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(54) **Compact silencer for a condensation boiler**

Kompakter Schalldämpfer für einen Kondensationsboiler

Silencieux compact pour chaudière à condensation

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Description

[0001] The present invention relates to a silencer for a wall-mounted gas-fired condensation boiler in accordance with the introduction to the main claim.

[0002] A boiler of the stated type is known to comprise a burner which receives a mixture of gas and air through a conduit connected to a fan. This latter is operationally associated with a mixer member receiving the gas and the combustion air.

[0003] In recent years condensation boilers have become increasingly more important because of their high efficiency. In this respect, there is a known tendency to reduce wastage of currently available energy sources by paying maximum attention to their utilization and seeking to achieve maximum efficiency in their use. This tendency also applies to natural gas.

[0004] To achieve optimal utilization of this gas, it is known to construct buildings which are better insulated thermally than in the past and which use high-performance condensation boilers, which however have a much lower thermal power than previously (from 3 to 5 kW during heating). However this power reduction opposes the need for the availability of ever more hot water in living accommodation, often due to the presence of two or more bathrooms.

[0005] The result is that boiler manufacturers are faced with two apparently opposing requirements, i.e. to provide boilers of very low thermal power during heating but of high thermal power during hot water production. These requirements result in the construction of boilers with a high modulation range: currently a condensation boiler has a modulation range from 8 kW to 24 kW or from 10 to 28 kW, whereas the objective is to guarantee a variation from 2 kW to 24 kW or from 3 kW to 28 kW.

[0006] The use of condensation boilers is becoming increasingly more important. However, improving efficiency in small-dimension boilers intended for domestic heating by increasing the boiler power density results in "sound" problems linked to the generation of low frequency vibration or high frequency hissing. These problems derive from fluctuations in the pressure of the fuel/air mixture within the burner and variations in the flow of combustion air or of the air/fuel mixture through the conduits and members connected to the burner or combustion chamber.

[0007] Because of these problems, it is known to use silencers where the combustion air enters towards the mixer member. However, known silencers present various complex geometries which are bulky and negatively affect the overall boiler dimensions, which cannot be reduced to enable it to occupy a dedicated space within a kitchen or compartment provided to contain it.

[0008] DE 10202702, which forms the basis for the preamble of the main claim, describes a heating device which comprises a housing into which an air inlet line and an exhaust gas outline open. A fuel/air mixture branch, preferably provided with a fuel fitting, is joined to the air

inlet line. The air inlet line is provided on its inlet side with a tubular extension and has a wedge-shaped section at least partly filled with sound-absorbing or sound-dampening material and having a tapered end oriented in the flow direction of the air inlet line. The wedge-shaped section has at least one region of more or less constant cross-section which is partly filled with sound-absorbing material.

[0009] FR 2043926 relates to a rotary pump mainly of the vortex type, mainly to use the fan to move the air or other gaseous medium. The pump comprises a rotor consisting of an impeller or the like rotating within an annular duct which is incompletely filled, so as to promote the swirling motion of the air. The pump also comprises a silencer interposed between the inlet ducts and the outlet and rotor.

[0010] GB1589007 relates to a boiler with a burner with combustion air fan for liquid or gaseous fuels with at least one combustion chamber gate, whose gate plate is formed as a base plate for the burner and has a protective plate spaced therefrom on the side of the combustion chamber, the free space thus created serving as a supply means for combustion air; the free space between the gate plate and the protective plate is formed as a spiral blower casing with a fan blower provided therein. A part of the free space may advantageously be formed as a spiral casing, the chambers formed by such subdivision of the free space having a common connection for the flow of air.

[0011] EP 0126221 (A2) relates to a forced-draught burner which consists of a rotor housing having an air intake opening for the motor-driven compressor and an air blow-out opening in the vicinity of the housing for the combustion jet. On the intake side, there is arranged before the rotor housing an intake housing in whose lateral enclosing wall is located the outer intake opening. Within the intake housing, a flow guide web extends approximately in the form of a spiral from the outer intake opening to the inner intake opening.

[0012] An object of the present invention is to provide a silencer which is highly efficient but of reduced dimensions compared with known silencers, to enable it to be used within boilers of small dimensions (for example 700 mm height x 390 mm width x 290 mm depth).

[0013] Another object is to provide a silencer of the stated type which is of simple construction and easy to mount within a condensation boiler.

[0014] These and other objects which will be apparent to the expert of the art are attained by a silencer in accordance with the accompanying claims.

[0015] The present invention will be more apparent from the accompanying drawings, which are provided by way of non-limiting example and in which:

Figure 1 is a front view of a condensation boiler with its front wall removed for clarity, but provided with a silencer according to the invention;

Figure 2 is a perspective view of the silencer of Figure

1 associated with a functional part of the boiler;
 Figure 3 is an exploded view of that shown in Figure 2;
 Figure 4 is a transparent view of the silencer of Figure 1; and
 Figure 5 is an exploded view of the silencer of Figure 4.

[0016] With reference to said figures, Figure 1 shows a condensation boiler 1 comprising an outer casing 2 containing a burner 3 which receives a mixture of air and gas via a mixing conduit 4. This is connected to a fan 5 itself connected to a mixer member 6 of known type, connected to a gas conduit 7. The mixer member 6 is connected to a silencer 9 to which atmospheric air flows.

[0017] According to the invention, the silencer 9 comprises a box body 12 having perimetral side walls 16 and 17, an upper wall 18, a lower wall 19 and an end wall 20 (all with reference to Figures 1, 4 and 5) provided with an aperture 21. The body 12 is not provided with the second end side wall but with an opening 23 thereat. Through this, a baffle 24 is inserted (to form a perfect seal), defined by a first wall which is straight (or in any event such as to be able to be disposed longitudinally within a longitudinal cavity 30 of the body 12 bounded by the walls 16, 17, 18, 19 and 20) and is arranged slightly inclined to a central plane P through said body 12 perpendicular to the lower wall 19 so as to define within the body 12 a first conduit 31 (connected to the aperture 21) in combination with the upper wall 18, side wall 16 and end wall 20 thereof, against which the wall 25 rests.

[0018] The baffle 24 is associated with a wall 32 to be positioned against the end opening 23 of the body 12, to close it. In proximity to this wall 32, the baffle 24 presents an aperture or recess 36 bounded by said wall 32 and by a web 37 associated with the baffle 24 and directed, when the baffle is inserted into the body 12, towards the lower wall 19 and the side wall 17 thereof, against which it rests. This web is connected to a second wall 39 separating from the first wall 25 of the baffle 24 and directed towards and resting on the said side wall 17 of the body 12 to define in combination with this latter wall, with the upper wall 18 and with the web 37, a second conduit 40 through which the air moves in the opposite direction to that through the conduit 31. This second wall 39 is inclined to the first wall.

[0019] The wall 39 has a length less than the baffle and has its free end 39A spaced from that side wall 20 of the body 12 which faces it.

[0020] In this manner, within the conduit 40 an aperture 42 is obtained directed towards another (third) conduit 44 lying below the wall 39 and bounded at one end by the web 37 and by the walls 17 and 19 of the body 12. The web 37 rests on the perimetral wall 16 and, as already stated, on the lower wall 19 to close the conduit 44 at a through hole 50 provided in the wall 16.

[0021] In this manner, the silencer 9 comprises an aperture 21 for its air entry, and substantially parallel con-

duits 31, 40 and 44 through which the air entering the box body 12 passes (arrows K, W and X respectively) until it reaches the hole 50 through which the air leaves the silencer (arrow Y). This hole 50 is connected to the mixer member 6 so that the air which has passed through the silencer can reach this member and the fan 5 connected to it. Any resonance, hissing, etc. is damped within the silencer, with the result that the boiler is silent in use.

[0022] Because of the particular formation of the silencer 9, i.e. of the body 12 containing a plurality of substantially parallel conduits for air passage, a relatively lengthy path is achieved for the air, but within an environment (the body 12) of small dimensions: by way of example, the body 12 can have a depth (distance between the wall 20 and the wall 32) between 180 and 270 mm, preferably between 210 and 230 mm, such as to enable it to be used in a boiler of less than 300 mm in depth.

[0023] The baffle 24 of the silencer 9 also performs the function of guiding the air flows within the body 12 (intake and delivery to the fan), so reducing pressure drops.

[0024] A preferred embodiment of the invention has been described. Others are however possible (such as that in which the silencer 9 presents a baffle 24

[0025] defining only two parallel conduits within its body 12, with the apertures 21, 50 being provided in the same wall of the body) and are to be considered as falling within the scope of the following claims.

Claims

1. For a wall-mounted gas-fired condensation boiler (1), a silencer for introducing air into a mixer member (6) which receives the gas and is connected to a fan (5) which feeds this gas and said air to a conduit (4) connected to a burner (3), said silencer (9) presenting a body (12) having a first aperture (21) for drawing air from the external environment and a second aperture (50) to which the mixer member (6) can be connected for its air intake, at least two parallel conduits (31, 40, 44) being provided within said body (12) and being separated by a dividing wall or baffle (24) provided with at least one internal aperture (36) to enable communication between said conduits (31, 40, 44), said baffle (24) creating two parallel combustion air flows and guiding these to the mixer member (6), **characterised in that** the baffle (24) is separate from the silencer body (12) and is arranged to be inserted securely into a cavity (30) defined within the body (12) by its side walls (16, 17), upper wall (18) lower wall (19) and end wall (20), another end of this body having an opening (23) to enable the baffle (24) to be inserted into the body (12), the baffle comprising an end wall (32) which becomes positioned against the opening (23) when the baffle is inserted into said body (12), to hence close it.

2. A silencer as claimed in claim 1, **characterised in that** its first aperture (21) is provided in the end wall (20) of its body (12), the other aperture (50) being provided in a different wall (17) of said body (12).
3. A silencer as claimed in claim 1, **characterised in that** said first and second aperture (21, 50) are provided in the same wall of said body (12).
4. A silencer as claimed in claim 1, **characterised by** comprising three parallel conduits (31, 40, 44) provided in the silencer body (12) and bounded by the baffle (24) and by the walls (16, 17, 18, 19, 20) of said body (12).
5. A silencer as claimed in claim 4, **characterised in that** said baffle (24) comprises a first straight wall (25) to lie longitudinally within the silencer body (12), a web (37) deviating from said first wall (25) and a second wall (39) inclined to said first wall and fixed to it.
6. A silencer as claimed in claim 1, **characterised in that** said first wall (25) is advantageously inclined to a central plane (P) through said silencer body (12) and rests against the upper wall (18), against at least one side wall (16) and against the end wall (20) of said body, to hence define the conduits (31, 40, 44) within the silencer (9).
7. A silencer as claimed in claim 5, **characterised in that** the web (37) rests against the lower wall (19) of the silencer body (12) and against a side wall (17) of this latter, this web, in combination with the first wall (25) and second wall (39) of the baffle (24) and the upper wall (18) of said body (12), defining within the silencer the second conduit (40), which is parallel to the first (31) and through which the air moves in the opposite direction to that in which it moves through the first conduit (31), these conduits being connected together by an aperture (36) in the baffle (24).
8. A silencer as claimed in claim 7, **characterised in that** the second wall (39) of the baffle (24) rests against a side wall (17) of the silencer body (12) and has a free end (39A) spaced from that end wall (20) of said body (12) which faces it, to hence define an aperture (42) which connects the second conduit (40) to a third silencer conduit (44) defined by the second wall (39) and by a side wall (17) of the silencer body (12), and bounded by the web (37) of the baffle (24), said third conduit being connected to the second aperture (50) of the silencer (1), the air passing through this third conduit in the same direction as its passage through the first conduit.
9. A silencer as claimed in claim 1, **characterised by**

having a depth, measured longitudinally, of between 180 and 270 mm and preferably between 210 and 230 mm.

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Patentansprüche

1. Schalldämpfer für einen wandmontierten, gasbefeue-
erten Kondensationsboiler (1) zum Einführen von
Luft in ein Mischerelement (6), das das Gas erhält
und mit einem Lüfter (5) verbunden ist, der das ge-
nannte Gas und die genannte Luft zu einer mit einem
Brenner (3) verbundenen Leitung (4) zuführt, wobei
der genannte Schalldämpfer (9) einen Körper (12)
mit einer ersten Öffnung (21) zum Ziehen von Luft
aus der äußeren Umgebung sowie einer zweiten Öff-
nung (50) zur Verbindung mit dem Mischerelement
(6) zum Lufteinlass aufweist, wobei mindestens zwei
zueinander parallel verlaufende Leitungen (31, 40,
44) in dem genannten Körper (12) vorhanden sind
und durch eine Trennwand oder Blende (24) ge-
trennt sind, wobei die Blende mit mindestens einer
inneren Öffnung (36) versehen ist, um die Kommu-
nikation zwischen den genannten Leitungen (31, 40,
44) zu erlauben, wobei die genannte Blende (24)
zwei zueinander parallel verlaufende Verbren-
nungsluftströme erzeugt und sie zum Mischerele-
ment (6) führt, **dadurch gekennzeichnet, dass** die
Blende (24) von dem Schalldämpferkörper (12) ge-
trennt ist und derart angeordnet ist, dass sie in einen
Hohlraum (30) fest eingeführt wird, die in dem Körper
(12) durch ihre Seitenwände (16, 17), durch ihre
Oberwand (18), durch ihre Unterwand (19) und
durch ihre Endwand (20) bestimmt ist, wobei ein an-
deres Ende dieses Körpers eine Öffnung (23) haben,
um die Einführung der Blende (24) in den Körper
(12) zu erlauben, wobei die Blende eine Endwand
(32) umfasst, die gegen die Öffnung (23) angeordnet
ist, wenn die Blende in den genannten Körper (12)
eingeführt wird, um ihn dementsprechend zu schlie-
ßen.
2. Schalldämpfer nach Anspruch 1, **dadurch gekenn-
zeichnet, dass** seine erste Öffnung (21) in der End-
wand (20) seines Körpers (12) vorhanden ist, wobei
die andere Öffnung (50) in einer unterschiedlichen
Wand (17) des genannten Körpers (12) vorhanden
ist.
3. Schalldämpfer nach Anspruch 1, **dadurch gekenn-
zeichnet, dass** die genannte erste Öffnungen und
die genannte zweite Öffnung (21, 50) in derselben
Wand des genannten Körpers (12) vorhanden sind.
4. Schalldämpfer nach Anspruch 1, **dadurch gekenn-
zeichnet, dass** er drei zueinander parallel verlau-
fende Leitungen (31, 40, 44) umfasst, die in dem
Schalldämpferkörper (12) vorhanden und durch die

Blende (24) und durch die Wände (16, 17, 18, 19, 20) des genannten Körpers (12) begrenzt sind.

5. Schalldämpfer nach Anspruch 4, **dadurch gekennzeichnet, dass** die genannte Blende (24) eine erste, in Längsrichtung innerhalb des Schalldämpferkörpers (12) liegende, geradlinige Wand (25) umfasst, wobei eine Bahn (37) von der genannten ersten Wand (25) abweicht und eine zweite Wand (39) zur genannten ersten Wand geneigt ist und daran befestigt ist. 5 10
6. Schalldämpfer nach Anspruch 1, **dadurch gekennzeichnet, dass** die genannte erste Wand (25) vorteilhaft zu einer mittleren Ebene (P) über dem genannten Schalldämpferkörper (12) geneigt ist und gegen die Oberwand (18), gegen mindestens eine Seitenwand (16) und gegen die Endwand (20) des genannten Körpers liegt, so dass sie die Leitungen (31, 40, 44) innerhalb des Schalldämpfers (9) bestimmt. 15 20
7. Schalldämpfer nach Anspruch 5, **dadurch gekennzeichnet, dass** die Bahn (37) gegen die Unterwand (19) des Schalldämpferkörpers (12) und gegen eine Seitenwand (17) davon liegt, wobei die genannte Bahn, in Verbindung mit der ersten Wand (25) und der zweiten Wand (39) der Blende (24) und der Oberwand (18) des genannten Körpers (12), die zweite Leitung (40) innerhalb des Schalldämpfers bestimmt, wobei die zweite Leitung parallel zu der ersten (31) verläuft und die Luft durch die zweite Leitung in der entgegengesetzten Richtung relativ zu der durch der ersten Leitung (31) fließt, wobei diese Leitungen durch eine Öffnung (36) in der Blende (24) miteinander verbunden sind. 25 30 35
8. Schalldämpfer nach Anspruch 7, **dadurch gekennzeichnet, dass** die zweite Wand (39) der Blende (24) gegen eine Seitenwand (17) des Schalldämpferkörpers (12) liegt und ein freies, von der ihm zugewandten Endwand (20) des genannten Körpers (12) abgestandenes Ende (39A) hat, um eine Öffnung (42) zu bestimmen, die die zweite Leitung (40) mit einer dritten Leitung (44) des Schalldämpfers verbindet, die durch die zweite Wand (39) und durch eine Seitenwand (17) des Schalldämpferkörpers (12) bestimmt ist und die durch die Bahn (37) der Blende (24) begrenzt ist, wobei die genannte dritte Leitung mit der zweiten Öffnung (50) des Schalldämpfers (1) verbunden ist, wobei die Luft durch diese dritte Leitung in derselben Richtung als in der ersten Leitung fließt. 40 45 50
9. Schalldämpfer nach Anspruch 1, **dadurch gekennzeichnet, dass** er eine in Längsrichtung gemessene Tiefe zwischen 180 und 270 mm und vorzugsweise zwischen 210 und 230 mm hat. 55

Revendications

1. Silencieux pour chaudière à gaz murale à condensation (1), pour introduire de l'air dans un élément mélangeur (6) qui reçoit le gaz et qui est connecté à un ventilateur (5) qui alimente ledit gaz et ledit air à un conduit (4) connecté à un brûleur (3), ledit silencieux (9) présentant un corps (12) ayant une première ouverture (21) pour aspirer l'air de l'environnement extérieur et une seconde ouverture (50) à laquelle l'élément mélangeur (6) peut être connecté pour son admission d'air, au moins deux conduits parallèles (31, 40, 44) étant prévus à l'intérieur dudit corps (12) et étant séparés par un mur ou une cloison de division (24) pourvu d'au moins une ouverture intérieure (36) pour permettre la communication entre lesdits conduits (31, 40, 44), ladite cloison (24) formant deux courants d'air de combustion parallèles et guidant les mêmes à l'élément mélangeur (6), **caractérisé en ce que** la cloison (24) est séparée du corps (12) du silencieux et est agencée pour être introduite fermement dans une cavité (30) définie à l'intérieur du corps (12) par ses parois latérales (16, 17), sa paroi supérieure (18), sa paroi inférieure (19) et sa paroi d'extrémité (20), une autre extrémité de ce corps ayant une ouverture (23) pour permettre d'introduire la cloison (24) dans le corps (12), la cloison comprenant une paroi d'extrémité (32) qui est positionnée contre l'ouverture (23) lorsque la cloison est introduite dans ledit corps (12), de façon à le fermer.
2. Silencieux selon la revendication 1, **caractérisé en ce que** sa première ouverture (21) est prévue dans la paroi d'extrémité (20) de son corps (12), l'autre ouverture (50) étant prévue dans une paroi différente (17) du dit corps (12).
3. Silencieux selon la revendication 1, **caractérisé en ce que** ladite première et seconde ouverture (21, 50) sont prévues dans la même paroi dudit corps (12).
4. Silencieux selon la revendication 1, **caractérisé en ce qu'il** comprend trois conduits parallèles (31, 40, 44) prévus dans le corps (12) du silencieux et délimités par la cloison (24) et par les parois (16, 17, 18, 19, 20) dudit corps (12).
5. Silencieux selon la revendication 4, **caractérisé en ce que** ladite cloison (24) comprend une première paroi rectiligne (25) posée longitudinalement à l'intérieur du corps (12) du silencieux, une bande (37) s'écartant de ladite première paroi (25) et une seconde paroi (39) inclinée par rapport à ladite première paroi et fixée à elle.
6. Silencieux selon la revendication 1, **caractérisé en**

ce que ladite première paroi (25) est avantageusement inclinée par rapport à un plan central (P) traversant ledit corps (12) du silencieux et s'appuie contre la paroi supérieure (18), contre au moins une paroi latérale (16) et contre la paroi d'extrémité (20) dudit corps, pour définir ainsi les conduits (31, 40, 44) à l'intérieur du silencieux (9). 5

7. Silencieux selon la revendication 5, **caractérisé en ce que** la bande (37) s'appuie contre la paroi inférieure (19) du corps (12) du silencieux et contre une paroi latérale (17) de ce dernier, cette bande, en association avec la première paroi (25) et la seconde paroi (39) de la cloison (24) et la paroi supérieure (18) dudit corps (12), définissant à l'intérieur du silencieux le deuxième conduit (40), qui est parallèle au premier (31) et à travers lequel l'air s'écoule dans la direction opposée à sa direction d'écoulement à travers le premier conduit (31), ces conduits étant connectés l'un à l'autre par une ouverture (36) dans la cloison (24). 10 15 20

8. Silencieux selon la revendication 7, **caractérisé en ce que** la seconde paroi (39) de la cloison (24) s'appuie contre une paroi latérale (17) du corps (12) du silencieux et a une extrémité libre (39A) écartée de ladite paroi d'extrémité (20) dudit corps (12) lui faisant face, pour définir ainsi une ouverture (42) qui connecte le deuxième conduit (40) à un troisième conduit (44) du silencieux défini par la seconde paroi (39) et par une paroi latérale (17) du corps (12) du silencieux et délimité par la bande (37) de la cloison (24), ledit troisième conduit étant connecté à la seconde ouverture (50) du silencieux (1), l'air s'écoulant à travers ce troisième conduit dans la même direction de son écoulement à travers le premier conduit. 25 30 35

9. Silencieux selon la revendication 1, **caractérisé en ce qu'il** a une profondeur, mesurée longitudinalement, entre 180 et 270 mm et préféablement entre 210 et 230 mm. 40

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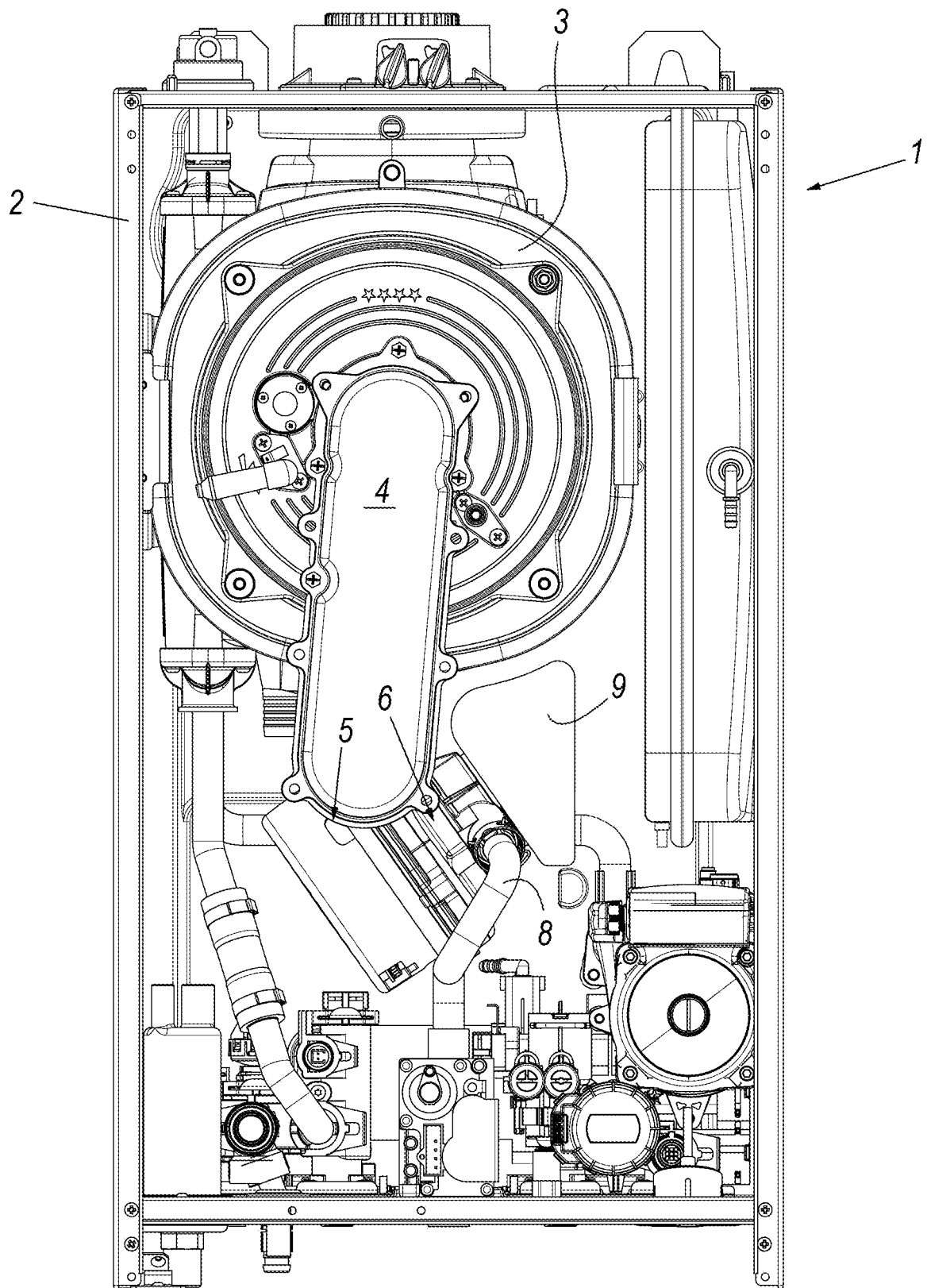


Fig. 1

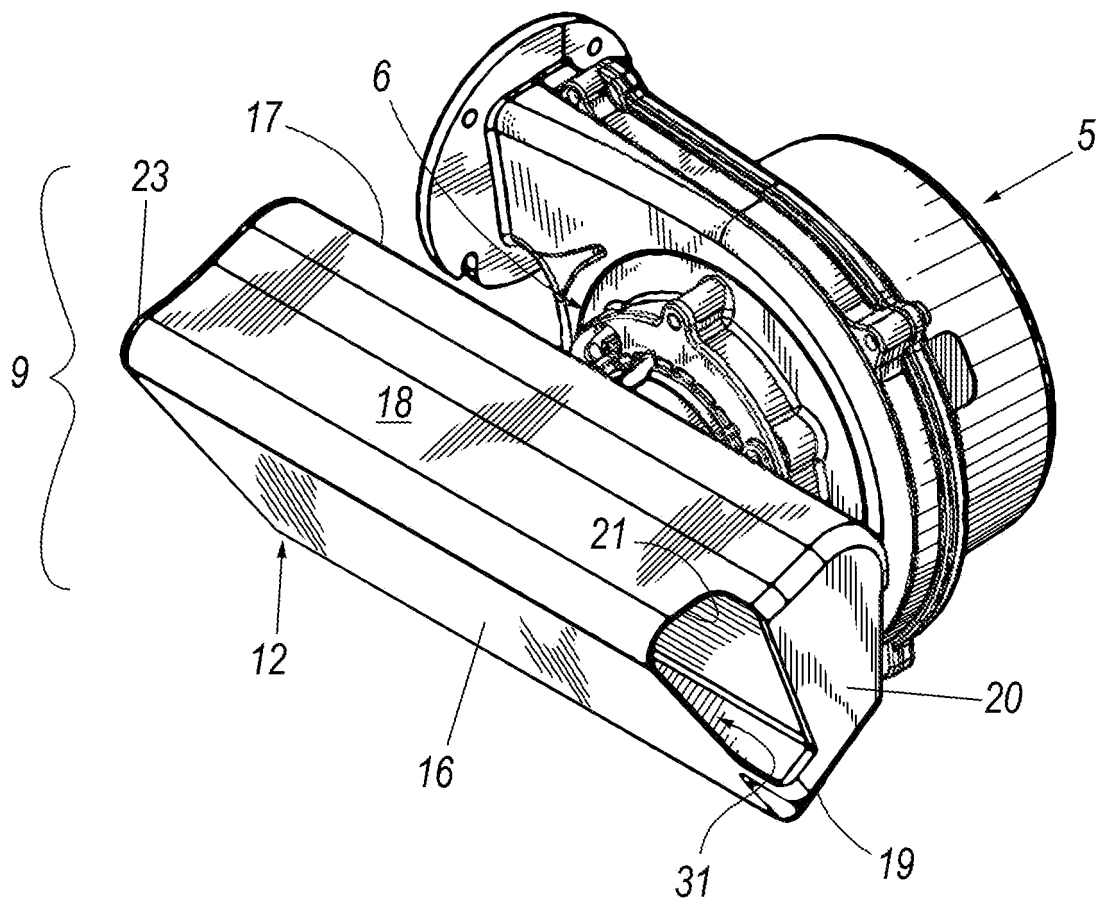


Fig. 2

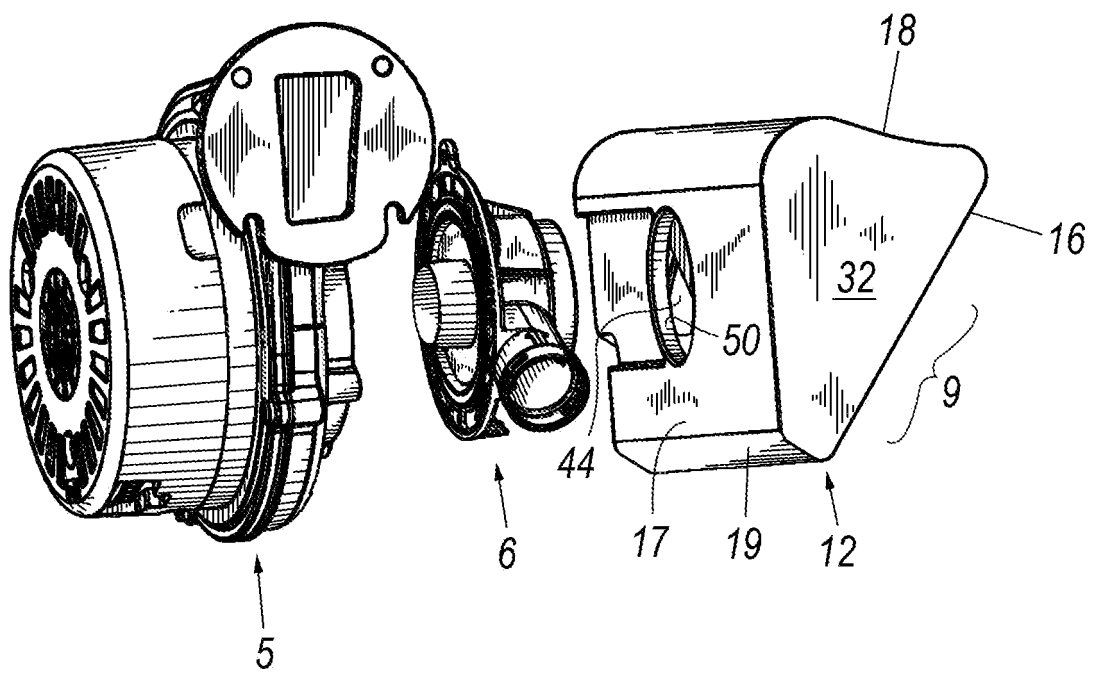


Fig. 3

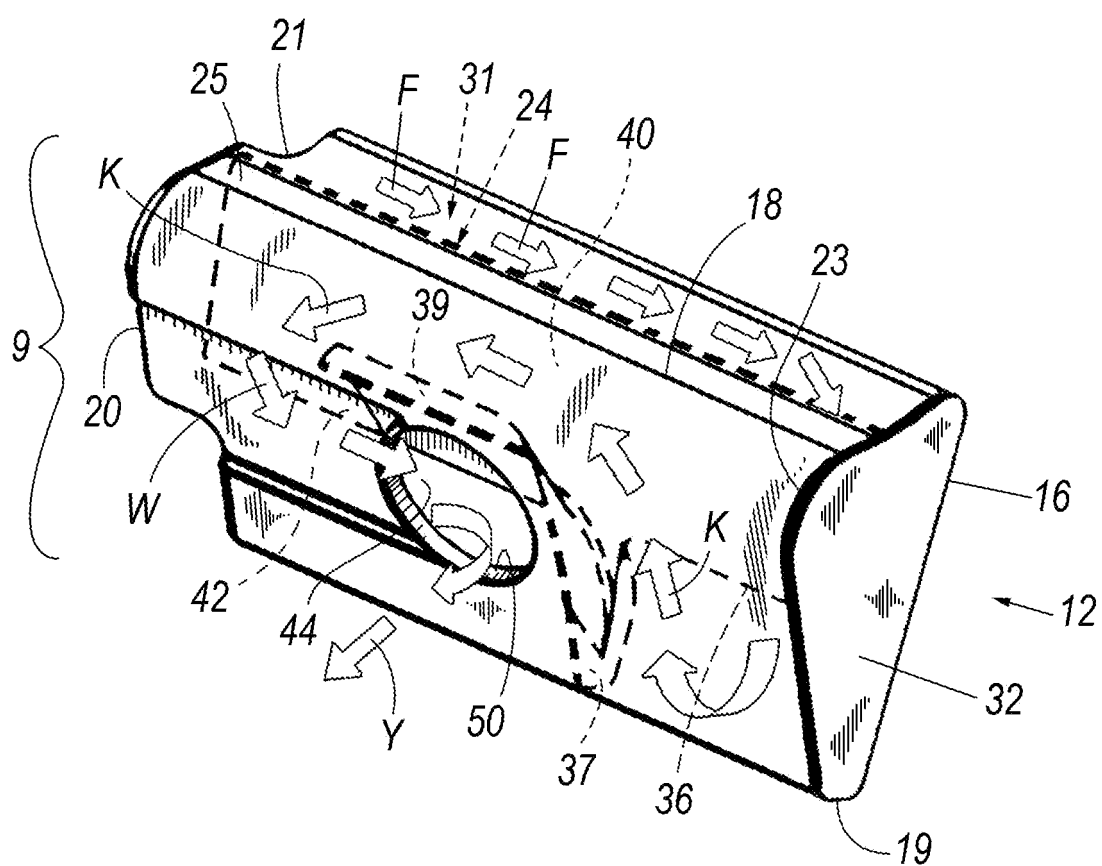


Fig. 4

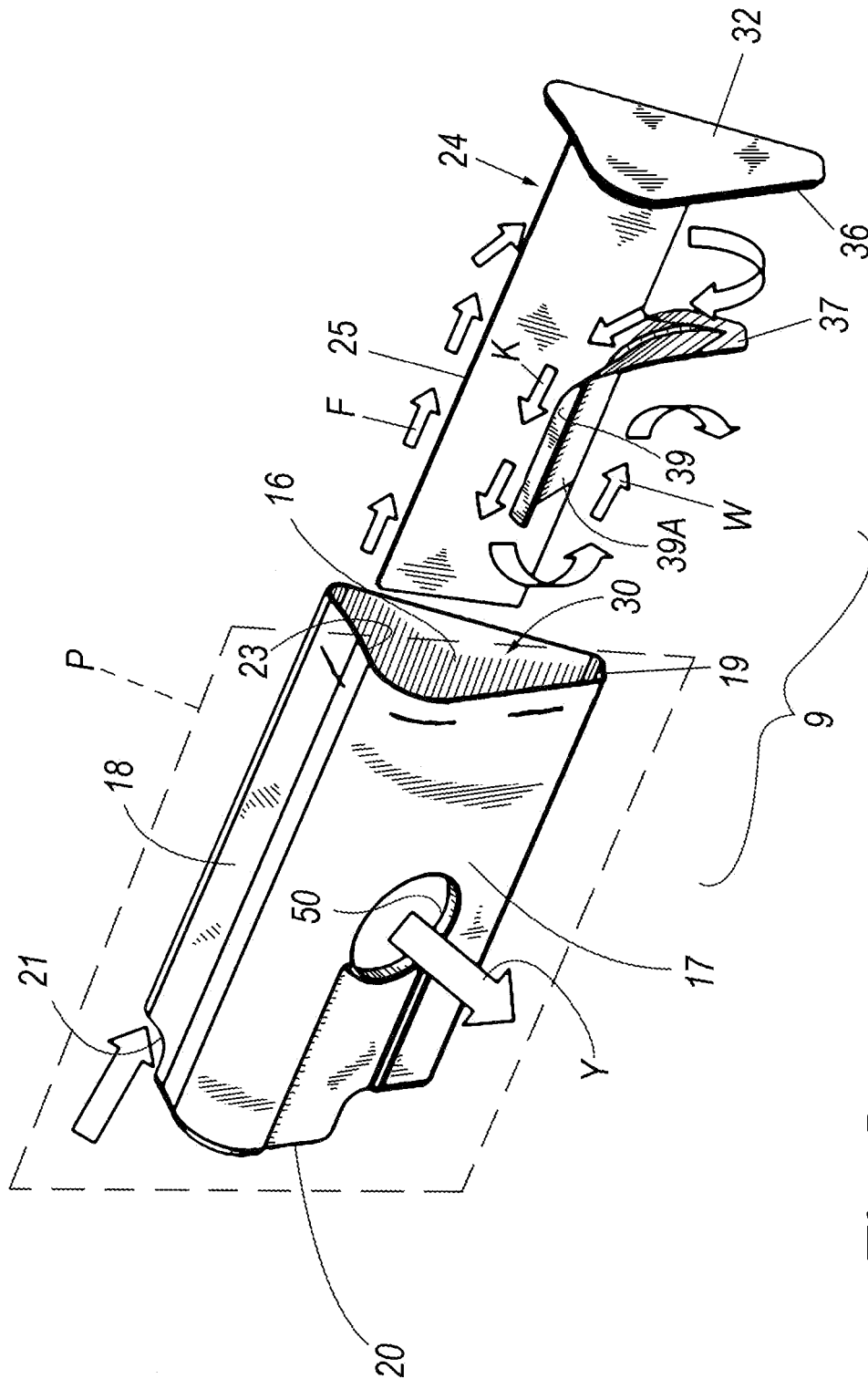


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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