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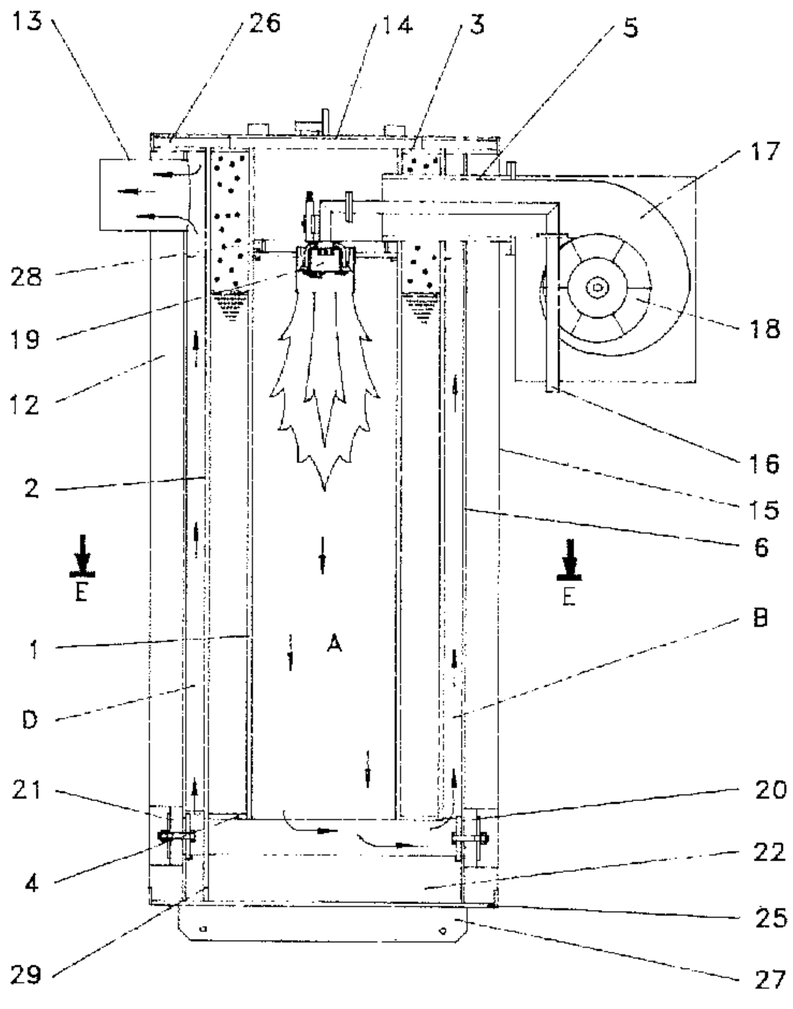
(72) Inventeur/Inventor:
Dobi, Stevan, CA

(73) Propriétaire/Owner:
Dobi, Stevan, CA

(74) Agent: THOMPSON, DOUGLAS B.

(54) Titre : CHAUDIERE VERTICALE SOUS TUBES D'EAU
(54) Title: VERTICAL TUBELESS BOILER



(57) Abrégé/Abstract:
A vertical tubeless boiler relates to the generation of hot fluids. A boiler is presented with improved efficiency and capacity causing less pollution and noise wherein the water jacket, formed by inside pipe-combustion chamber inserted into the outside pipe with the upper header and the bottom header placed between and at each end of the pipes, is surrounded with hot combustion products generated in the combustion chamber by burning oil or gas. Passages are arranged to make four passes of hot combustion products. The first pass is downward below the burner head and inside the inner pipe of the water jacket. The second pass is upward by one section of the external wall of the water jacket.The third pass is downward by two sections of the external wall of the water jacket. The fourth pass is upward by remaining section of the external wall of the water jacket. The external wall of the water jacket is conducted by fins pitched to increase the heat flow from the hot gases to the heated fluid. The fins are wrapped around with the flue jacket which is gas tight welded to the flue dividers, the nozzle the boiler support plate and to the sleaves. The flue jacket is wrapped with ceramic fibre to insulate hot combustion products. The air for combustion is supplied through a nozzle placed between the inside pipe of the water jacket and the outside wall of the water jacket and bellow the top header of the water jacket. The burner head is radially positioned to the nozzle- air supply. The air for combustion is supplied by the centrifugal fan with radial blades.

ABSTRACT

A vertical tubeless boiler relates to the generation of hot fluids. A boiler is presented with improved efficiency and capacity causing less pollution and noise wherein the water jacket, formed by inside pipe-combustion chamber inserted into the outside pipe with the upper header and the bottom header placed between and at each end of the pipes, is surrounded with hot combustion products generated in the combustion chamber by burning oil or gas. Passages are arranged to make four passes of hot combustion products. The first pass is downward below the burner head and inside the inner pipe of the water jacket. The second pass is upward by one section of the external wall of the water jacket.The third pass is downward by two sections of the external wall of the water jacket. The fourth pass is upward by remaining section of the external wall of the water jacket. The external wall of the water jacket is conducted by fins pitched to increase the heat flow from the hot gases to the heated fluid. The fins are wrapped around with the flue jacket which is gas tight welded to the flue dividers, the nozzle the boiler support plate and to the sleaves. The flue jacket is wrapped with ceramic fibre to insulate hot combustion products. The air for combustion is supplied through a nozzle placed between the inside pipe of the water jacket and the outside wall of the water jacket and bellow the top header of the water jacket. The burner head is radially positioned to the nozzle- air supply. The air for combustion is supplied by the centrifugal fan with radial blades.

This invention relates to a vertical tubeless boiler that generates hot fluids.

It is common for the vertical tubeless boilers to have two passes where the first pass is inside the inner pipe of the water jacket and the second pass is partially around the outside pipe of the water jacket and vertical tubeless boilers to have three passes where the first pass is inside the inner pipe of the water jacket, the second and the third pass around the outside pipe of the water jacket.

The burners are installed at the bottom , middle or at the very top of the boiler. It is inconvenient in most installations to have the burner at the bottom of the boiler because the whole system is close to the ground. The burner controls and the burner settings can be accidentally damaged or changed causing unsafe operation or sooting up the unit. The burners installed at the bottom or in the middle are usually the inshoot type, fan assisted and draft dependent-sensitive. For ignition and the burner head setup, the burner has to be completely removed resulting in longer and more expensive service. Boilers with the burner installed at the very top are two pass design with a downshoot burner, fan assisted and draft dependant-sensitive. Access to the burner head and the burner head setup is difficult because the burner is high from the floor. Boilers with two or three passes have low speed of combustion products resulting in lower heat transfer and lower efficiency. Boilers with fan assisted burner require larger diameter stack and/or draft control to help the combustion products exit to the atmosphere. When the fan assisted burner is installed in a dusty environment the fan tends to build up dust on the blades changing the performance of the fan resulting in less air delivered for combustion. Obviously this can cause incomplete combustion and the flue passes to be sooted up.

On this type of the vertical tubeless boiler refractory is used to insulate the flue passes-combustion products from the outside shell of the boiler. Refractory is poured into the space between outside circle of the flue passes and outside shell of the boiler. Because of the difference in thermal coefficient of expansion for steel and the refractory cracks can be found causing combustion products to leak into the boiler room. This units are heavy and hard to move during installation.

I have found that these disadvantages may be overcome by providing:

1- the nozzle between the inner pipe of the water jacket and the outside pipe of the water jacket placed bellow the top header of the water jacket. This nozzle allows the burner to be mounted at the eye level and supplies the air for combustion to the down shoot burner.

2- four passes for combustion products. One pass inside the inner pipe of the water jacket and three passes around the outside pipe of the water jacket.

3- the forced draft burner with centrifugal wheel and radial blades. The centrifugal wheel with radial blades is a self cleaning wheel- no build ups and is capable to create enough pressure to push the combustion products through all the four passes.

4- the flue jacket around the flue passes welded gas tight around the nozzles and dividers.

5- the ceramic fibre as an insulator between flue jacket and the outside shell of the boiler.

6- the controls on the side of the boiler.

These and other objects and advantages of the invention will appear more clearly from the following specification, in connection with the accompanying drawings, in which:

Fig. 1 represents a cross section through a vertical tubeless boiler according to the invention.

Fig. 2 illustrates a horizontal cutout of the vertical tubeless boiler according to the invention at the point E-E showing the flue passes.

Fig. 3 illustrates elevational view of developed projection of the vertical tubeless boiler according to the invention.

The vertical tubeless boiler illustrated on Fig.1 comprises a pipe 1 which is inserted into a pipe 2. The top header 3 and the bottom header 4 are placed between and at the ends of the pipe 1 and the pipe 2 forming the water jacket of the vertical tubeless boiler. The burner 17 (without the combustion head) is mounted to the nozzle 5 supplying the air for combustion radially to the combustion head 19. The nozzle 5 is placed between and at the upper top of pipe 1, pipe 2 and bellow the top header 3.

The pitched fins 11 are arranged around the outside wall of the pipe 2 to increase the heat transfer from the hot combustion products to the heated fluid. As illustrated on Fig.1, Fig.2 and Fig.3, the fins 11, the flue pass dividers 7,8,9,10, and the flue jacket 6, are all arranged to form the flue passes 23 as follows:

-first pass A is down inside the pipe 1

-second pass B is up between flue dividers 7 and flue dividers 8

-third pass C is down in two sections C/2 between flue dividers 7 and 9 on right side and between flue dividers 8 and 10 on the left side

-fourth pass D is up between flue dividers 9 and 10

The water jacket support 29 ,which is an extension at the bottom of the pipe 2 and runs between the flue divider 7 and the flue divider 8, divides the first pass A from the third passes C/2 and the fourth pass D.

The flue passes A, B, C/2 and D are divided as follows:

A > B > 2 times C/2 > D .

As it is shown with the above equation the speed of the combustion products are increasing as they are cooling down resulting in higher heat transfer or higher efficiency.

When the burner 17 and the combustion head 19 are firing combustion products are pushed down through the pipe 1 making the first pass A. At the end of the first pass the combustion products are confronting the refractory 22 which is poured onto the boiler support plate 25 supported by the boiler legs 27 and between the water jacket support 29 and the flue jacket 6 turning the combustion products up into the second pass B. Combustion products are sealed at the top of the water jacket by ceramic fibre gasket 26 and the boiler lid 14. Combustion products are then divided into two sections and forced down. First section C/2 is formed between the flue dividers 7, the sleave 24, the flue divider 9, the water jacket support 29, refractory 22a and the flue jacket 6. This section is on the right side of the boiler looking from the burner 17 side. Second section C/2 is formed between the flue dividers 8, the sleaves 24, the flue divider 10, the water jacket support 29, refractory 22a and the flue jacket 6. This section is on the left side of the boiler looking from the burner 17 side. At the bottom the combustion products are then combined and pushed up into the fourth pass D into stack 13. The fourth pass is formed between flue divider 9, flue divider 10, water jacket support 29, refractory 22a, flue jacket 6 and gasket 26.

The flue jacket 6 is gas tight welded to the boiler support plate 25, the flue dividers 7, the flue dividers 8, the nozzle 5 and the stack 13.The ceramic fibre insulator 12 is installed between the flue jacket 6 and the outside shell of the boiler 15 to insulate hot combustion products.

The flue passes 23 can be easily cleaned by removing the boiler top lid 14 and the gasket 26 and brushing the flue passes up and down. Collected soot can be removed through the clean out openings 20 and 21. The clean out opening 20, at the front, is provided to clean out the first pass A and the second pass B. The second clean out opening 21 is provided at the rear to clean out the third passes C/2 and the fourth pass D.

The combustion head 19 is sealed with the gasket 28 around the pipe 1 not allowing any of the air for combustion to pass beside it into the combustion chamber.

The fuel is supplied through the fuel supply line 16. The air necessary for complete combustion is supplied by the centrifugal fan with radial blades 18.

What I claim is:

1. A vertical tubeless boiler, comprising:

an inner pipe;

a burner discharging hot combustion gases into the inner pipe;

an outer pipe surrounding the inner pipe;

a water retaining top header and a water retaining bottom header bridging opposed ends of the outer pipe and the inner pipe to form a water jacket positioned between the inner pipe and the outer pipe;

an outer wall surrounding the outer pipe to form a flue jacket between the outer pipe and the outer wall, the flue jacket being in fluid communication with and receiving the hot combustion gases from the inner pipe, the flue jacket also being in fluid communication with an exhaust stack;

a plurality of heat transfer fins positioned in the flue jacket extending between the outer pipe and the outer wall;

the flue jacket being divided into sections by flue dividers, hot flue gases generated by the burner having to make four passes by the water jacket prior to reaching the exhaust stack, including a first pass in a first direction along the inside pipe, a second pass in a second direction along a first of the flue jacket sections, a third pass in the first direction along a second of the flue jacket sections and a fourth pass in the second direction along a third of the flue jacket sections to the exhaust stack.

2. The vertical tubeless boiler as defined in claim 1, wherein the burner is a downshoot burner with a combustion head disposed within the inner pipe.

3. The vertical tubeless boiler as defined in claim 2, wherein combustion air for the burner is supplied by a nozzle extending through the water jacket.

4. The vertical tubeless boiler as defined in claim 3, wherein combustion air is moved through the nozzle by a forced air blower.

5. The vertical tubeless boiler as defined in Claim 4, wherein the forced air blower is a centrifugal fan with radial blades.

6. The vertical tubeless boiler as defined in claim 1, wherein a thermally insulated outside shell surrounds the outer wall.

7. The vertical tubeless boiler as defined in Claim 6, wherein the outside shell is thermally insulated with ceramic fibres.

8. The vertical tubeless boiler as defined in Claim 1, wherein a flow area of the third of the flue jacket sections is less than a flow area of the second of the flue jacket sections.

9. The vertical tubeless boiler as defined in Claim 8, wherein a flow area of the second of the flue jacket sections is less than a flow area of the first of the flue jacket sections.

10. A vertical tubeless boiler, comprising:

an inner pipe;

a downshoot burner having a combustion head disposed within the inner pipe discharging hot combustion gases into the inner pipe;

an outer pipe surrounding the inner pipe;

a water retaining top header and a water retaining bottom header bridging opposed ends of the outer pipe and the inner pipe to form a water jacket positioned between the inner pipe and the outer pipe;

a nozzle extending through the water jacket, thereby supplying combustion air to the combustion head of the burner;

a forced air blower moving the combustion air through the nozzle;

an outer wall surrounding the outer pipe to form a flue jacket between the outer pipe and the outer wall, the flue jacket being in fluid communication with and receiving the hot combustion gases from the inner pipe, the flue jacket also being in fluid communication with an exhaust stack;

a plurality of heat transfer fins positioned in the flue jacket extending between the outer pipe and the outer wall;

the flue jacket being divided into sections by flue dividers, hot flue gases generated by the burner having to make four passes by the water jacket prior to reaching the exhaust stack, including a first pass in a first direction along the inside pipe, a second pass in a second direction along a first of the flue jacket sections, a third pass in the first direction along a second of the flue jacket sections and a fourth pass in the second direction along a third of the flue jacket sections to the exhaust stack, a flow area of the third of the flue jacket sections being less than a flow area of the second of the flue jacket sections, a flow area of the second of the flue jacket sections being less than a flow area of the first of the flue jacket sections; and

a thermally insulated outside shell surrounding the outer wall.

Fig. 1

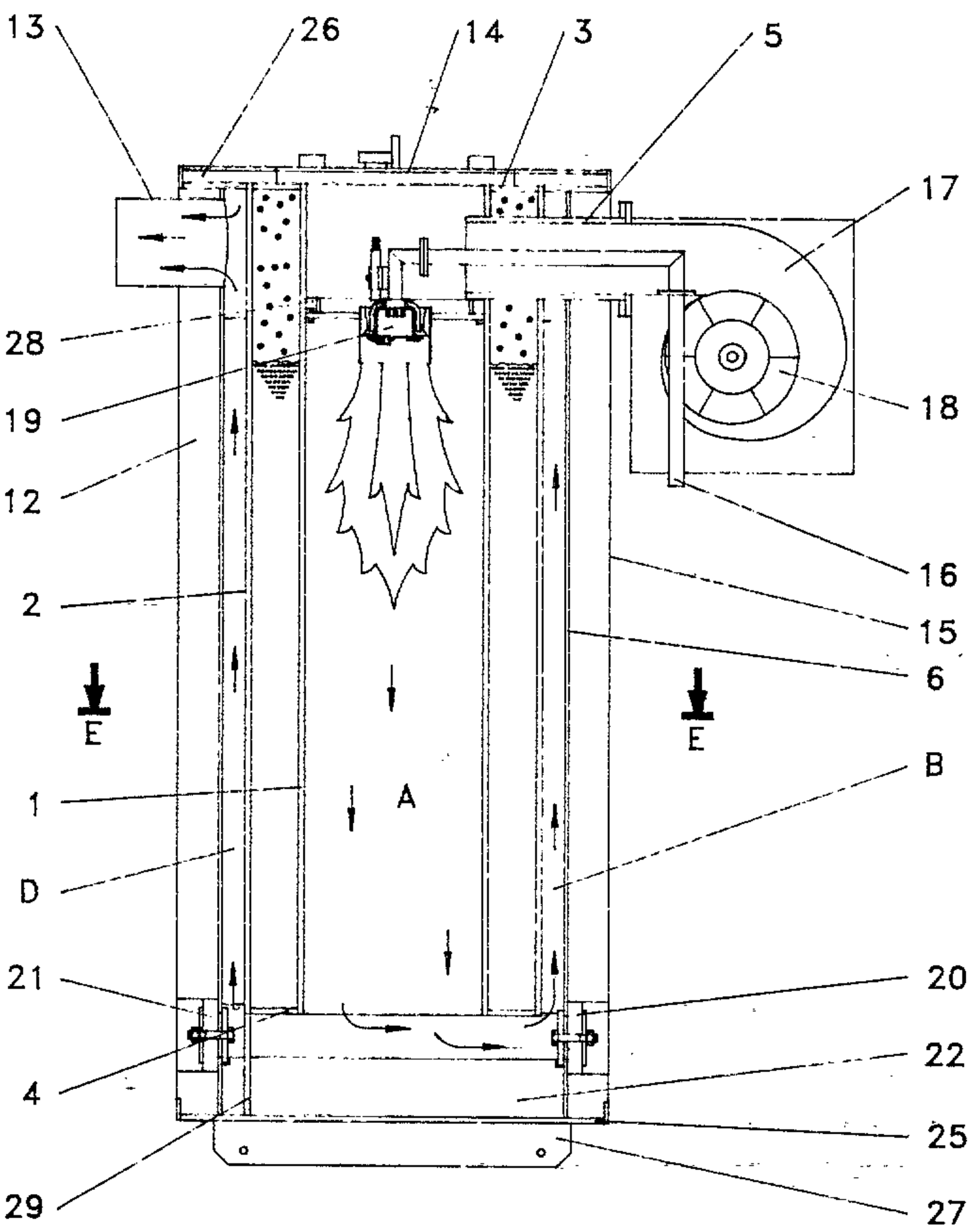


Fig. 2

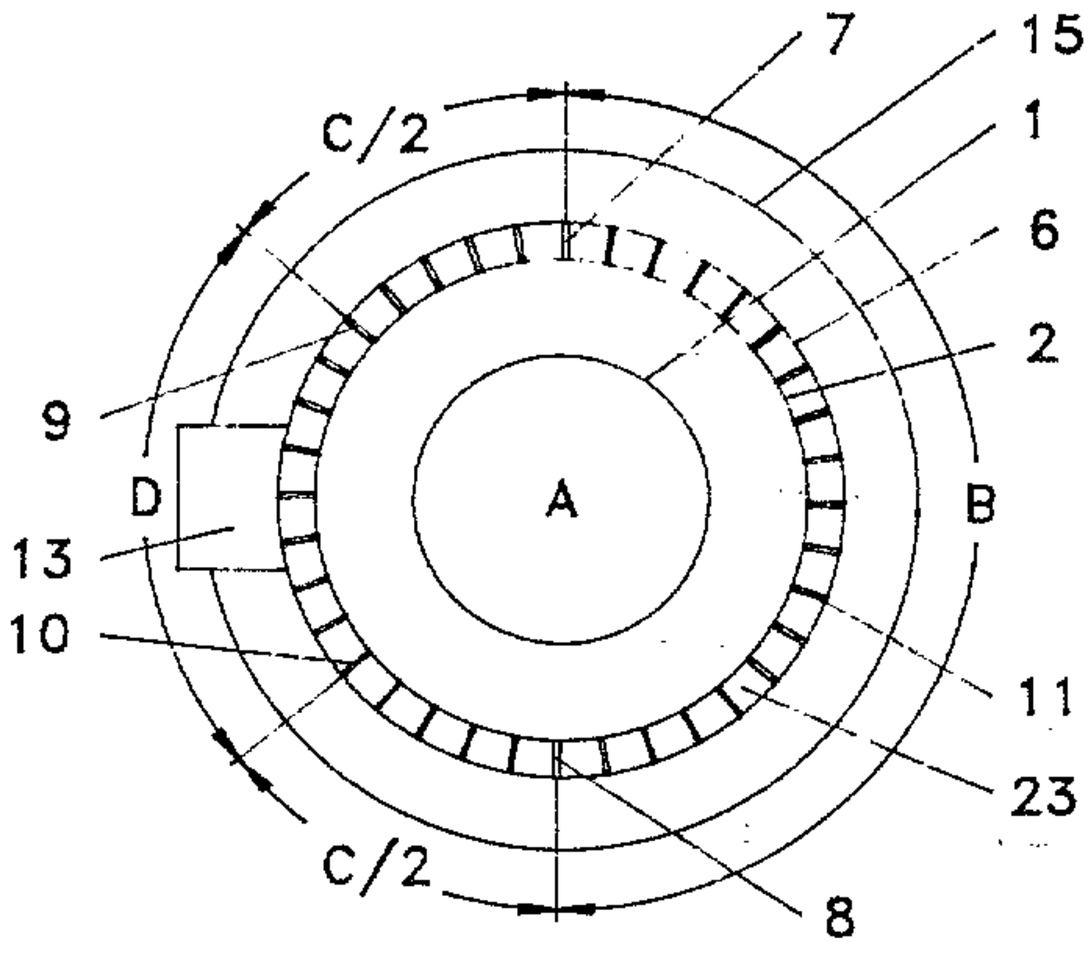


Fig. 3

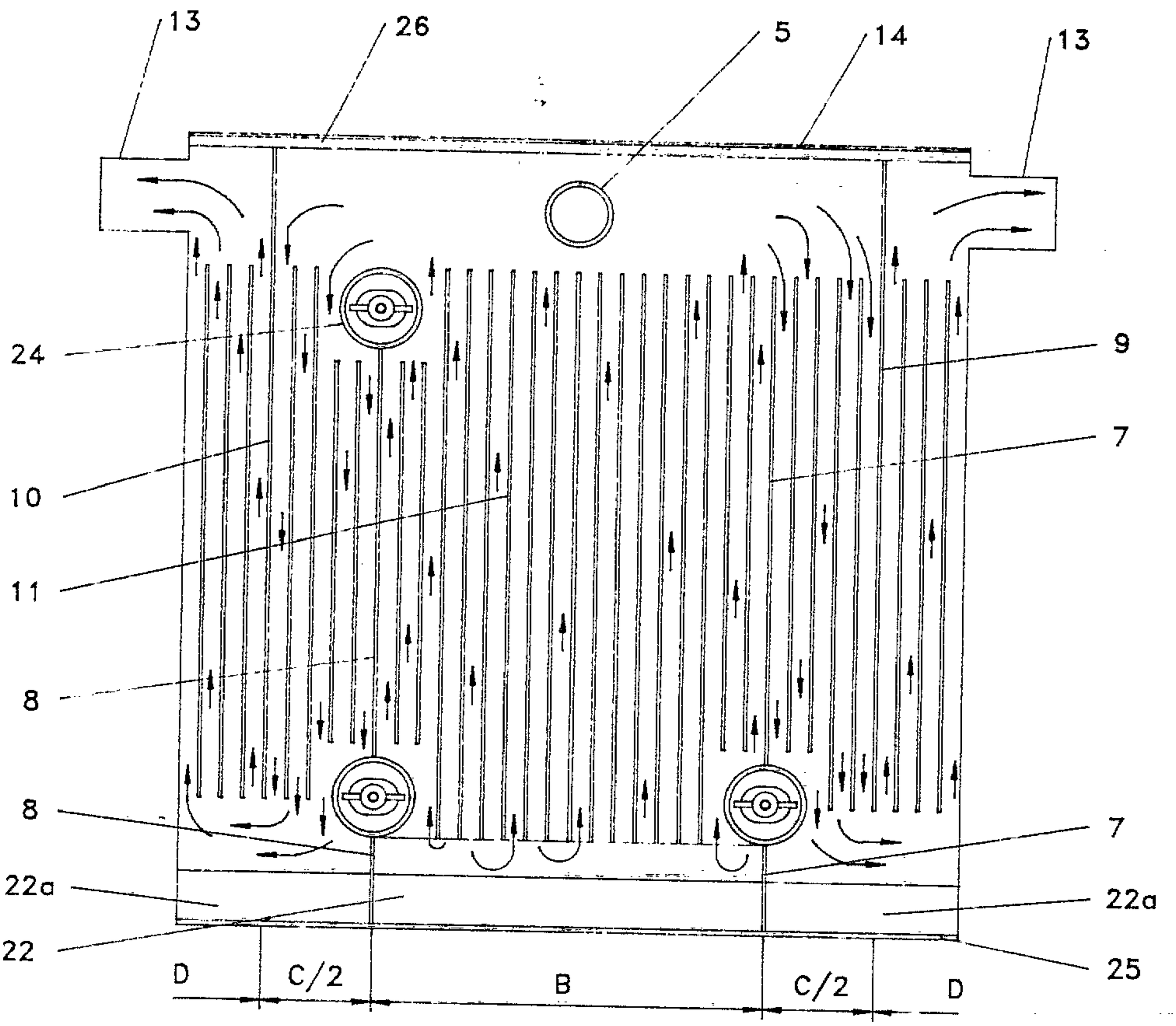
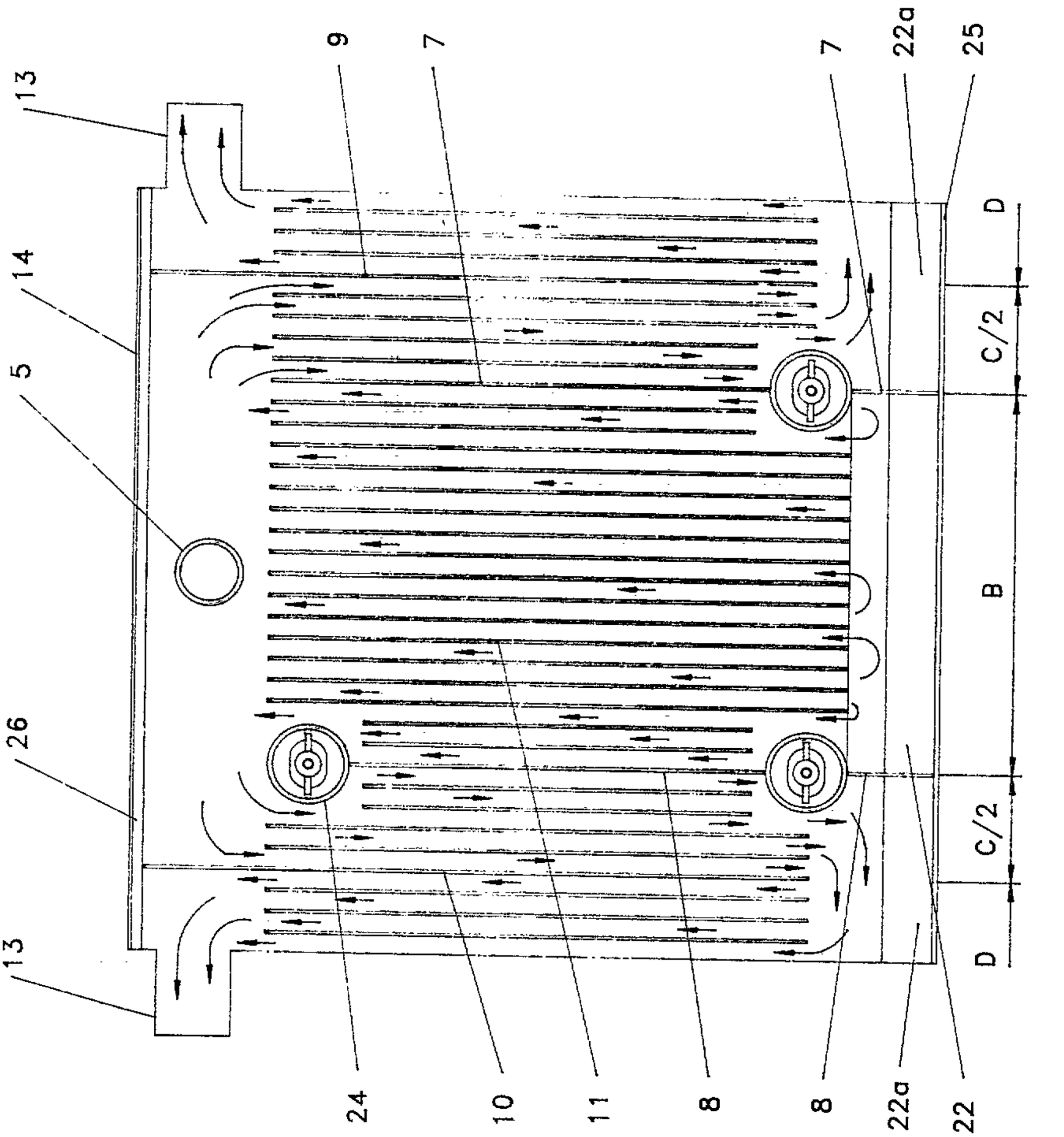
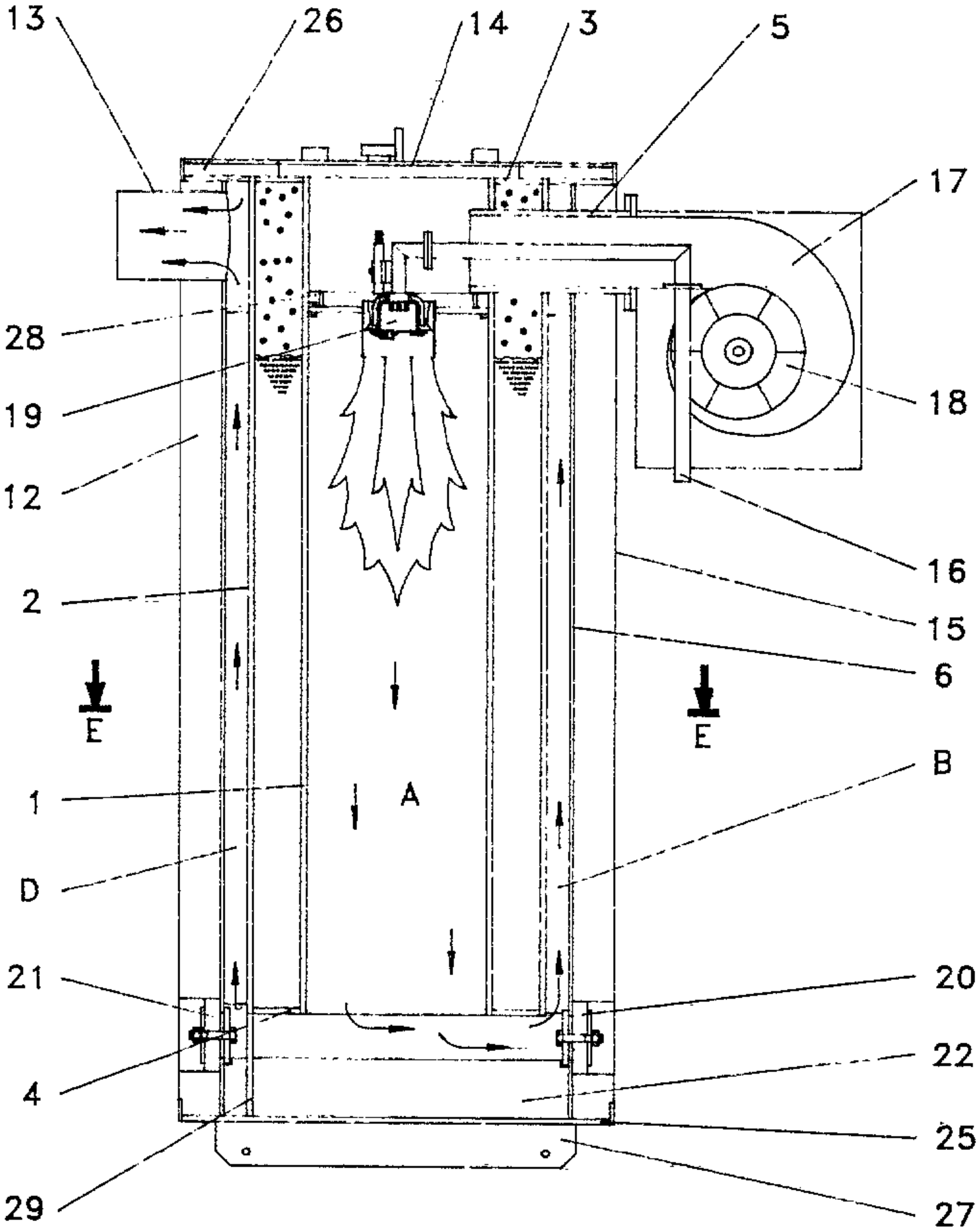


Fig. 3

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