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## (54) Multi-purpose boiler for producing hot water.

(57) A multi-purpose boiler for producing hot water comprises: a body (14); a first part of a boiler (1) made in the body (14); a first cavity (21), made in said body (14), which develops along a longitudinal symmetry axis and which is suited to be crossed by smokes shot by a burner (22); a chimney (11); a second cavity (19), made in body (14), which holds a liquid and which communicates with an user (2); an overflow tank (10); first elements (25) to feed the burner (22) with fuel; second adjusting elements for the feeding elements (25); third safety elements (24) to intercept the feeding elements (25); the cavity (21) is adapted to house a second part of said boiler (1) in which a third cavity (28,31,34,36) to hold liquid is made.

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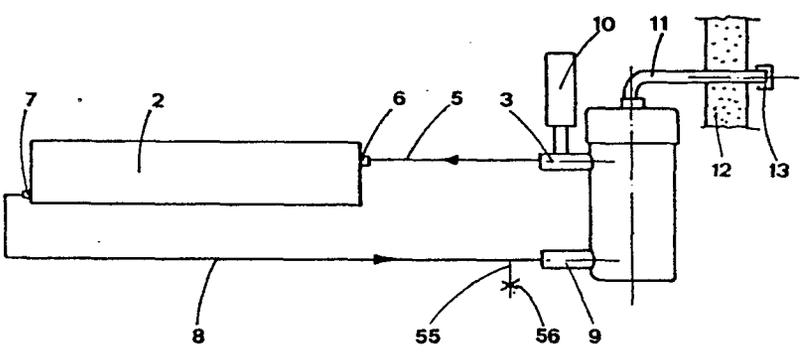


FIG.1

# MULTI-PURPOSE BOILER FOR PRODUCING HOT WATER

The present invention is related to a boiler suited to warm-up a liquid until a temperature of 110° C. aproximately, in order to put the liquid at the disposal of an user equipment; more in particular it is related to a boiler, preferably a small-sized boiler, suited to send liquid to an equipment comprising at least an user element, such as a convector, a radiator or a coil immerged in a tank for water, for example for domestic use water, in order to realize a self-contained equipment easy to be assembled in any sort of room or house and having a low thermic inertia, thus being particularly suitable for a desultory use.

At present, to warm-up an user of the above kind, electrical resistance heaters are used whose consumption is very high and which are, therefore, unfavourable from the economic standpoint.

In accordance with the present invention a boiler is realized which uses a burner for preferably gaseous fuels (methane, propane, butane) to warm-up the liquid; the boiler consists of a tubular body which is a first part thereof and in which a first cavity is made; also said cavity being tubular and being suited to house a second part of the boiler. The first and the second part having a second and a third cavity, respectively, adapted to hold liquid and connected to each other by at least a first pipe through which the liquid passes from the second to the third cavity and a second pipe through which the liquid passes from the third to the second cavity.

Also in accordance with the present invention the fuel burner is located at a downstream part of the tubular cavity, below the second part; the tubular cavity is a first section of a chimney for the smokes shot by the burner.

In one embodiment of a boiler according to the present invention, the chimney is encircled by a lug placed upstream the first part to increase the thermal exchange surface between the smokes passing through the chimney and the liquid held in the boiler; the lug being tubular-shaped and having a fourth cavity which communicates with the second cavity.

In one embodiment of a boiler according to the present invention, the first part is tubular-shaped and has an elliptic base.

Preferred but not limiting embodiments of the invention will be described below with reference to drawings in which:

Fig. 1 is a schematic view of an equipment comprising a boiler according to the invention and of an user of the above kind.

Fig. 2 shows a side view of a first embodiment of a boiler according to the invention.

Fig. 3 shows a top view of the boiler of Fig. 2.

Fig. 4 shows a second side view of the boiler of Fig. 2.

Fig. 5 is a cross-section view of the boiler according to a plane A-A of Fig. 2.

Fig. 6 is a second embodiment of a boiler according to plane B-B of Fig. 2.

Fig. 7 shows a side view of a second embodiment of a boiler according to the present invention.

Fig. 8 is a top view of the boiler of Fig. 7.

Fig. 9 is a second side view of the boiler of Fig.7.

Fig. 10 is a cross-section view of the boiler according to a plane C-C of Fig. 7.

Fig. 11 is a cross-section view of the boiler according to a plane D-D of Fig. 7.

Fig. 12 is a side view of a third embodiment of a boiler according to the invention.

Fig. 13 is a top view of the boiler of Fig. 12.

Fig. 14 is a second side view of the boiler of Fig. 12.

Fig.15 is a cross-section view of the boiler according to plane C-C of Fig. 12.

Fig. 16 is a cross-section view of the boiler according to plane D-D of Fig. 12.

Fig. 17 is a longitudinal cross-section view of a detail of a fourth embodiment of a boiler according to the present invention.

Fig. 18 is an overflow tank of a further embodiment of the boiler according to the present invention.

Fig.19 is an electric circuit suited to detect the starting state of a burner placed inside the boiler of the present invention.

The equipment shown in Fig.1 comprises a boiler 1 and an user 2 of the above kind, for example a convector. An outlet pipe 3 is placed at an upper part of the boiler 1; a first end of a delivery pipe 5 is inserted in pipe 3; said delivery pipe 5 having a second end inserted in an inlet 6 of the user 2; a first end of a return pipe 8 is inserted in an outlet 7 of the user 2; said return pipe 8 having a second end inserted in an inlet pipe 9, placed at a lower part of boiler 1. A pipe 55 is inserted in pipe 9 and is connected to the hydraulic main; the pipe 55 being fitted with a cock to allow filling of the equipment.

An overflow tank 10 is connected to pipe 3 to allow expansion of the liquid held in boiler 1 and let out the air contained in the liquid.

Preferably the overflow tank 10 has a closure substantially hermetic to prevent the vapours of the

heating liquid from exiting since the volume of the liquid held in the boiler 1 and in the equipment connected thereto is substantially minimized.

A preferred embodiment of the tank is shown in Fig.18. According to this embodiment, the tank 10 is fitted with an inlet 43 to fill the equipment with liquid; the inlet 43 being in communication with pipe 55 and being suited to be closed hermetically by a screw plug 44; an oulet for the liquid is suited to be closed hermetically by a plug 46; a bore 47, made in the upper part of tank 10, joins the internal part of an elastic wall spherical element 48 to the atmosphere. In this embodiment the tank is arranged as shown in Fig.1 but the pipe 55 is placed on the upper part, with respect to the equipment, to be inserted in the inlet 43.

During the filling phase, plugs 44 and 46 are moved away from the relevant seats 43 and 45 and liquid is entered in inlet 43 to fill completely the circuit. The complete filling is detected by the transfer of liquid from the outlet 45.

Once the plugs are placed again in their seats and once the combustion is started, the liquid expands and compresses the wall of the spheric element 48 thus preventing the pressure from increasing inside the equipment due to the presence of small volumes of air or of other gas compressed by the liquid which expands for thermic effect. The presence of the spheric element 48 which is directly connected to the atmosphere prevents an overpressure from forming in the warming liquid during the working of the boiler.

A smoke chimney 11 develops from the upper part of the boiler to the external room; the chimney 11 crosses a thickness 12 of a wall to let said smokes outside the room in which said boiler is placed. The external end of chimney 11 is fitted with a windbracing element 13.

Said boiler 1 is shown in detail in Figs.2-6 and comprises: a body 14, essentially tubular, constitued by a first external wall 15 and by a second internal wall 16 spaced from each other by a predetermined distance d; walls 15 and 16 being tubular. A first and a second annular closing element 17 and 18 are placed at an upper and at a lower end of the metallic walls 15 and 16, respectively. A tubular interspace 19 is thus formed in body 14; said interspace 19 being suited to hold the liquid. The outlet 3 and the inlet 9 are placed in the same part of body 14.

The body 14 has a cover 20 on top which is inserted snugly in the external wall 15 and to which chimney 11 is connected. A tubular cavity 21 extends along a longitudinal symmetry axis of body 14; the cavity 21 being suited to be crossed by the smokes shot by a burner 22 placed downstream of cavity 21.

Burner 22 is equipped with a known lighting device 23, for example with a pieoelectric lighting device, and with a thermocouple, not shown, and placed in a suitable zone of the surface of body 14; the thermocouple being connected to a safety valve 24 whose kind and functions are known.

The adjustment of the fuel amount, crossing a feeding channel 25 for the burner 22, is entrusted to a known device, not shown, connected with a thermosensitive bulb 26, housed in a metallic pipe 27, supported by wall 15; the bulb 26 being directly in contact with the wall 15 to measure the temperature of the liquid contained in the interspace 19. Since wall 15 is metallic and relatively thin, the temperature which is measured in contact with its external surface is not notably different from the temperature of the liquid housed in interspace 19. The adjustment of the fuel amount may be either of the ON/OFF or of the analogue type according to the requirements of the equipment, by considering the economy and the reliablity of the devices which accomplish the adjustment.

The safety valve 24 is able to intercept the amount of fuel which passes through channel 25 in case that the thermocouple detects a temperature value grater than a safety value in that zone.

To visually show the combustion in the burner 22, the electric circuit of Fig.19 is used. In this circuit, a L.E.D. is continuously fed by a p.n.p power transistor 49 whose base is connected to a node 51 via a resistance 50 and whose manifold is connected to the positive pole of an electric energy source; the node 51 being placed in sequence to a resistance 52 connected to a positive polarity. The node 51 is also connected to the manifold of a n.p.n control transistor 53 electrically connected to a thermocouple T.C. suited to provide a predetermined E.M.F. above a predetermined temperature value; the thermocouple T.C. is lapped by the smokes.

A resistance 54 is placed between the base of the transistor 53 and the thermocouple T.C. The sender of the transistor 53 is connected to an adjustable resistance in order to increase the sensitivity of the circuit.

Four pipes 28 are placed inside cavity 21; the pipes 28 extend substantially from bottom to top in parallel with the symmetry axis of boiler 1; each pipe 28 is connected with interspace 19 via an inlet 29 and an outlet 30, placed in the downstream part and in the upstream part of boiler 1, respectively. The inlet 29 and the outlet 30 cross the wall 16 in zones diametrically opposed with respect to the symmetry axis of cavity 21.

In the embodiment shown in Figures 1-6, the second cavity is constitued by the interspace 19 and the third cavity is constitued by internal parts of pipes 28.

The boiler shown in Figures 7-11 is fitted with

a certain number of constructive elements of the boiler shown in Figures 2-6; these constructive elements are marked with the same numeral references as in Figures 2-6.

The distinctive element of the boiler 1 according to the embodiment shown in Figures 7-11 consists of a container 31 for the liquid. A first pipe 32 connects the interspace 19 with the internal part of container 31; a second pipe 33 connects the internal part of container 31 with interspace 19. The first and the second pipes 32 and 33 cross the wall 16 in an upstream and in a downstream part thereof, respectively, which are diametrically opposed with respect to the symmetry axis, to reach the interspace 19

The zones concerned by the unions with pipes 32 and 33 excepted, the container is hermetically closed. The external surface of container 31 has a lower part which is directly exposed to the flame of the burner 22 and which is substantially cigar-point shaped thus offering a notable resistance to the topward movement of the smokes.

The advantage offered by this increased resistance consists in a more elevated efficiency in the thermal exchange between the smokes and the liquid held in the boiler 1 and in particular in container 31.

In the embodiment shown in Fig.7-11, the second cavity is constitued by the interspace 19 and the third cavity is constitued by the inner wall of container 31.

The boiler shown in Figs.12-16 is fitted with a great number of constructive elements of the boiler shown in Figs.2-6; these constructive elements are marked with the same numeral references as in Figs.2-6.

The elements which distinguish the boiler 1 according to the embodiment shown in Figures 12-16 are constitued by two series of pipes 34 and 35 each of which is provided with an inlet 36 from the interspace 19 to the internal parts of pipe (34,35) and with an outlet 37 from the internal part of pipe (34,35) to the interspace 19, in zones diametrically opposed to the simmetry axis. The inlet 36 and the outlet 37 crossing wall 16 through to holes 38 and 39.

In a preferred embodiment shown in Figs.12-16, pipes 33 and 34 are slightly inclined, with respect to a horizontal plane, with the upper part placed near the outlet 3 and the inlet 9 to favour circulation of liquid inside pipes 33 and 34.

In the embodiment shown in Figs.12-16, the second cavity is constitued by the interspace 19 and the third cavity is constitued by the internal parts of pipes 34 and 35.

Fig.17 shows a constructive detail of a boiler according to the present invention. In this embodiment the walls 15 and 16 prolong beyond cover 20, thus forming a passage 57 and are connected, respectively, with two coaxial walls 40, 41 equally spaced to each other such to form an interspace 42, connected directly to interspace 19.

This embodiment establishes a thermal exchange between the smokes and the liquid in a zone in which the temperature of the smokes is still greater than the temperature of the liquid. Besides, since wall 40 has a diameter notably smaller than the diameter of wall 16, a loss of load occurs in the motion of smokes, thus establishing an increased efficiency in the thermal exchange between smokes and liquid.

These losses of load slow down the motion of smokes also in the zone downstream walls 40 and 41 thus establishing an higher ther- mal exchange in the portion of boiler in which said second part is housed.

In the embodiment shown in Fig.17, the second cavity consists of said interspaces 19 and 42 and said third cavity consists of any structure already described and shown in Figs.2-16, for example of pipe 28 or of container 31.

Only preferred embodiments of the invention have been disclosed which may be modified without affecting the essence thereof.

To increase the thermal exchange between smokes and liquid, fins are provided both in wall 16 and in the second part of boiler 1, and particularly in the external surface of container 31.

In an other embodiment, the second part consists of a pipe coil, made with one or more pipes folded according to a cylindric or conic spiral; each one of the pipes having a first and a second end connected to interspace 19 at a lower part and at and upper part of wall 16, respectively

In a further embodiment, the second part consists of a predetermined number of pipes arranged as shown in Fig.15, but one by one, so as to realize a series of pipes staggered from bottom to top according to a spiral; each one of the pipes connects two portions of wall 16, the portions being diametrically opposed with respect to a symmetry axis. The pipes are preferably inclined like the ones shown in Fig.15.

In a preferred embodiment, not shown, the burner is insulated from the room in which said boiler is located and is connected with the external room by a suitable conduct, not shown.

Insulation is obtained by introducing the boiler 1 and the burner 22 in a sealed container connected with the external room via a channel to feed the combustion with air. The container is fitted with hermetic-tight connections for passage of pipes 5 and 8 and of chimney 11.

In an other embodiment of the invention, the tank 10 includes a container whose capacity is a notable fraction of the capacity of the whole equip-

ment. The container is fitted with an inlet for the delivery pipe 5 and with an inlet for an exhaust pipe; the upper end of the exhaust pipe is inserted in the container up to a predetermined height therewithin, for example up to half its whole height. The lower end of the exhaust pipe is fitted with a known element (such as a cock, a screw plug or the like) to close this end. The upper end of the exhaust pipe determines a level of liquid inside the container so as to leave an air volume over the level for absorbing expansions, due to heating of liquid, without increasing notably the liquid pressure inside the equipment.

## Claims

1. Multi-purpose boiler for producing hot water comprising at least: a body (14); a first part of a boiler (1) made in said body (14); a first cavity (21) made in said body (14), said first cavity (21) developing along a longitudinal symmetry axis of said body (14) and being suited to be crossed by smokes shot by a burner (22) located downstream said first cavity (21); a chimney (11) to move said smokes away from said boiler (1); a second cavity (19) made in said body (14); said second cavity (19) holding a liquid and communicating with an user (2) via a delivery pipe (5) and a return pipe (8); a pipe (55) for feeding the equipment; an overflow tank (10) connected with said delivery pipe (5) or with said return pipe (8); first elements (25) to feed said burner (22) with a fuel; second adjusting elements for said feeding elements (25); third safety elements (24) to intercept said feeding elements (25) when the temperature in said boiler (1) is above a predetermined temperature; characterized by the fact that said first cavity (21) is suited to house a second part of said boiler (1); a third cavity (28,31,34,36) being made in said second part to hold liquid; at least an inlet (29) through which the liquid passes from said second (19) to said third (28,31,34,36) cavity and at least an outlet (30) through which liquid passes from said thrid (28,31,34,36) to said second (19) cavity.

2. Boiler, as in claim 1, characterized by the fact that first pipes (28,33,34) and second pipes (28,32,34) are inserted in said inlet (29) and in said outlet (30), respectively; said inlet (29) and said outlet (30) being made in a wall (16) delimiting said second cavity in zones of said wall (16) diametrically opposed with respect to a symmetry axis of said boiler (1).

3. Boiler, as in claim 1, characterized by the fact that said overflow tank (10) is fitted with an inlet (43) and an outlet (45) for the liquid; the inlet (43) and the outlet (45) being fitted with hermetic-tight elements (44,46); a hole (47) is present in the upper wall of tank (10) to connect the internal part of an elastic wall spherical element (48) with the atmosphere; the element (48) being housed in said tank (10).

4. Boiler, as in claim 1, characterized by the fact that said second cavity is made by a first and a second interspaces (19,42) in communication and coaxial each other; said second interspace (42) being a lug embracing the chimney (11) upstream said first part.

5. Boiler, as in claim 1, characterized by the fact that said first part is tubular-shaped and has an elliptic base.

6. Boiler, as in claim 1, characterized by the fact that said burner (22) is located in a lower part of said tubular cavity (21) downstream said second part; said cavity (21) being connected with a passage (57) constituing a first section of said chimney (11).

7. Boiler, as in claims 1 and 6, characterized by the fact that said burner (22) is insulated from the room in which said boiler (1) is located and communicates with the external room via a suitable conduct.

8. Boiler, as in claim 1, characterized by the fact that said second part is constitued by a predetermined number of pipes (34,35) arranged so as to realize a series of pipes staggered from bottom to top according to a spiral; each one of said pipes (34,35) connecting two zones of said wall (16) diametrically opposed with respect to said symmetry axis.

9. Boiler, as in claims 1 and 8, characterized by the fact that said pipes (34,35) are slightly inclined with respect to a horizontal plane with the upper part placed near said outlet (30) and said inlet (29).

10. Boiler, as in claim 1, characterized by the fact that said boiler (1) is fitted with elements to visually show the functioning state of the burner (22); said elements including an electric circuit suited to feed a L.E.D. via a power transistor (49) whose base is connected with a manifold of a second control transistor (53); the base of said control transistor (53) being connected with a thermocouple (T.C.) suited to transmit a predetermined E.M.F. above a predetermined temperature value; said thermocouple (T.C.) being lapped by said smokes.

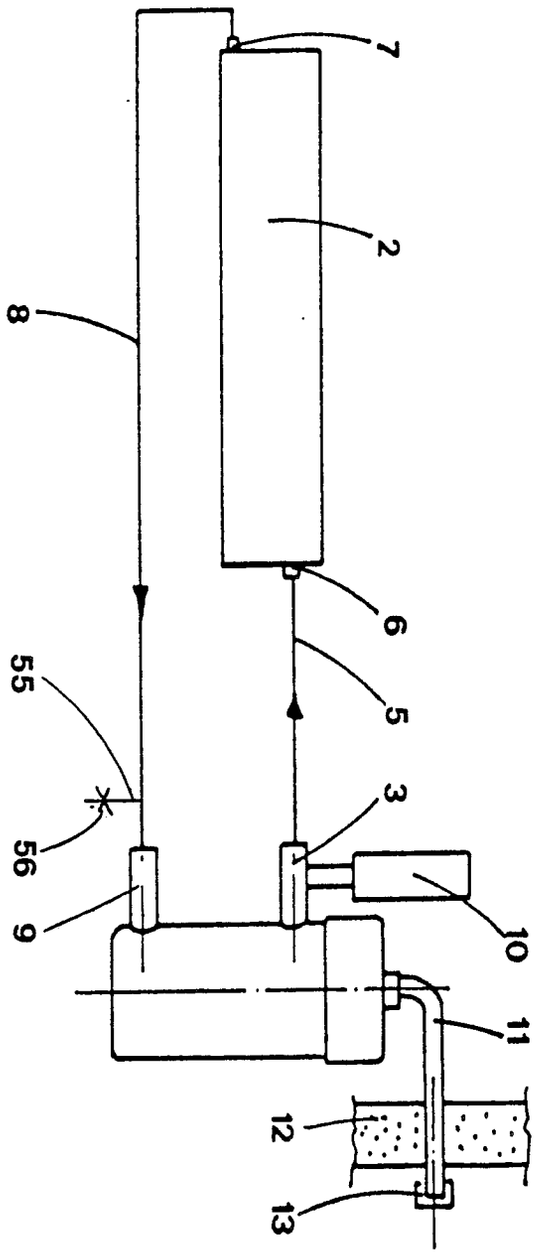


FIG.1

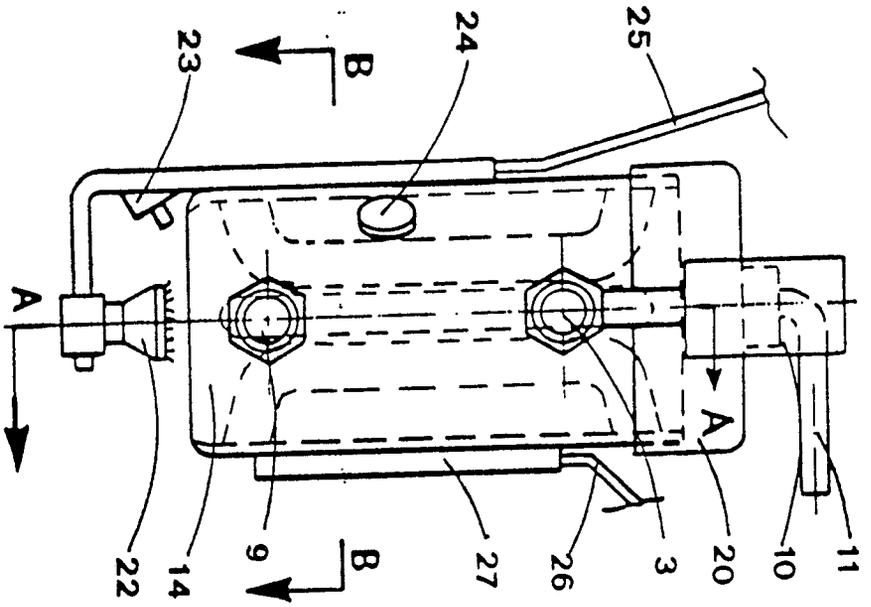


FIG.2

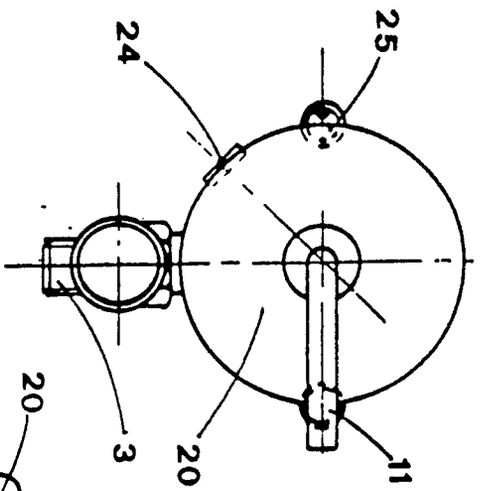


FIG.3

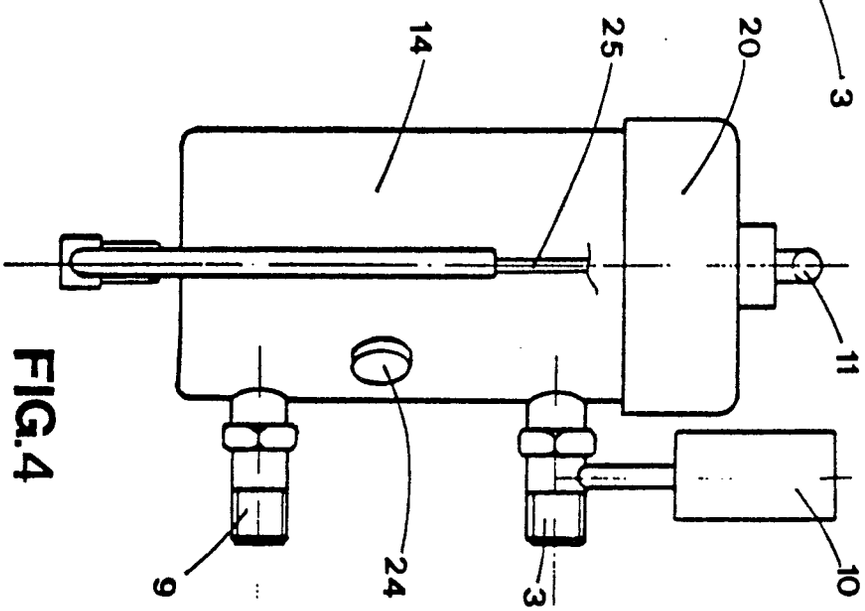


FIG.4

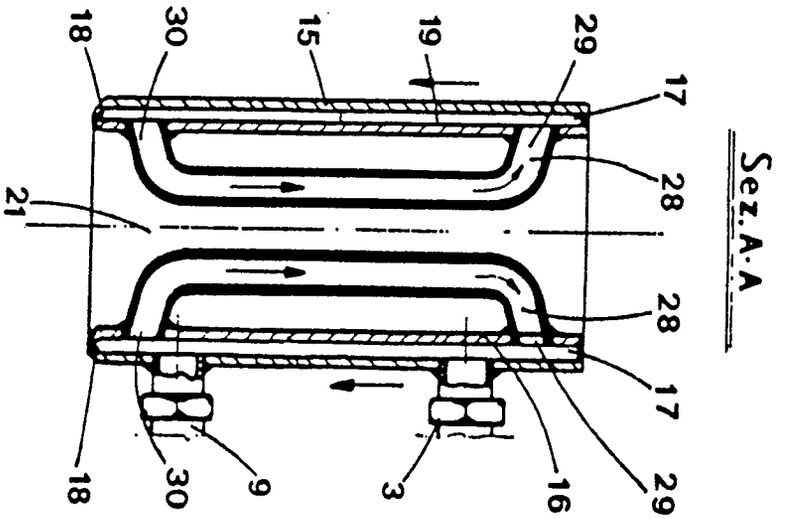
Sez. A-A
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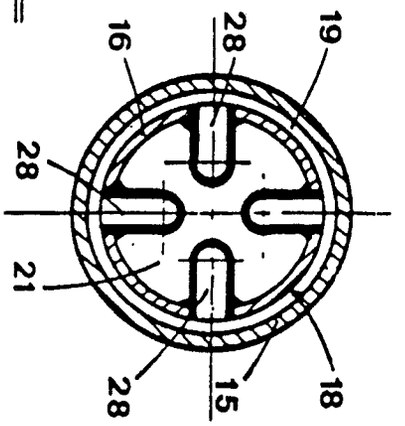
FIG. 5


Sez. B-B
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21
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15
18

FIG. 6

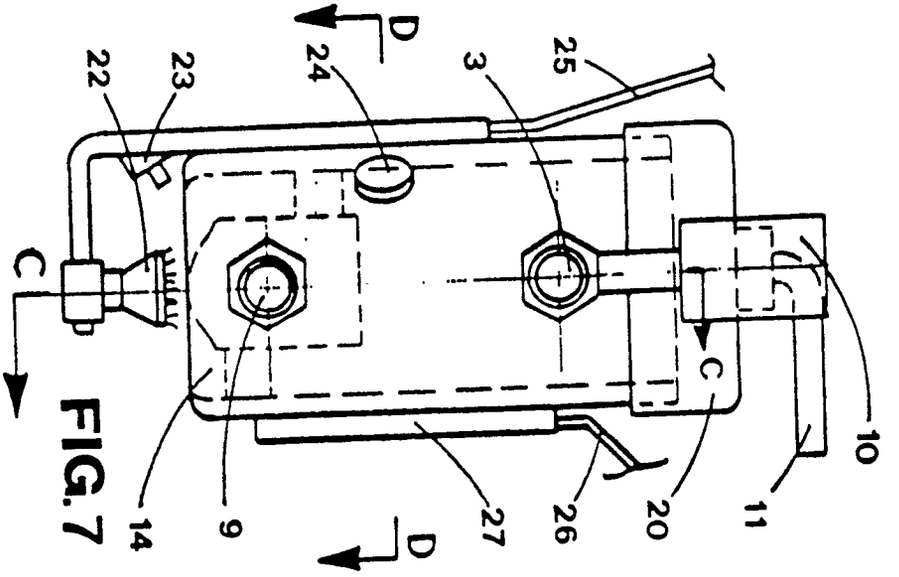



FIG.7

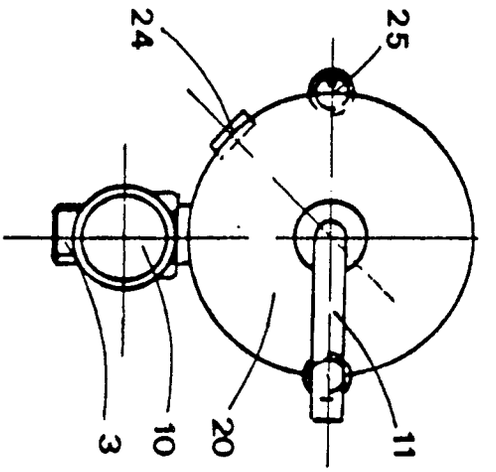



FIG. 8

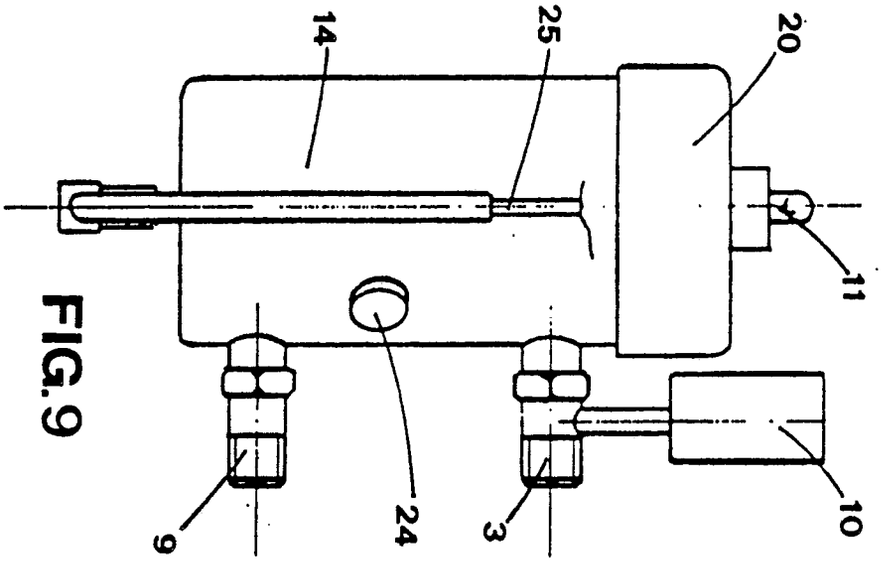



FIG.9

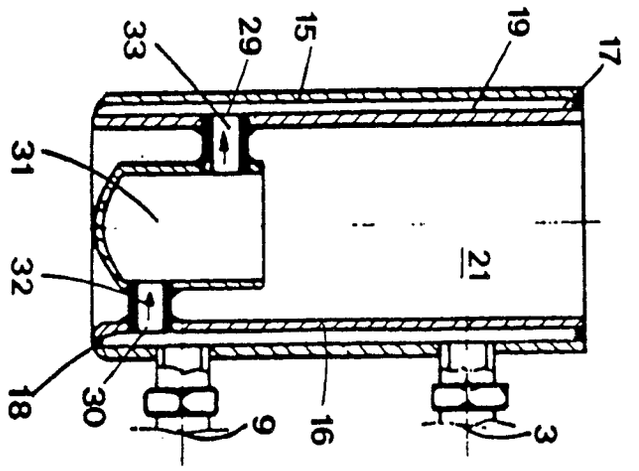



FIG. 10

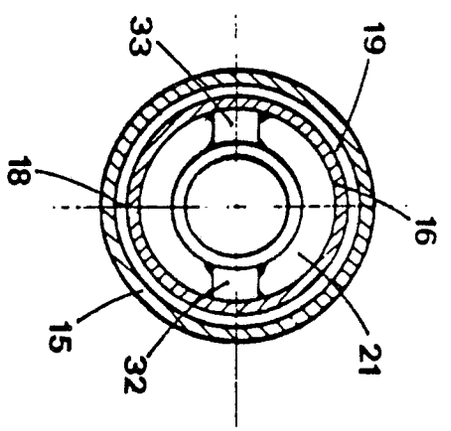



FIG. 11

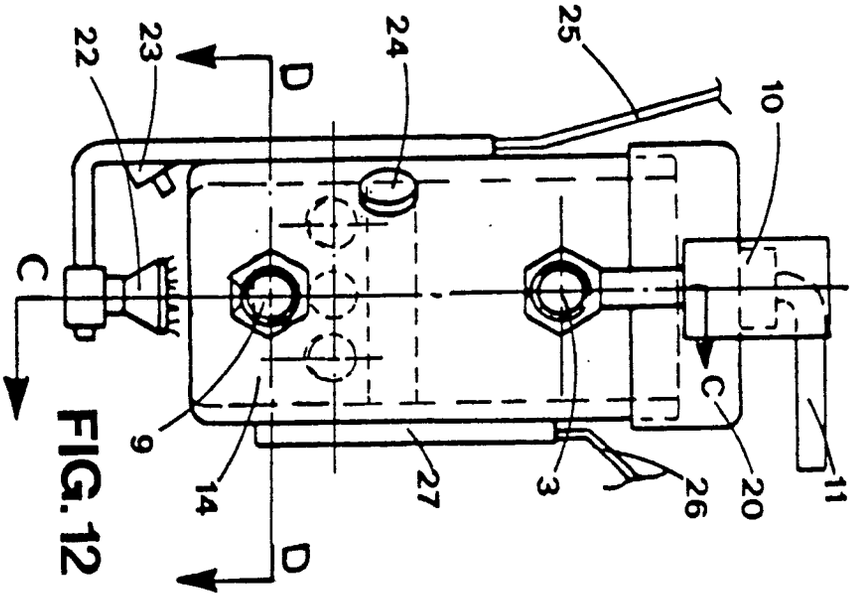



FIG.12

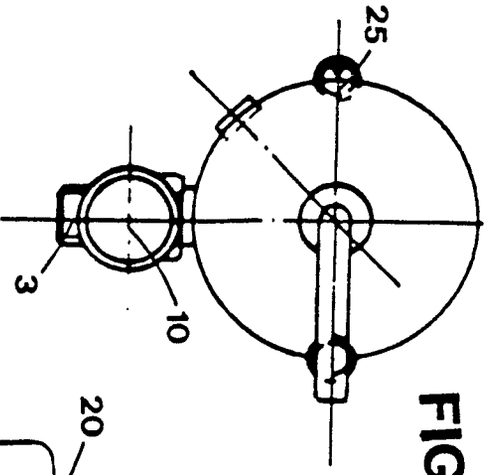



FIG.15

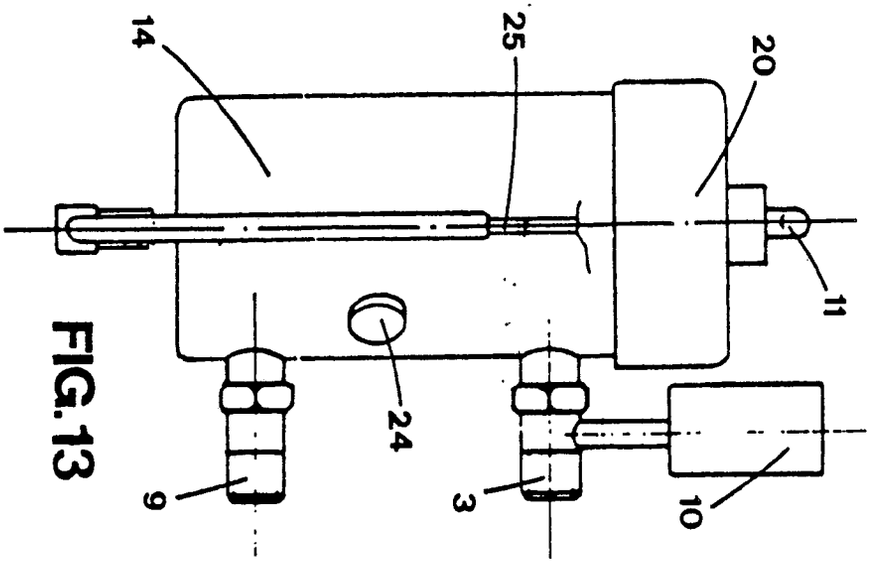
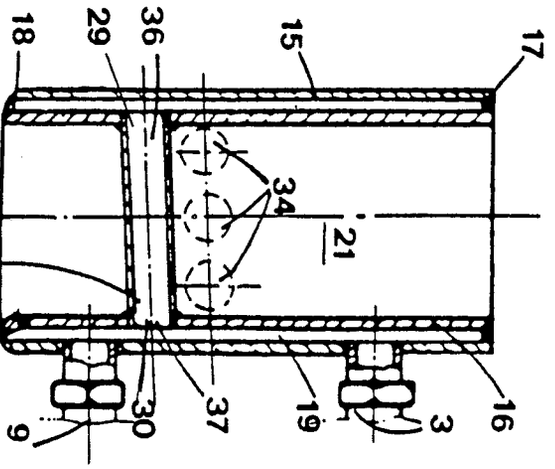
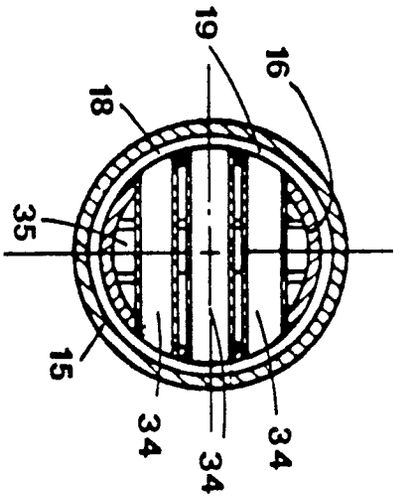



FIG.13




Sez. C-C

FIG.14




Sez. D-D

FIG.16

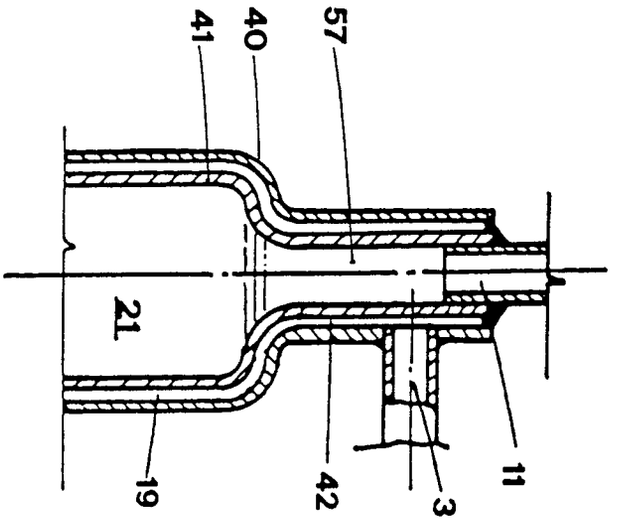



FIG.17

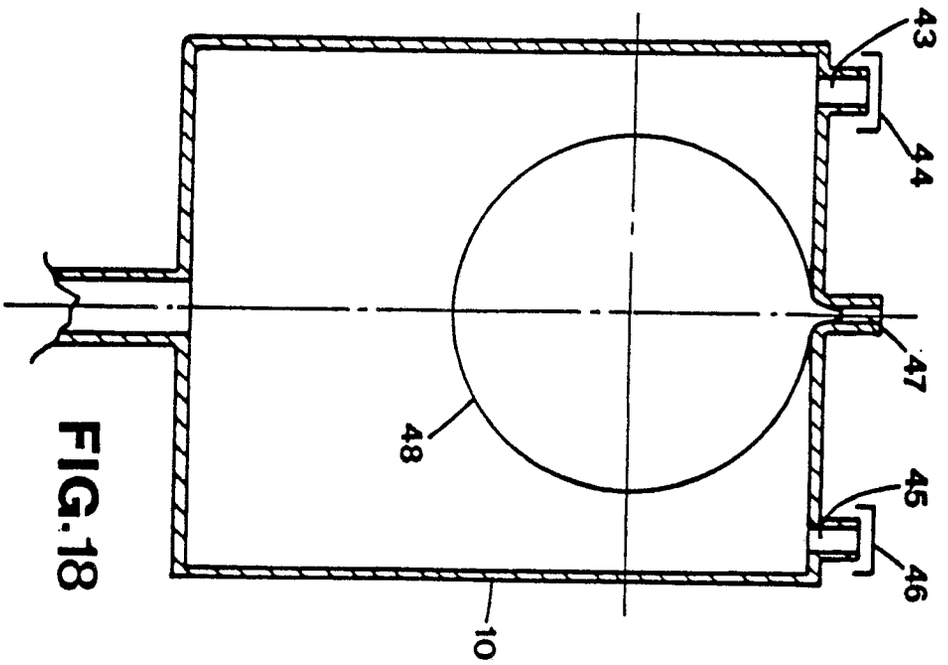



FIG.18

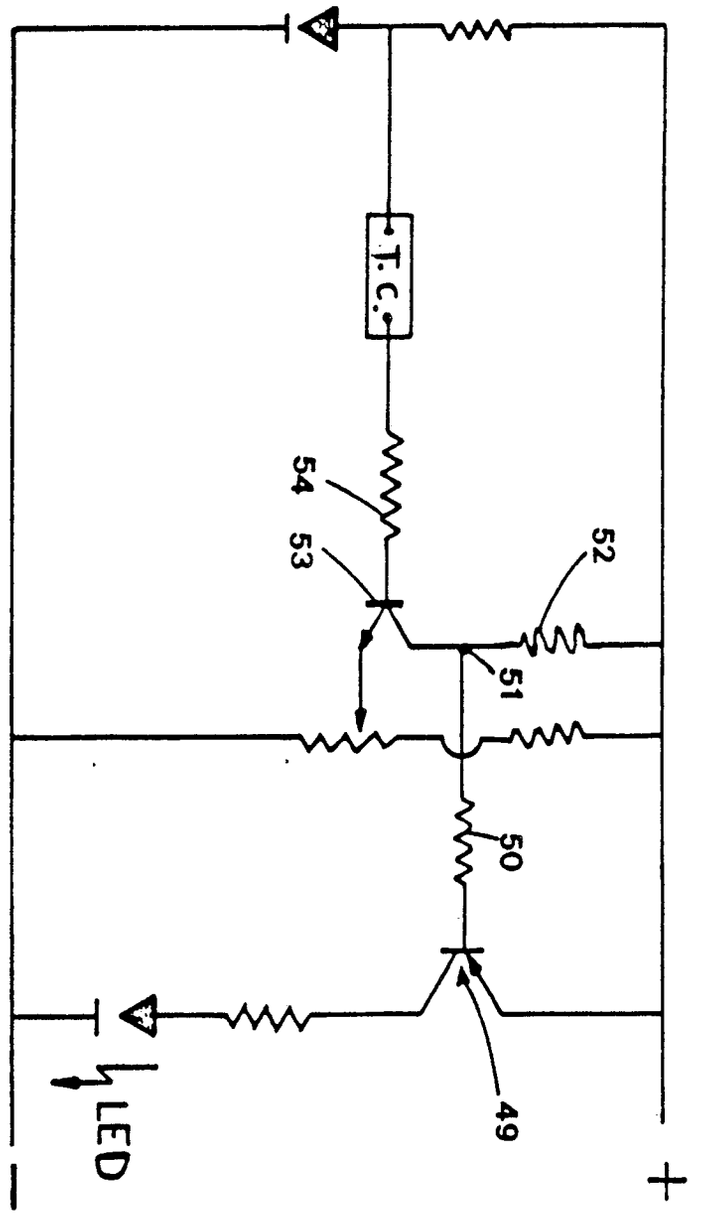



FIG.19