extended periods without a flame in the burner unit 1, 24.

As described previously, in the embodiments which foresee that the shutter element 16 can

assume any intermediate position between the two end positions, the two flames in the two burners can be both maintained alight in order to combine their effects.

When automatic control means such as those described above are used, this advantageously permits precision adjustment of the total thermal power produced in the burner unit l, 24, in order to maintain it constant, for example.

As stated previously, all aspects described up to this point are just as valid in cases where, instead of using pellets 3, any other solid fuel in small pieces is used, such as coal, pieces of wood or fuel of plant origin.

According to the descriptions provided up to this point, it is clear that the burner unit and the combustion device used therein, both of which are objects of present invention, achieve all the aims as established.

In particular, the flame of the second fluid fuel burner makes it possible to obtain the ignition of the solid fuel in a time lapse that is considerably shorter than that of conventional ignition systems of prior art.

Furthermore, the flame produced by the second burner is able to compensate any possible depletion of solid fuel, maintaining continued heat distribution by the burner.

During construction, modifications and improvements can be applied to the burner unit of the invention and to the combustion device used therein.

It is obvious that if said modifications or improvements not described or illustrated herein are included in the concepts described in the following claims, they are to be all considered protected by the present patent.

CLAIMS

Claim 1 Burner unit (1) of the type comprising a first solid fuel (3) burner (2) and a second fluid fuel burner (4) operating in a combined manner, and both connected to the exterior by means of a comburent air feeder circuit (6),

characterised in that

said first burner (2) and said second burner (4) share a single common combustion chamber (7) wherein the flames of both burners are generated.

Claim 2 Burner unit (1) according to claim 1,

characterised in that

at least the flame produced by the combustion of said solid fuel (3) is present in said combustion chamber (7).

Claim 3 Burner unit (1) according to claim 1,

characterised in that

at least the flame produced by the combustion of said fluid fuel (3) is present in said combustion chamber (7).

Claim 4 Burner unit (1) according to claim 1,

characterised in that

both the flames produced by the combustion of said solid fuel (3) and the combustion of said fluid fuel are simultaneously present in said combustion chamber (7).

Claim 5 Burner unit (1) according to claim 4,

characterised in that

said flames produced by the combustion of said solid fuel (3) and the combustion of said fluid fuel are generated in directions incident to one another.

Claim 6 Burner unit (1) according to claim 1,

characterised in that

said feeder circuit (6) includes a feeder chamber (5) connected to said comburent air supply means (20) and provided with a first opening (11) communicating with a header chamber (13) connected to said first burner (2) and with a second opening (12) communicating with a feeder pipe (14) connected to said second

burner (4), there being also present valve means (15) to distribute the flow of said comburent air between said first opening (11) and said second opening (12).

Claim 7 Burner unit (1) according to claim 6,
characterised in that
said first burner (2) includes a combustion grate (8) for said solid fuel (3) provided with a plurality of slots (8a) positioned between said combustion chamber (7) and said header chamber (13).

Claim 8 Burner unit (1) according to claim 6,
characterised in that
said second burner (4) includes a diaphragm element (9) provided with a plurality of slots (9a) positioned between said feeder pipe (14) and said combustion chamber (7) and a supply unit (10) of said fluid fuel.

Claim 9 Burner unit (1) according to claim 6,
characterised in that
said valve means (15) include a mobile shutter element (16) associated with actuator means (17) conceived to define for said shutter element (16) at least one first closure position of said first opening (11) and a second closure position of said second opening (12).

Claim 10 Burner unit (1) according to claim 9,
characterised in that
said actuator means (17) are conceived to define for said shutter element (16) a first closure position for said first opening (11), a second closure position for said second opening (12) and an intermediate position whatsoever between the two openings.

Claim 11 Burner unit (1) according to any one of the claims 9 or 10,
characterised in that it includes a control unit for said actuator means (17).

Claim 12 Burner unit (1) according to claim 11,
characterised in that
said control unit includes an ignition timer.

Claim 13 Burner unit (1) according to claim 8

characterised in that said supply unit (10) includes a nozzle (18) positioned inside said feeder pipe (14) in proximity to a central slot (19) of said diaphragm element (9).

Claim 14 Burner unit according to claim 6,

characterised in that

said supply means (20) of said feeder circuit (6) include at least a centrifugal fan (21) provided with an intake suction inlet (21a) for said comburent air, communicating with the exterior.

Claim 15 Burner unit (1) according to any one of the previous claims

characterised in that said fluid fuel is a gas.

Claim 16 Burner unit (1) according to any one of the previous claims

characterised in that said fluid fuel is a liquid.

Claim 17 Burner unit (1) according to any one of the previous claims

characterised in that said solid fuel (3) is composed of pellets.

Claim 18 Combustion device (22) for internal room heating composed of a specifically shaped casing (23) enclosing:

- a burner unit (24) of the type composed of a first solid fuel (3) burner (25) and a second fluid fuel burner (26) operating in a combined manner and both connected to the exterior by means of a feeder circuit for comburent air;
- supply means (28) of said solid fuel (3) in said first burner (25);
- means of heat exchange (31) between the hot fumes generated by the combustion in said burner unit (24) and the fluid for the heating of said rooms;

characterised in that

said first burner (25) and said second burner (26) share a single common combustion chamber (27) wherein the flames of both burners are generated.

Claim 19 Combustion device (22) according to claim 18,

characterised in that said fluid fuel is a gas.

Claim 20 Combustion device (22) according to claim 18 characterised in that said fluid

fuel is a liquid.

Claim 21 Combustion device (22) according to any one of the claims from 18 to 20, characterised in that said solid fuel (3) is composed of pellets.

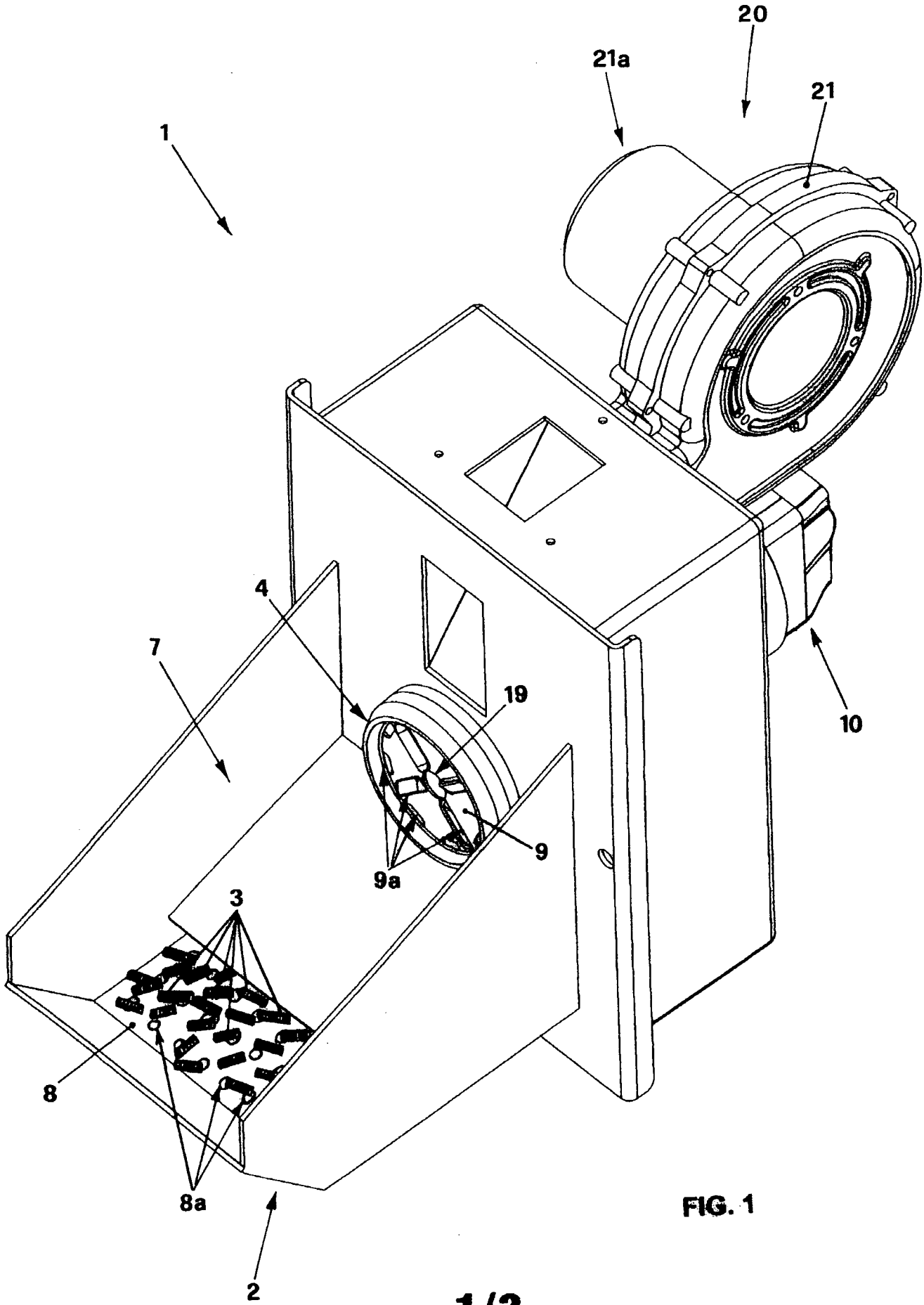


FIG. 1

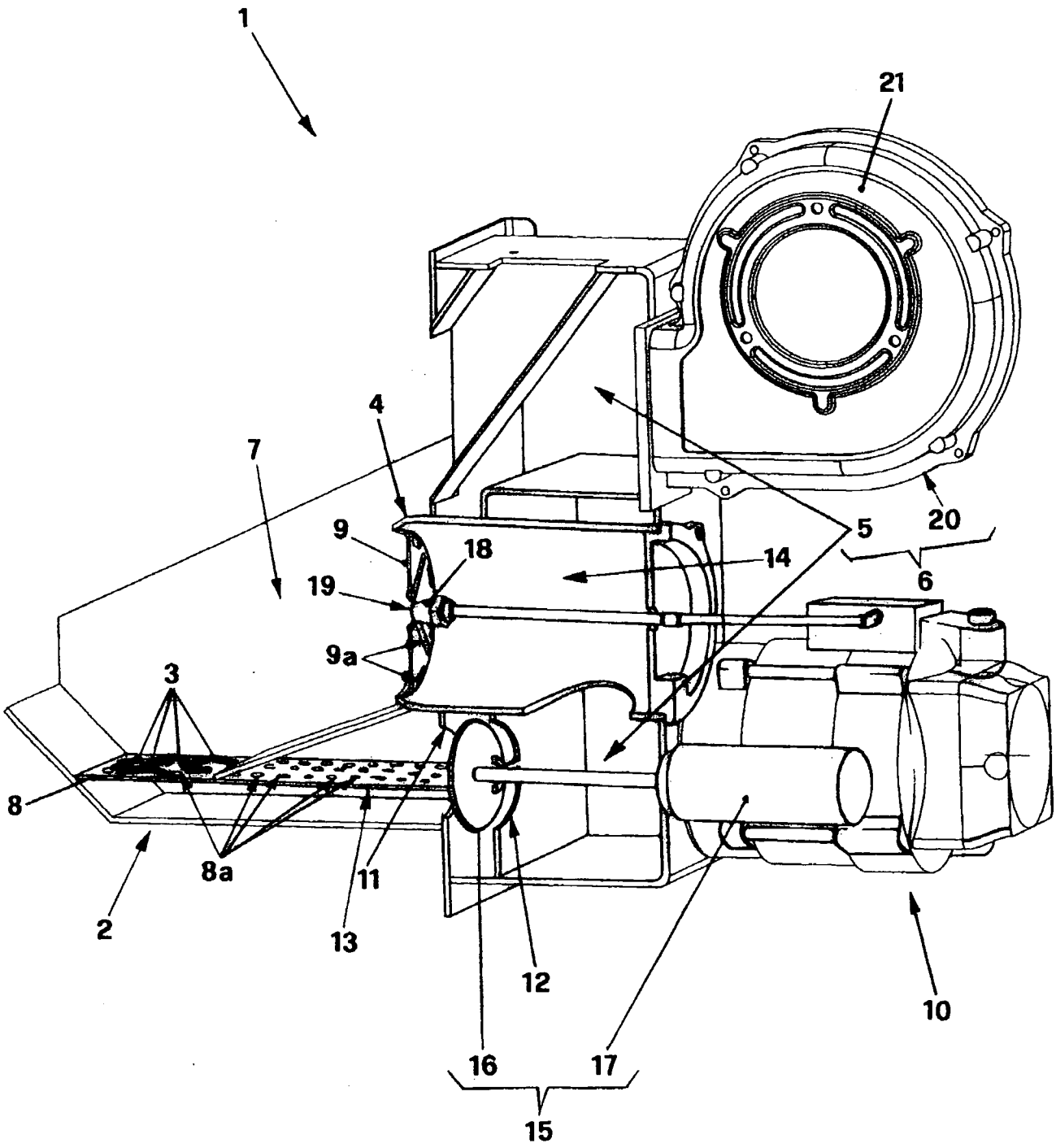


FIG. 2

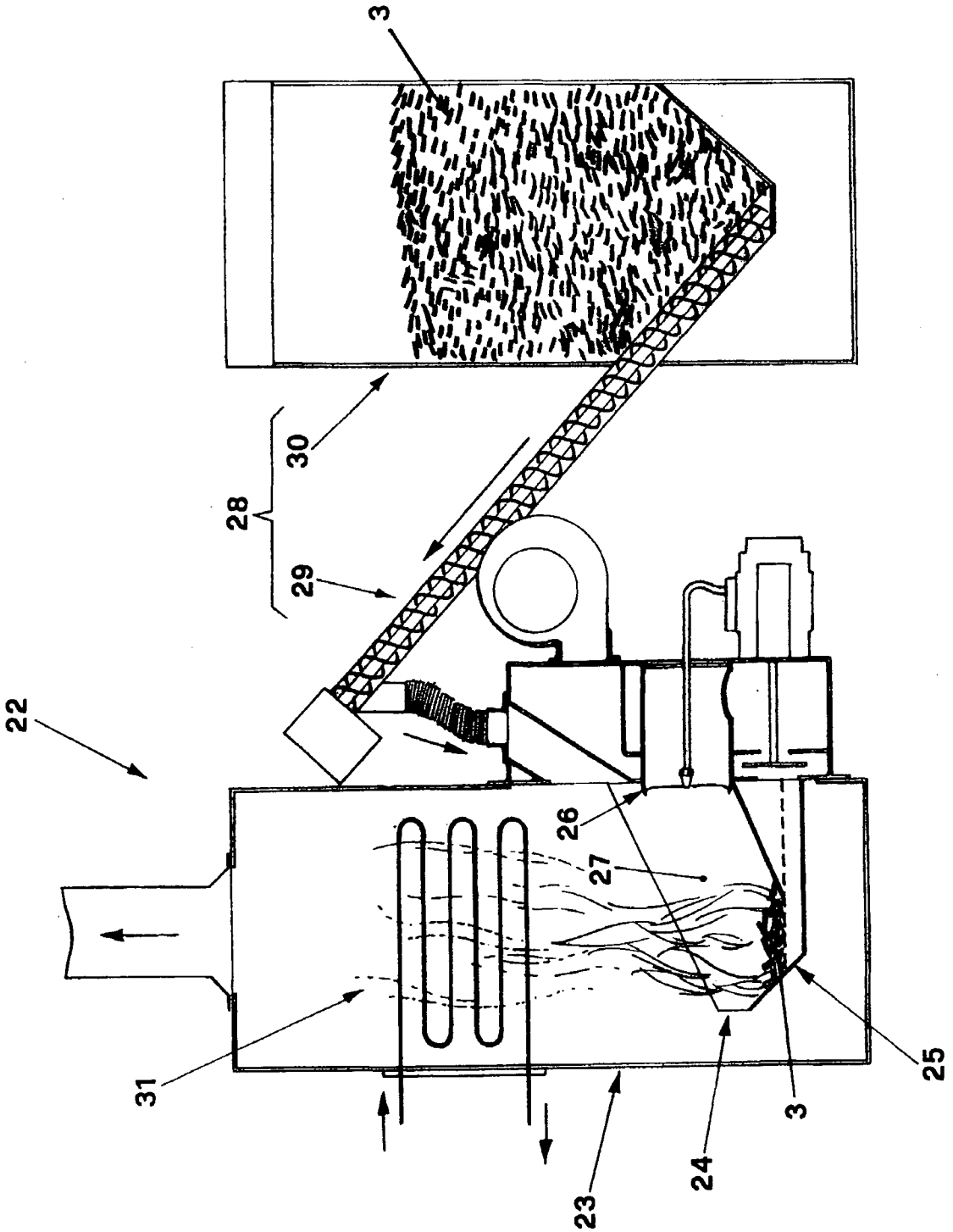


FIG. 3