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(54) HOT WATER HEATERS

HEISSWASSERBOILER

CHAUFFE-EAU

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Description

This invention relates to hot water heaters particularly but not exclusively to hot water heaters which can be used in domestic hot water systems.

US patent specification No. 2,404,860 discloses a hot water heater having a gas burner beneath a water vessel and passages which convey combustion products up one side of the vessel, across the top and down the other side so as to heat the water through the walls of the vessel. The combustion products are then discharged through a vertical pipe into a stack.

It is an object of the present invention to provide an efficient hot water heater in which a uniform water temperature distribution is possible.

According to the present invention, there is provided a hot water heater comprising a vessel for water, heating means for applying heat to one side of the vessel for heat transfer to water in the vessel adjacent to said one side to thereby establish a convection current in the water from said one side towards the top of the vessel, the heating means comprising a burner located below the vessel and which produces hot combustion products, the heating means further including a flue structure arranged to receive the hot combustion products from the burner the flue structure including a first exhaust duct at said one side and arranged so that combustion products from the burner pass upwardly through the first exhaust duct to heat water in the vessel at said one side, the flue structure further including secondary duct means spaced from said one side of the vessel, the secondary duct means being arranged to receive combustion products from the first exhaust duct and to pass combustion products from the burner in a downwards direction and to heat water in the vessel adjacent said secondary duct means. The heater is characterised by a balanced flue having an air intake through which air from atmosphere is drawn and supplied to said burner and having an exhaust in communication with said secondary duct means so that the combustion products from the secondary duct means enter the balanced flue and then escape to atmosphere through said exhaust, the air intake and exhaust being adjacent to each other, whereby combustion products from the burner pass upwardly through said first exhaust duct at said one side of the vessel and then pass downwardly through the secondary duct means, spaced from said one side of the vessel, and then pass to atmosphere through the exhaust of the balanced flue adjacent to the air intake of the balanced flue.

Preferably the first exhaust duct decreases in surface area in an upwards direction and/or the secondary duct means decreases in surface area in the downwards direction.

The secondary duct means preferably discharges combustion products away from the vessel at a bottom end of the secondary duct means to an exhaust arrangement of the balanced flue. The exhaust arrangement may include an exhaust chamber into the bottom of which combustion products from the secondary duct means enter, the exhaust chamber having a transfer opening at an upper portion thereof and through which combustion products pass into a flue outlet chamber having the exhaust for discharge of combustion products to atmosphere.

The secondary duct means preferably comprises second and third separate exhaust ducts which are disposed at respective opposite sides of the vessel relative the one side where the first exhaust duct is located. Preferably the opposite sides of the vessel where the second and third ducts are provided are not located diametrically opposite to the side of the vessel where the first duct is located. The opposite sides and the one side of the vessel where heating of water in the vessel by heat transfer through the vessel occurs preferably comprise a major proportion of the surface area of the vessel (4).

The first exhaust duct and the secondary duct means may be defined by a sheet metal member which includes formations which cooperate with the vessel to define the first exhaust duct and the secondary duct means. The sheet metal member may be located around the outside of the vessel, the sheet metal member having portions being spaced from the outside surface of the vessel to define the first exhaust duct and the secondary duct means, the sheet metal member being turned inwardly to define the formations which contact the outside surface of the vessel along substantially the entire height of the vessel and thereby define the boundaries of the first exhaust duct and the secondary duct means.

Preferred features of the invention will now be further described with refrence to the accompanying drawings, in which:

FIGURE 1 is a schematic perspective view of a gas fired hot water heater embodying the principles of the invention;
FIGURE 2 is a schematic cross-sectional view of the heater of Figure 1;
FIGURE 3 is a fragmentary view of the flue assembly;
FIGURE 4 is a schematic side view of the heater;
FIGURE 5 is a cross-sectional view along line 21-21;
FIGURE 6 is a cross-sectional view along line 22-22;
FIGURE 7 is a side view of a burner useable in the invention; and
FIGURE 8 is a fragmentary end view along the line 24-24.

Figures 1 to 8 illustrate schematically a gas fired hot water heater 2. In these Figures, some parts have been omitted for clarity of illustration but such omitted parts will be either mentioned specifically or will be obvious and conventional components.

The heater 2 includes a cold water inlet 6 through the sidewall 29, near the bottom of the vessel 4, and a hot water outlet 8 located at the top of the vessel. Beneath the vessel 4 is a combustion chamber 11 the bot-

tom of which is formed as a condensate tray 13 having an outlet 15. A burner 17 is located so as to project into the combustion chamber 11. More particularly, the combustion chamber includes an opening 19 through which the burner 17 passes. As best seen in Figures 7 and 8, the burner is generally wedge shaped and has a number of outlet orifices 25 on its narrow end.

The vessel 4 is surrounded by a partitioned flue structure 27 which serves to direct hot combustion products from the chamber 11 upwardly adjacent to one side 29 of the vessel and then downwardly adjacent to opposed sides 32 and 33 (see Figure 5) of the vessel and then to a balanced flue assembly 34, which is omitted in Figure 1 for clarity of illustration. The flue structure 27 is shaped so as to keep the hot exhaust products away from the side 36 which is opposite to the side 29 which first receives the combustion products from the chamber 11. The side 29 is therefore very hot whereas the opposite side 36 remains relatively cool. This establishes a convection current indicated by wavy arrows 38. The circulating convection current tends to promote a more uniform temperature distribution in the water throughout the vessel. This is in contrast to other hot water heaters which normally have a more or less static body of water within them with a significant temperature differential between the top and bottom. The circulating current tends to avoid overheating at the top of the tank which might otherwise occur and, in addition, leads to a greater volume of hot water being available to the user at a more or less uniform temperature.

The flue structure 27 is preferably formed from a sheet of stainless steel or aluminized steel and is shaped so as to generally surround the vessel 4 and to define three exhaust ducts 40, 42 and 35 adjacent to the sides 29, 32 and 33 respectively. The structure 27 includes grooves 46 and 48 the inner ends of which bear against the outer periphery of the vessel 4, as best seen in Figure 5. The grooves 46 and 48 define the boundary between the ducts 40 and the adjacent parts of the ducts 42 and 45. The outer ends of the ducts 42 and 35 are defined by inturned legs 50 and 52 of the structure 27. As best seen in Figure 4, the grooves 46 and 48 taper towards one another in the upward direction so that the duct 40 decreases in cross-sectional area in the upward direction. This tends to promote more uniform heat transfer to the vessel along its height because at the bottom where the exhaust gases are hottest, the area of the duct 40 is relatively wide. At the top, the exhaust gases have been cooled somewhat but are more concentrated owing to the smaller size of the duct 40. When the exhaust gases reach the top of the duct 40, they then pass adjacent to the top 21 of the vessel and then travel downwardly through the ducts 42 and 35 into the balanced flue structure 34. A heat shield 56 may be located near the centre of the top 21 of the vessel to prevent the exhaust gases from passing over that point. This avoids possible overheating or boiling of the water at the top centre of the vessel. The shield 56 preferably comprises a hollow cylindrical body which again may be made from stainless steel.

The vessel 4 and flue structure 27 are located within the housing 152 which is lined with insulating material 150, the housing 152 and insulating material 150 being shown in full in Figure 2 and indicated in part only in Figure 4. The flue structure 27 lies adjacent to the insulating material 150 and protects it from exposure to the exhaust gases. The insulation at the top of the vessel is protected by a plate 62. The housing 152 includes a base plate 64, a funnel 66 being provided to collect condensate from the outlet 15.

The heater includes a thermostatically controlled gas valve 68 which is located in the air inlet chamber of the balanced flue structure 34 and it functions in the usual way. A probe 69 extends into the vessel 4 for sensing the temperature of the water and controlling the valve 68 in the usual way. The valve 68 includes an outlet nozzle 72 which is located adjacent to the flared end 74 of an inlet pipe 76 to the burner 17. Primary combustion air is drawn into the flared inlet 74 in the usual way.

Figure 3 schematically illustrates the balanced flue structure 34. The structure 34 essentially comprises a box structure having sidewalls 75 and 76 and a top wall 77. The structure has an inner face 78 which is essentially open and lies adjacent to the flue structure 27. The box structure has an outer face which is open except for a flange 79 which extends inwardly from sidewalls 75, 76 and top wall 77 and across the bottom face 91 which is open at the inner part 93 and closed at the outer part 95. The outer face is closed by a removable cover (not shown) which permits access to the burner 17 and control valve 68. The box structure includes a partitioning plate 80 which is vertically disposed and forms an exhaust chamber 81 towards the inner face 78 of the structure and an inlet chamber 82 towards the outer face of the structure. It also includes a horizontally disposed plate 83 extending betwen the sidewalls 75 and 76 and the plate 80 and front face 79. The plate 83 defines a flue outlet chamber above it. The plate 80 includes a transfer opening 84 bounded by two baffle plates 85 to permit exhaust gases to pass from the chamber 81 into the outlet chamber and then through exhaust outlet grates 86 formed in the sidewalls 75 and 76. The sidewalls 75 and 76 also include air inlet grates 87 located beneath the grates 86 to permit air to be drawn into the inlet chamber 82. Because the grates 86 and 87 are located adjacent to one another, the arrangement acts as a balanced flue. Streams of exhaust gases, as indicated by arrows 88 from the exhaust ducts 42 and 35, enter the lower part of the chamber 81 from beneath the lower edges of the ducts 42 and 35 and then pass through the opening 84 and escape through the grates 86.

Inlet streams of air, as indicated by arrows 89 in Figure 3, pass through the grates 87 downwardly through the chamber 82 and exit through the open bottom part 93 so as to then be drawn into the combustion chamber 11 to provide secondary air for the burner 17. Since the

probe 69 passes through the exhaust chamber 81 it may include heat shielding to prevent overheating.

Figures 7 and 8 illustrate the preferred arrangement for the burner 17. The burner is generally wedge shaped and is formed from upper and lower pressed steel portions 120 and 122. The front edges of the portions 120 and 122 are formed with accurate grooved portions which cooperation to form the row of outlet orifices 25 with cross lighting gaps.

The gas fuel inlet pipe 76 is connected near the rear part of the upper member 120 and an internal baffle 128 is provided so as to direct the gas air mixture towards the orifices 25. Mixing of the gases occurs in the body of the burner 17 as well as in the pipe 76. In use the burner 17 produces a row of flames which are located near the centre of the bottom of the vessel 4 and are directed generally towards the passage 40. Heat transfer will occur at the bottom of the vessel 4 as well as within the passages 40, 42 and 35.

Claims

1. A hot water heater comprising a vessel (4) for water, heating means (17) for applying heat to one side (29) of the vessel (4) for heat transfer to water in the vessel adjacent to said one side (29) to thereby establish a convection current (38) in the water from said one side (29) towards the top (21) of the vessel, the heating means (17) comprising a burner located below the vessel (4) and which produces hot combustion products, the heating means (17) further including a flue structure (27) arranged to receive the hot combustion products from the burner (17), the flue structure (27) including a first exhaust duct (40) at said one side (29) and arranged so that combustion products from the burner pass upwardly through the first exhaust duct (40) to heat water in the vessel (4) at said one side (29), the flue structure (27) further including secondary duct means (35, 42) spaced from said one side (29) of the vessel, the secondary duct means (35, 42) being arranged to receive combustion products from the first exhaust duct (40) and to pass combustion products in a downwards direction and to heat water in the vessel (4) adjacent said secondary duct means (35, 42), the heater being characterised by a balanced flue (34) having an air intake (87) through which air from atmosphere is drawn and supplied to said burner (17) and having an exhaust (86) in communication with said secondary duct means (35, 42) so that the combustion products from the secondary duct means enter the balanced flue (34) and then escape to atmosphere through said exhaust (86), the air intake (87) and exhaust (86) being adjacent to each other, whereby combustion products from the burner (17) pass upwardly through said first exhaust duct (40) at said one side (29) of the vessel (4) and then pass downwardly through the secondary duct means (35, 42) spaced from said one side (29) of the vessel, and then pass to atmosphere through the exhaust (86) of the balanced flue (34) adjacent to the air intake (87) of the balanced flue (34).

2. A heater as claimed in Claim 1 characterised in that the first exhaust duct (40) decreases in surface area in the upwards direction.

3. A heater as claimed in Claim 1 or 2 characterised in that the secondary duct means (35, 42) decreases in surface area in the downwards direction.

4. A heater as claimed in any one of the preceding claims characterised in that the secondary duct means (35, 42) discharges combustion products away from the vessel (4) at a bottom end of the secondary duct means to an exhaust arrangement (81, 84, 85) of the balanced flue (34).

5. A heater as claimed in Claim 4 characterised in that the exhaust arrangement includes an exhaust chamber (81) into the bottom of which combustion products from the secondary duct means (35, 42) enter, the exhaust chamber (81) having a transfer opening (84) at an upper portion thereof and through which combustion products pass into a flue outlet chamber having said exhaust (86) for discharge of combustion products to atmosphere.

6. A heater as claimed in any one of the preceding claims characterised in that the secondary duct means (35, 42) comprises second and third separate exhaust ducts (35 and 42) which are disposed at respective opposite sides (32, 33) of the vessel (4) relative said one side (29) where the first exhaust duct (40) is located.

7. A heater as claimed in Claim 6 characterised in that said opposite sides (32, 33) of the vessel (4) are not located diametrically opposite to said one side (29) of the vessel (4).

8. A heater as claimed in Claim 6 or 7 characterised in that said opposite sides (32, 33) and said one side (29) of the vessel (4) where heating of water in the vessel by heat transfer through the vessel occurs comprise a major proportion of the surface area of the vessel (4).

9. A heater as claimed in any one of the preceding claims characterised in that the first exhaust duct (40) and the secondary duct means (35, 42) are defined by a sheet metal member (27) which includes formations (46, 48, 50, 52) which cooperate with the vessel (4) to define said first exhaust duct (40) and said secondary duct means (35, 42).

10. A heater as claimed in Claim 9 characterised in that the sheet metal member (27) is located around the outside of the vessel (4), the sheet metal member having portions being spaced from the outside surface of the vessel (4) to define the first exhaust duct (40) and the secondary duct means (35, 42), the sheet metal member (27) being turned inwardly to define the formations (46, 48, 50, 52) which contact the outside surface of the vessel (4) along substantially the entire height of the vessel and thereby define the boundaries of the first exhaust duct (40) and the secondary duct means (35, 42).

Patentansprüche

1. Heißwassererhitzer mit einem Behälter (4) für Wasser, einem Heizmittel (17) zum Beaufschlagen einer Seite (29) des Behälters (4) mit Wärme, zur Übertragung von Wärme auf Wasser in dem der besagten einen Seite (29) benachbarten Behälter, um dadurch eine Konvektionsströmung (38) in dem Wasser von der besagten einen Seite (29) zur Oberseite (21) des Behälters aufzubauen, wobei das Heizmittel (17) einen unterhalb des Behälters (4) befindlichen und heiße Verbrennungsprodukte erzeugenden Brenner umfaßt, wobei das Heizmittel (17) weiterhin eine Zugkanalstruktur (27) enthält, die zum Empfangen der heißen Verbrennungsprodukte vom Brenner (17) angeordnet ist, wobei die Abzugsstruktur (27) einen ersten Abgaskanal (40) auf der besagten einen Seite (29) enthält und so angeordnet ist, daß Verbrennungsprodukte vom Brenner nach oben durch den ersten Abgaskanal (40) treten, um Wasser im Behälter (4) an der besagten einen Seite (29) aufzuheizen, wobei die Zugkanalstruktur (27) weiterhin untergeordnete Kanalmittel (35, 42) enthält, die von der besagten einen Seite (29) des Behälters beabstandet sind, wobei die untergeordneten Kanalmittel (35, 42) angeordnet sind, um Verbrennungsprodukte von dem ersten Abgaskanal (40) zu empfangen und Verbrennungsprodukte nach unten weiterzuleiten und im Behälter (4) neben besagten untergeordneten Kanalmitteln (35, 42) Wasser zu erhitzen, wobei der Erhitzer durch einen symmetrischen Zugkanal (34) gekennzeichnet ist, mit einem Lufteinlaß (87), durch den Luft aus der Atmosphäre angesogen und besagtem Brenner (17) zugeführt wird, und mit einem Abgasaustritt (86), der mit besagten untergeordneten Kanalmitteln (35, 42) so in Verbindung steht, daß die Verbrennungsprodukte von den untergeordneten Kanalmitteln in den symmetrischen Zugkanal (34) eintreten und dann durch besagten Abgasaustritt (86) in die Atmosphäre entweichen, wobei der Lufteinlaß (87) und der Abgasaustritt (86) nebeneinander liegen, wodurch Verbrennungsprodukte von dem Brenner (17) nach oben durch den besagten ersten Abgaskanal (40) an besagter einer Seite (29) des Behälters (4) treten und dann nach unten durch die von besagter einer Seite (29) des Behälters beabstandeten untergeordneten Kanalmittel (35, 42) treten und dann durch den neben dem Lufteinlaß (87) des symmetrischen Zugkanals (34) liegenden Abgasaustritt (86) des symmetrischen Zugkanals (34) in die Atmosphäre treten.

2. Erhitzer nach Anspruch 1, dadurch gekennzeichnet, daß die Oberfläche des ersten Abgaskanals (40) nach oben hin abnimmt.

3. Erhitzer nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Oberfläche der untergeordneten Kanalmittel (35, 42) nach unten hin abnimmt.

4. Erhitzer nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das untergeordnete Kanalmittel (35, 42) an einem unteren Ende der untergeordneten Kanalmittel Verbrennungsprodukte vom Behälter (4) weg zu einer Abgasaustrittsanordnung (81, 84, 85) des symmetrischen Zugkanals (34) abführt.

5. Erhitzer nach Anspruch 4, dadurch gekennzeichnet, daß die Abgasaustrittsanordnung eine Abgaskammer (81) enthält, in deren Boden Verbrennungsprodukte von den untergeordneten Kanalmitteln (35, 42) eintreten, wobei die Abgas kammer (81) an einem oberen Teil davon eine Übertragungsöffnung (84) aufweist, durch die Verbrennungsprodukte zum Abführen der Verbrennungsprodukte in die Atmosphäre in eine Zugkanalsauslaßkammer mit besagtem Abgasaustritt (86) treten.

6. Erhitzer nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die untergeordneten Kanalmittel (35, 42) einen zweiten und dritten getrennten Abgaskanal (35 und 42) umfassen, die an jeweils gegenüberliegenden Seiten (32, 33) des Behälters (4) bezüglich der besagten einen Seite (29), an der sich der erste Abgaskanal (40) befindet, angeordnet sind.

7. Erhitzer nach Anspruch 6, dadurch gekennzeichnet, daß besagte gegenüberliegende Seiten (32, 33) des Behälters (4) sich nicht diametral gegenüber der besagten einen Seite (29) des Behälters (4) befinden.

8. Erhitzer nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß besagte gegenüberliegende Seiten (32, 33) und besagte eine Seite (29) des Behälters (4), wo ein Erhitzen des Wassers im Behälter durch Wärmeübertragung durch den Behälter erfolgt, einen großen Teil der Oberfläche des Behälters (4) umfassen.

9. Erhitzer nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der erste Abgaskanal (40) und die untergeordneten Kanalmittel (35, 42) durch einen Blechkörper (27) abgegrenzt sind, der Gebilde (46, 48, 50, 52) enthält, die mit dem Behälter (4) zusammenwirken, um besagten ersten Abgaskanal (40) und besagte untergeordnete Kanalmittel (35, 42) abzugrenzen.

10. Erhitzer nach Anspruch 9, dadurch gekennzeichnet, daß der Blechkörper (27) sich um die Außenseite des Behälters (4) herum befindet, wobei der Blechkörper Teile aufweist, die von der Außenfläche des Behälters (4) beabstandet sind, um den ersten Abgaskanal (40) und die untergeordneten Kanalmittel (35, 42) abzugrenzen, wobei der Blechkörper (27) nach innen gewendet ist, um die Gebilde (46, 48, 50, 52) abzugrenzen, die die Außenfläche des Behälters (4) entlang im wesentlichen der gesamten Höhe des Behälters berühren und dadurch die Begrenzungen des ersten Abgaskanals (40) und der untergeordneten Kanalmittel (35, 42) festlegen.

Revendications

1. Chauffe-eau pour eau très chaude comprenant une cuve (4) pour l'eau, des moyens de chauffage (17) destinés à apporter de la chaleur à un côté (29) de la cuve (4) pour transmettre de la chaleur à l'eau contenue dans la cuve qui est adjacente audit côté donné (29), pour établir ainsi un courant de convection (38) dans l'eau, dudit côté (29) vers le sommet (21) de la cuve, les moyens de chauffage (17) comprenant un brûleur placé au-dessous de la cuve (4) et qui produit des produits de combustion très chauds, les moyens de chauffage (17) comprenant en outre une structure de conduits de fumées (27) agencée pour recevoir les produits de combustion très chauds issus du brûleur (17), la structure de conduits de fumées (27) comprenant un premier conduit d'échappement (40) situé au droit dudit côté (29) et agencé de manière que les produits de combustion issus du brûleur s'élèvent dans le premier conduit d'échappement (40) pour chauffer l'eau contenue dans la cuve (4) au droit dudit côté (29), la structure de conduits de fumées (27) comprenant en outre des moyens formant conduits secondaires (35, 42) espacés dudit côté (29) de la cuve, les moyens formant conduits secondaires (35, 42) étant agencés pour recevoir des produits de combustion issus du premier conduit d'échappement (40) et pour envoyer les produits de combustion dans une direction descendante et pour chauffer l'eau contenue dans la cuve (4) dans une position adjacente auxdits moyens formant conduits secondaires (35, 42), le chauffe-eau étant caractérisé par un conduit de fumées équilibré (34) ayant une entrée d'air (87) à travers laquelle de l'air provenant de l'atmosphère est aspiré et envoyé audit brûleur (17), et ayant un échappement (86) en communication avec lesdits moyens formant conduits secondaires (35, 42), de sorte que les produits de combustion issus des moyens formant conduits secondaires entrent dans le conduit de fumées équilibré (34) puis s'échappent dans l'atmosphère à travers ledit échappement (86), l'entrée d'air (87) et l'échappement (86) étant adjacents l'un à l'autre, de sorte que les produits de combustion issus du brûleur (17) s'élèvent dans ledit premier conduit d'échappement (40) au droit dudit côté (29) de la cuve (4), puis descendent dans les moyens formant conduits secondaires (35, 42), à distance dudit côté (29) de la cuve, puis passent à l'atmosphère à travers l'échappement (86) du conduit de fumées équilibré (34), dans une position adjacente à l'entrée d'air (87) du conduit de fumées équilibré (34).

2. Chauffe-eau selon la revendication 1, caractérisé en ce que le premier conduit d'échappement (40) diminue en surface dans la direction ascendante.

3. Chauffe-eau selon la revendication 1 ou 2, caractérisé en ce que les moyens formant conduits secondaires (35, 42) diminuent en surface dans la direction descendante.

4. Chauffe-eau selon l'une quelconque des revendications précédentes, caractérisé en ce que les moyens formant conduits secondaires (35, 42) rejettent les produits de combustion à distance de la cuve (4) à l'extrémité inférieure des moyens formant conduits secondaires, dans un conduit d'échappement (81, 84, 85) du conduit de fumées équilibré (34).

5. Chauffe-eau selon la revendication 4, caractérisé en ce que le dispositif d'échappement comprend une chambre d'échappement (81) dans le fond de laquelle entrent les produits de combustion issus des moyens formant conduits secondaires (35, 42), la chambre d'échappement (81) à sa partie supérieure ayant une ouverture de transfert (84) à travers laquelle les produits de combustion pénètrent dans une chambre de sortie de fumées présentant ledit échappement (86) pour rejeter les produits de combustion dans l'atmosphère.

6. Chauffe-eau selon l'une quelconque des revendications précédentes, caractérisé en ce que les moyens formant conduits secondaires (35, 42) comprennent des deuxième et troisième conduits d'échappement séparés (35 et 42) qui sont disposés au droit de côtés respectifs (32, 33) de la cuve (4) situés à l'opposé dudit côté (29) où est placé le premier conduit d'échappement (40).

7. Chauffe-eau selon la revendication 6, caractérisé en ce que lesdits côtés opposés (32, 33) de la cuve (4) ne sont pas placés diamétralement à l'opposé dudit côté (29) de la cuve (4).

8. Chauffe-eau selon la revendication 6 ou 7, caractérisé en ce que lesdits côtés opposés (32, 33) et ledit côté (29) de la cuve (4) où se produit le chauffage de l'eau contenue dans la cuve par transmission de chaleur à travers la cuve représentent une grande proportion de la surface de la cuve (4).

9. Chauffe-eau selon l'une quelconque des revendications précédentes, caractérisé en ce que le premier conduit d'échappement (40) et les moyens formant conduits secondaires (35, 42) sont définis par un élément en tôle (27) qui présente des formations (46, 48, 50, 52) qui coopèrent avec la cuve (4) pour définir ledit premier conduit d'échappement (40) et lesdits moyens formant conduits secondaires (35, 42).

10. Chauffe-eau selon la revendication 9, caractérisé en ce que l'élément en tôle (27) est placé à l'extérieur autour de la cuve (4), l'élément en tôle possédant des parties qui sont espacées de la surface extérieure de la cuve (4) pour définir le premier conduit d'échappement (40) et les moyens formant conduits secondaires (35, 42), l'élément en tôle (27) étant rabattu vers l'intérieur pour définir les formations (46, 48, 50, 52) qui entrent en contact avec la surface extérieure de la cuve (4) substantiellement sur toute la hauteur de la cuve et définissent de cette façon les limites du premier conduit d'échappement (40) et des moyens formant conduits secondaires (35, 42).

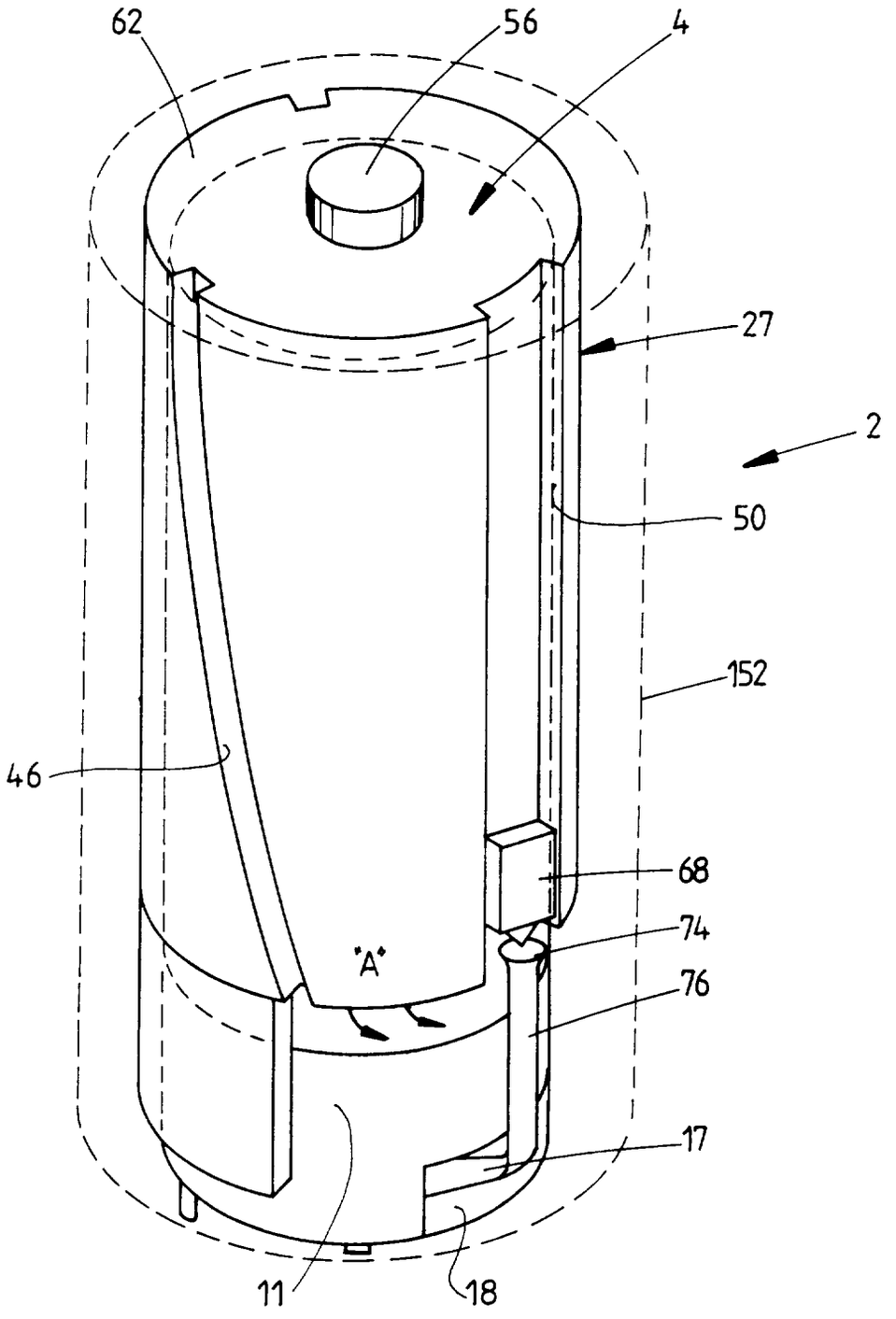

Fig. 1

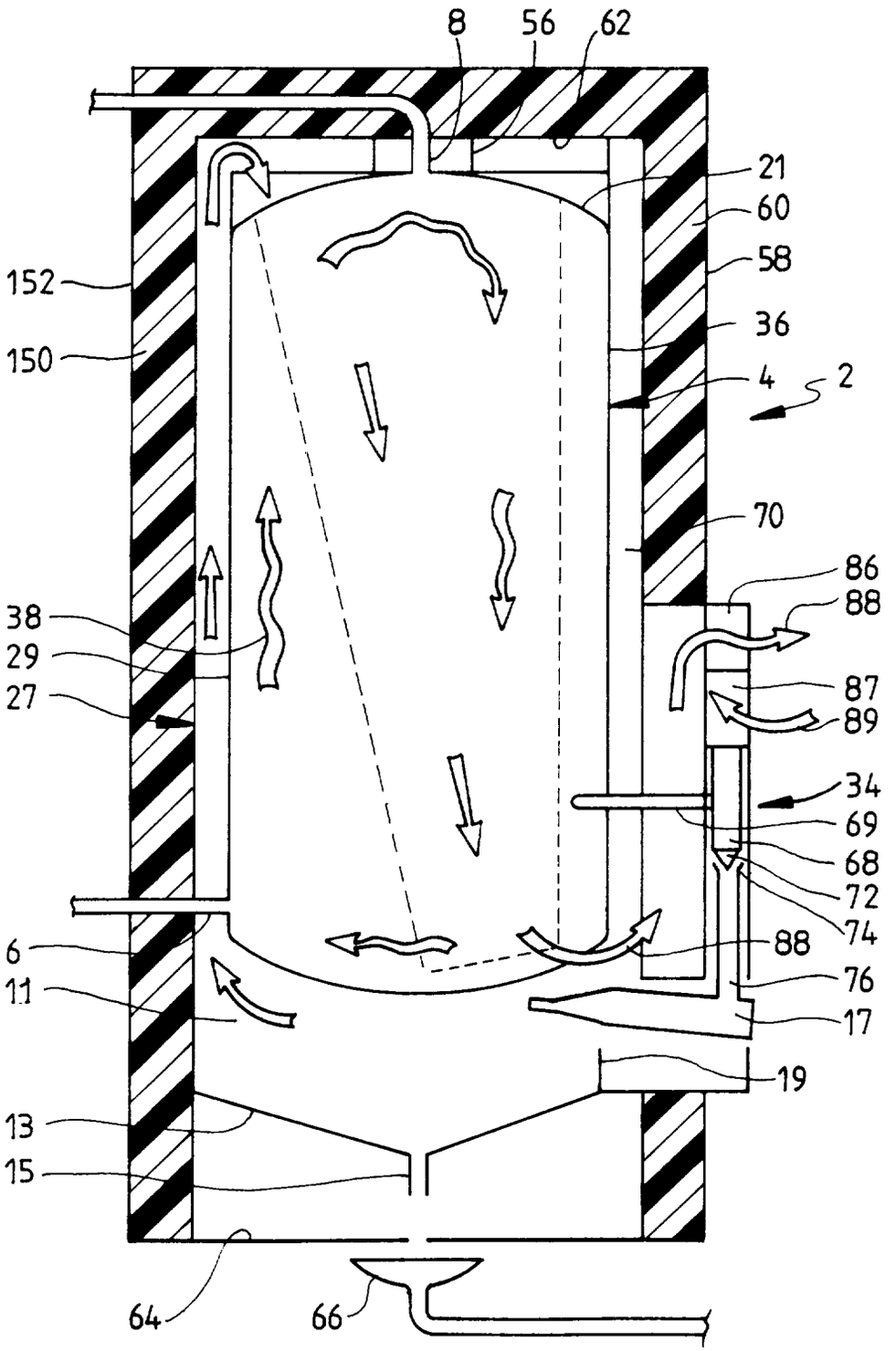
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Fig. 2

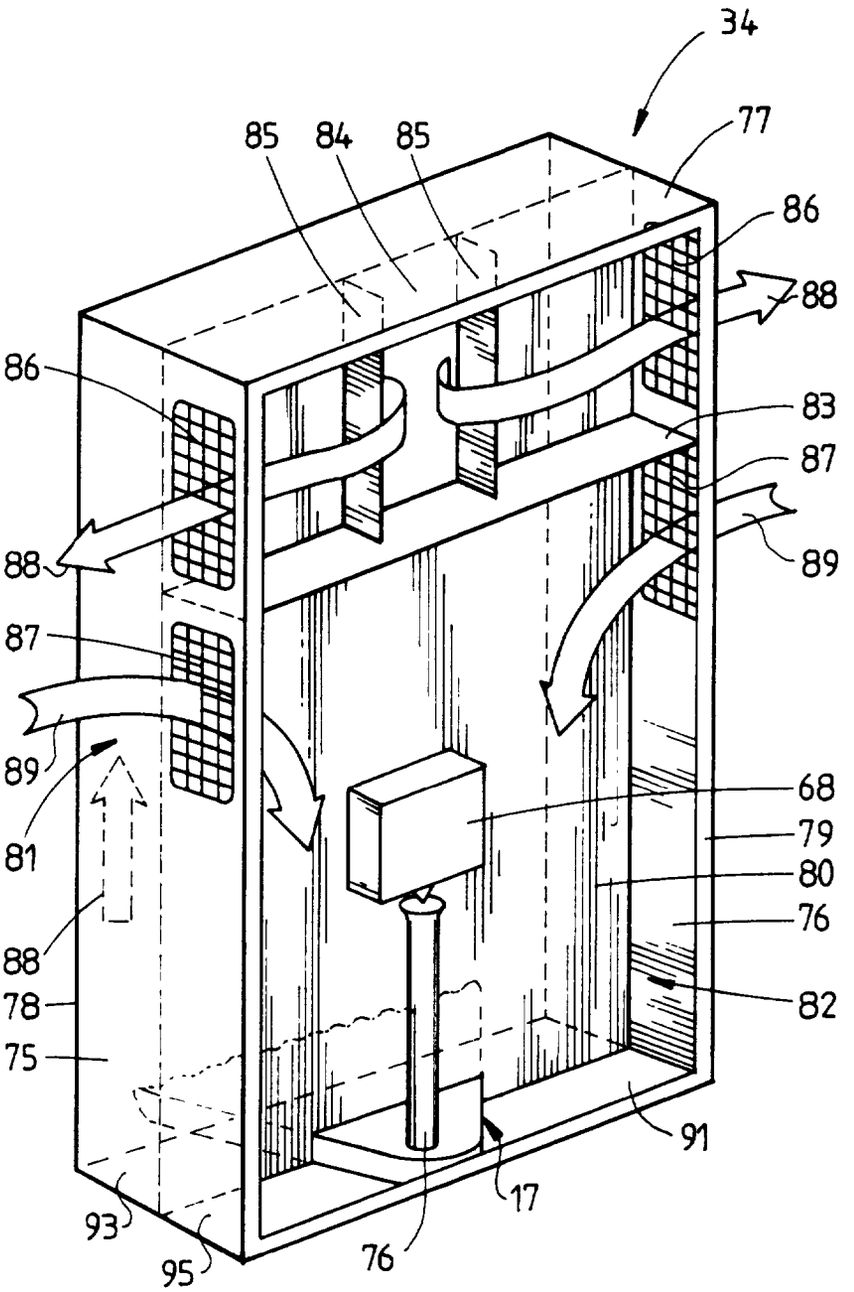
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Fig. 3

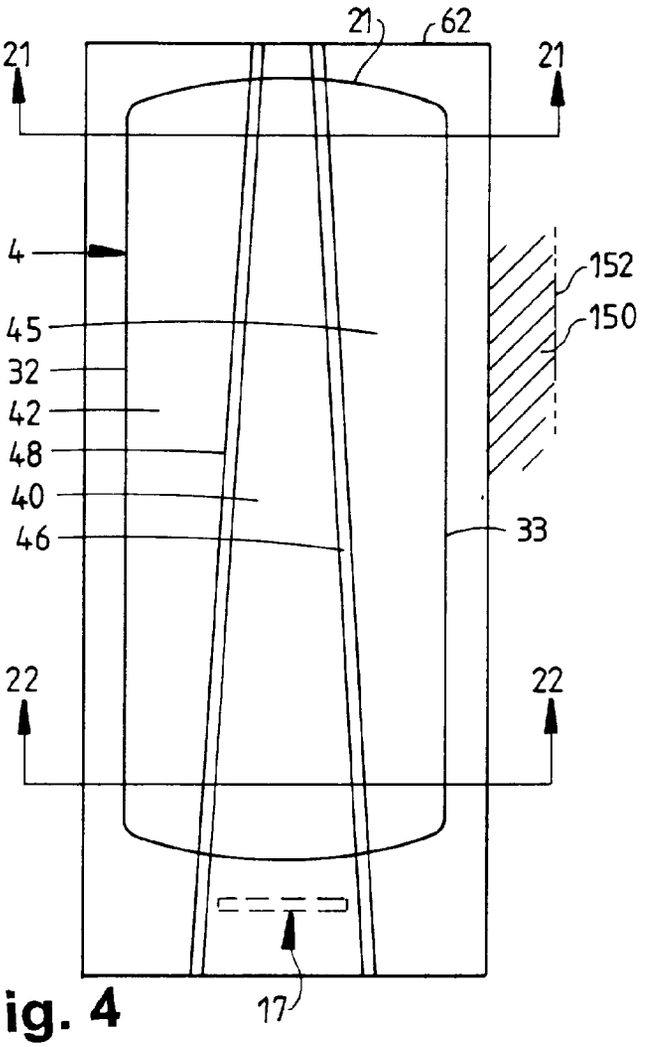

Fig. 4

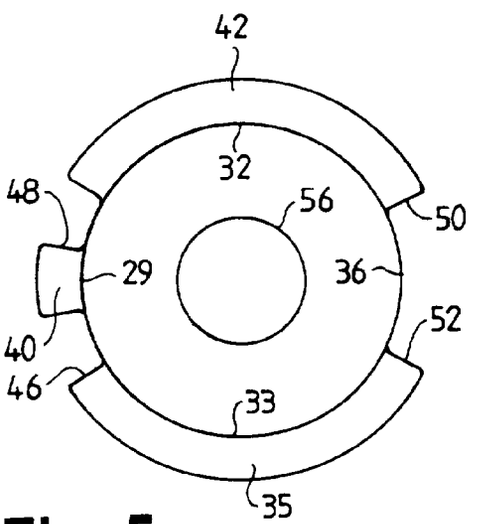

Fig. 5

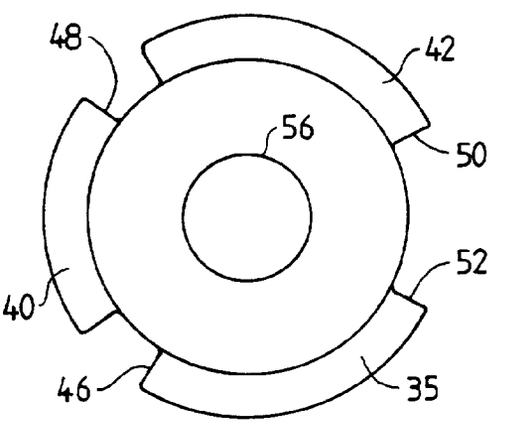

Fig. 6

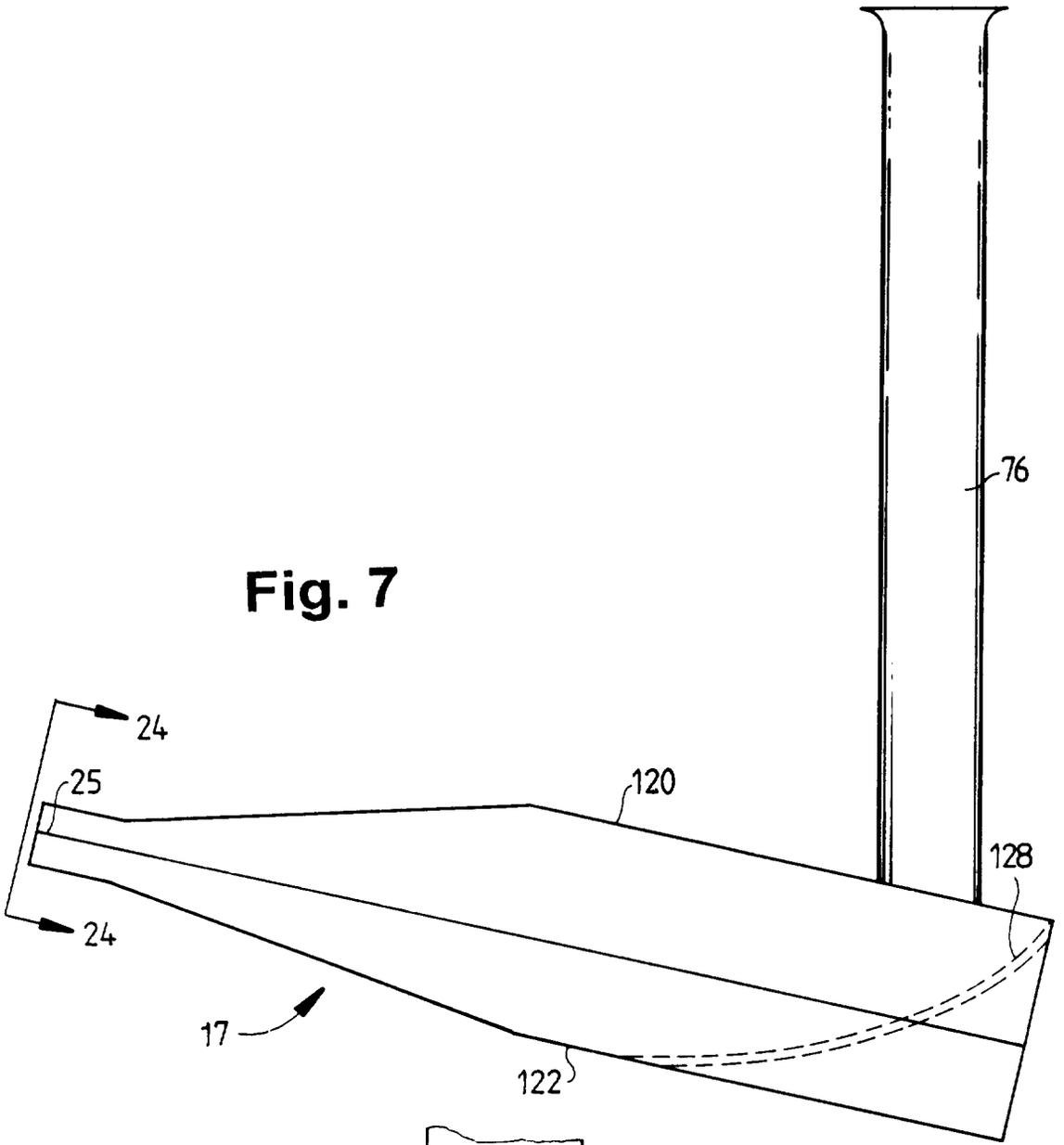

Fig. 7

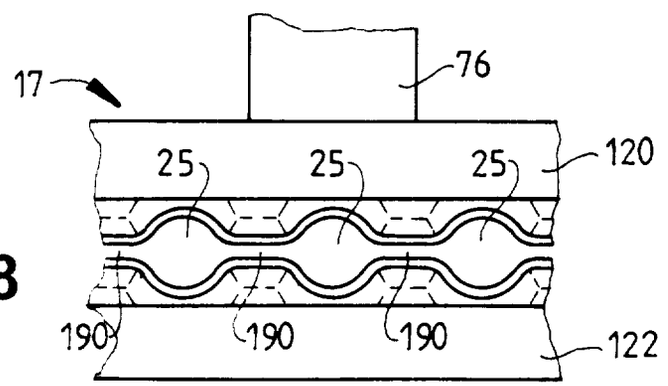

Fig. 8