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(54) Heat exchange apparatus.

(57) Heat exchange apparatus (2) comprising a housing (4), a chamber (6), in the housing (4) through which hot gases flow in use of the heat exchange apparatus (2), and a heat exchange wall (8) which is positioned in the chamber (6) and which has a plurality of corrugations (10) defining ridges (12) and troughs (14) over which the hot gases flow in order to increase the surface area in the chamber (6) for heat exchange purposes.

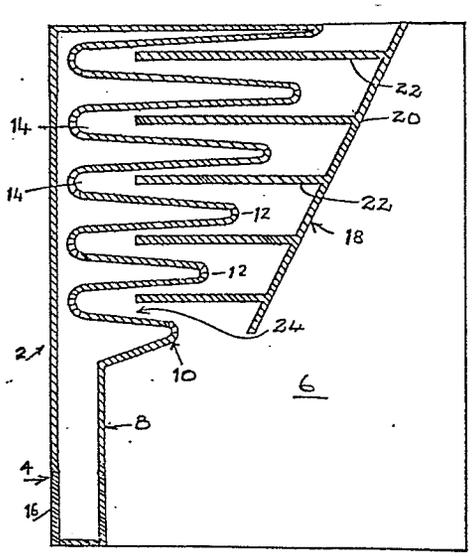

FIG 1

EP 0 230 789 A2

HEAT EXCHANGE APPARATUS

This invention relates to heat exchange apparatus.

Various types of heat exchange apparatus are known. Thus, for example, one form of known heat exchange apparatus which includes a combustion chamber is known as a wrap-around back boiler. Recently designed wrap-around back boilers are sometimes referred to as easy-to -clean back boilers.

It is an aim of the present invention to provide heat exchange apparatus which gives an efficient heat transfer and which is also able easily to be cleaned.

Accordingly, this invention provides heat exchange apparatus comprising a housing, a chamber in the housing through which hot gases flow in use of the heat exchange apparatus, and a heat exchange wall which is positioned in the chamber and which has a plurality of corrugations defining ridges and troughs over which the hot gases flow in order to increase the surface area in the chamber for heat exchange purposes.

The heat exchange wall with its corrugations enables the efficient heat transfer of heat as it passes through the heat exchange apparatus. This is because the ridges and troughs present an increased surface area over a straight wall and this increased surface area is available for heat

exchange purposes. The heat exchange wall with its corrugations is also such that it is able to be relatively easily cleaned.

The corrugations in the heat exchange wall may be V-shaped, U-shaped or rectangular in cross section. Other shaped corrugations may also be employed.

The heat exchange wall is preferably formed as a rear wall of the housing. Such a construction facilitates easy cleaning of the heat exchange apparatus.

The heat exchange wall may be made from a single sheet of metal. The single sheet of metal may be bent or formed to produce the required corrugations. The corrugations are advantageous from the ease of cleaning aspect in that substantially all of the wall is able to be seen so that cleaning can be carried out more easily and more efficiently than with other types of configuration. Furthermore, where the heat exchange wall forms the rear wall of the housing and it is desired to weld the heat exchange wall to side walls of the heat exchange apparatus, then welded seams may be employed that are substantially entirely visible from both the front and the back of the heat exchange apparatus. This means that the joints to form the welded seams can be welded on both sides which greatly reduces any possibility of gas leakage from within the heat exchange apparatus.

Preferably, the heat exchange apparatus includes baffle means for fitting into the corrugations of the heat exchange wall to restrict the flow of the hot gas through the chamber.

The provision of the baffle means may greatly improve the heat exchange efficiency of the heat exchange apparatus. The baffle means acts as an inducer to induce the greater heat efficiency.

The baffle means may be a fixed baffle means. However, preferably, the baffle means is a movable baffle means which can be moved from a closed position in which substantially all the hot gases are restricted from flowing over the heat exchange wall, to an open position in which substantially all the hot gases are caused to flow over the heat exchange wall.

Generally, the movable baffle means can be moved by sliding it backwards and forwards and it can be slid to any desired position between its fully closed position and its fully open position. When the baffle means is in a partially open position, it is able to restrict the amount of combusted hot gases that can flow upwardly through the heat exchange apparatus and, in so doing, it restricts the amount of the gases in contact with the heat exchange wall. The heat is thus extracted only from the hot gases that are in direct contact with the heat exchange wall.

With the baffle means in the closed position, all the hot gases are restricted from flowing upwards through the heat exchange apparatus and thus from making contact with any boiler that may be present in the heat exchange apparatus. In this case, the baffle means would only be used in the closed position when hot water was not required but when radiant heat was required.

With the baffle means in the open position, the maximum amount of hot gases are allowed to flow through the heat exchange apparatus and more specifically between the baffle means and the heat exchange wall. The baffle means in the open position will reduce the temperature of combustion since, as the baffle means is adjusted inwardly, the passage defined between the heat exchange wall and the baffle means will become more and more restricted, thereby allowing a smaller amount of hot gas to flow therethrough. This will cause the hot gases to flow faster and this will in turn cause more vigorous combustion with a resultant increase in temperature. This makes combustion more efficient, as at the higher temperature, more of the gases are burnt. This in turn reduces polution.

Preferably, the baffle means comprises a plurality of plate devices that slide between the ridges and into the troughs of the corrugations of the heat exchange wall. As indicated above, the more the baffle means moves towards a

closed position, the more it restricts the flow of hot gases that can pass through the passage defined by the heat exchange wall on the one hand and the baffle means on the other hand.

Where the baffle means is a fixed baffle means, it may be arranged such that it can be removed during cleaning but, between cleaning periods, it will be fixed in a desired position able to give the best desired results.

The baffle means may be made in one piece or it may be made up of several parts in order to facilitate removal and subsequent cleaning.

The heat exchange apparatus may have one or more hatches or doors for allowing removal of the baffle means for cleaning purposes.

The baffle means may be carried between side walls by lugs, brackets or channels fixed in position, for example by welding or other means.

The baffle means, especially for example in the case of oil or gas fired heat exchange apparatus, can be twin walled to hold water. Water inlets and outlets may be provided to extend beyond the thickness of the side walls and the main heat exchange apparatus.

The side walls may have a cut out to accommodate the extended water inlets and outlets, and connection to the water inlets and outlets may be by means of a flexible hose. This may be advantageous in helping to reduce the size of the heat exchange apparatus.

The heat exchange apparatus may include a combustion chamber.

The combustion chamber may be provided in close physical contact with the heat exchange wall. Alternatively, the combustion chamber can be placed at a remote location with respect to the heat exchange wall. Thus the combustion chamber may be placed in a different room to that in which the heat exchange wall is located. For example, the heat exchange wall can be placed in an adjacent room behind a room that contains the combustion unit. If desired, the heat exchange wall can be placed in a room above a room containing the combustion chamber, or it may even be placed in a roof space. All that is required to connect the combustion chamber to the heat exchange wall is an appropriate flue. This offers a considerable advantage to users of traditional fireplaces in which radiant heat is the only heat transfer and in which the traditional fireplaces are required to remain without losing any of their efficiency. For such an arrangement, a simple unit can be inserted into the flue in order to transfer the combustion gases to the heat exchange wall.

The heat exchange apparatus of the present invention may include a fan.

The fan may be used to improve operating efficiency of the heat exchange apparatus.

The baffle means may be formed as a unit which is substantially identical to the heat exchange wall. Thus, for example, the baffle means can be fabricated in double hollow skinned steel so that, when it is pushed forward towards it closed position, its projections and recesses fit into complementary recesses and projections on the heat exchange wall. With such an arrangement, water connections may be provided by means of flexible hoses.

The heat exchange apparatus may also include plate means which is positioned outside the baffle means and which is for increasing radiant heat.

The plate means may be placed at a distance away from a plate of the baffle means in order to allow combustion gases to flow upwards on the outside of the plate of the baffle means, whereupon at the top, the hot gases are drawn downwards to flow between the plate of the baffle means and the said plate means which is positioned outside the baffle means.

Embodiments of the invention will now be described solely by way of example and with reference to the accompanying drawings in which:

Figure 1 is a side sectional view of first heat exchange apparatus;

Figure 2 is a side sectional view of second heat exchange apparatus and which is like the heat exchange apparatus shown in Figure 1;

Figure 3 is a perspective sectional view of heat exchange apparatus similar to that shown in Figures 1 and 2;

Figure 4 is a side sectional view of heat exchange apparatus in the form of an oil fired central heating boiler;

Figure 5 is a section through heat exchange apparatus in the form of a flue pipe heat exchange unit;

Figure 6 is a perspective view of further heat exchange apparatus;

Figure 7 is a side sectional view of heat exchange apparatus in the form of a back boiler, the back boiler including baffle means and an additional plate located outside a face plate of the baffle means;

Figures 8 and 9 are side sectional views through double-faced back boilers;

Figure 10 is a sectional view through heat exchange apparatus and illustrates how hot gases can be diverted;

Figure 11 is a perspective view of a heat exchange wall formed from one piece of pipe;

Figure 12 is a cross section through heat exchange apparatus and shows the use of the heat exchange wall of Figure 11;

Figure 13 is a perspective view of the heat exchange apparatus shown in Figure 12;

Figure 14 is a perspective view from another angle of part of the heat exchange apparatus shown in Figures 12 and 13; and

Figure 15 shows further heat exchange apparatus employing a pair of doors and a pair of baffle means.

Referring to Figure 1, there is shown heat exchange apparatus 2 comprising a housing 4, a chamber 6 in the housing 4 through which hot gases flow in use of the heat exchange apparatus 2, and a heat exchange wall 8. As can be seen, the heat exchange wall 8 is positioned in the chamber 6 and it has a plurality of corrugations 10 defining ridges 12 and troughs 14. Hot gases flow over the ridges 12 and the troughs 14 in order to increase the surface area in the chamber 6 for heat exchange purposes. The corrugations 10 are generally V-shaped in cross section.

It will be seen from Figure 1 that the heat exchange wall 8 is formed as a rear wall of the housing 4. In fact the heat exchange wall 8 lies adjacent a rear wall 16 of the housing 4 so that the heat exchange wall 8 forms a secondary or inner rear wall of the housing 4.

The heat exchange wall 8 is made from a single sheet of metal which is bent to produce the corrugations 10.

The heat exchange apparatus 2 shown in Figure 1 includes baffle means 18 for fitting as shown into the corrugations 10 of the heat exchange wall 8 to restrict the flow of the hot gases through the chamber 4. The baffle means 18 acts as an inducer and is effective for improving heat exchange efficiency and general operation of the heat exchange apparatus 2.

The baffle means 18 is a movable baffle means which can be moved from a closed position in which substantially all the hot gases are restricted from flowing over the heat exchange wall 8, to an open position in which substantially all the hot gases are caused to flow over the heat exchange wall 8. Figure 1 shows the baffle means in a nearly closed position.

The baffle means 18 is made as a one piece unit which comprises a back plate 20 from which a series of plates 22 project. The plates 22 extend into the troughs 14 as shown. The plates 22 thus define a passage 24 between themselves and the heat exchange wall 8 through which the hot gases in the chamber 6 can be constrained to pass.

The heat exchange apparatus 2 may include a fan (not shown) for increasing movement of hot gases.

Referring now to Figure 2, similar parts as in Figure 1 have been given the same reference numerals and their precise construction and operation will not again be given. Figure 2 shows mainly the baffle means 18 being removed for enabling a cleaning operation to be effected. The precise shape of the corrugations 10 enables virtually the entire surface of the heat exchange wall 8 to be seen and easily to be cleaned. Figure 2 also shows the chamber 6 provided with a bottom wall 26.

In the following Figures 3 to 15, similar parts as in Figure 1 have been given the same reference numerals

and their precise construction and operation will not again be given.

In Figure 3, it will be seen that the corrugations 10 are rectangular in cross section. This means that the troughs 14 are also rectangular in cross section.

In Figure 4, there is shown heat exchange apparatus 2 in the form of an oil fired central heating boiler. The heart of the boiler is provided by the heat exchange apparatus shown in Figure 3. In addition, in Figure 4, it will be seen that the boiler is provided with a front door 28 and a flue pipe 30. A flame 32 is provided in the chamber 6 so that the chamber 6 in Figure 4 may be regarded as a combustion chamber. The gas required for the flame 32 is provided via feed apparatus 34 which may include appropriate valves and fans. The housing 4 is mounted on legs 36.

In Figure 5, there is shown heat exchange apparatus 2 in the form of a flue pipe heat exchange unit. The flue pipe heat exchange unit has an inlet flue pipe 38 and an outlet flue pipe 40.

Referring now to Figure 6, there is shown heat exchange apparatus somewhat similar to Figure 1 except that the baffle means 18 has a vertical back plate 20 so that the plates 22 are all of the same size. The housing 4 has a front door 28 and the chamber 6 is fed with hot gases from a vertical pipe 42. The gases pass up the pipe 42

through an inlet pipe 44, through the passage 24 and out through an outlet pipe 46.

Figure 7 shows heat exchange apparatus 2 in the form of a back boiler. Plate means in the form of a vent plate 48 is provided outside the baffle means 18 as shown and spaced apart from the back plate 20. Thus the bent plate 48 and the back plate 20 combine to define a passage 50. The passage 50 extends into a passage 52 which is defined between the bent plate 48 and the lowermost plate 22. The passage 52 then extends into the passage 24 defined between the plates 22 and the corrugations 10. The chamber 6 can be provided with a coal, wood or gas operated fire 54. Hot gases from the fire 54 pass in the direction of the illustrated arrows and out through an outlet 56 in the top of the housing 4 as shown. The fire 54 rests on the bottom wall 26 which forms a grate.

Figures 8 and 9 show heat exchange apparatus 2 in the form of double faced back boilers. As can be seen, two baffle means 18 are employed. The hot gases pass out through an outlet flue pipe 58. It is sometimes desirable to have one fireplace or chamber arrangement as shown in Figures 8 and 9. The bottom wall 26 forms a fire basket as shown which can be arranged to slide or otherwise move on a hearth 60 from one room to another. As the fire basket is slid backwards and forwards, it will locate in appropriate

closed positions in a channel or similar device. As the combustion gases rise to the top of the heat exchange wall 8 as shown, they are drawn back down through the heat exchange apparatus, as shown by the arrows, and returned up the other side, also as shown by the arrows. Thus, the heat exchange apparatus shown in Figures 8 and 9 is effective to shed heat on both sides of the heat exchange wall 8. This is a particularly efficient construction.

Referring now to Figures 10,11,12 and 13, there is shown heat exchange apparatus 2 from various angles. The heat exchange wall that is used is shown in Figure 11 and it may be formed from a pipe of the correct diameter that is pressed almost flat as shown or that is pressed out of shape to almost closed or meeting, The pipe is then bent to the illustrated shape. The arrangement is of advantage as it can be built into, or between, brickwork.

Figures 10,12 and 13 illustrate by means of the arrows, how the combustion gases are drawn from the fire 54 and through the apparatus, the combustion gases then passing underneath the fire 54 itself to be reburnt as they pass through the combustion zone. For clarity, in Figures 10 and 13, the baffle means 18 has been removed. The heat exchange apparatus 2 shown in Figures 10,11,12 and 13 may be most efficient in a closed unit such for example as a stove or a room heater.

Figure 14 shows the heat exchange wall 8 of Figure 11 based in a housing 4 having a door 62. The baffle means 18 is illustrated positioned between the corrugations 10 of the heat exchange wall 8.

Figure 15 shows an arrangement somewhat similar to Figure 14 but with two doors 62,64. As can be seen from the arrows, which illustrate the direction of flow of the hot gases, the heat exchange wall 8 is effective on both sides so that there is a doubling up of heat. Two baffle means 18 are also employed as shown. As shown by the arrows, the hot gases are induced through one side of the unit and down the other side. The reverse arrangement can however be employed.

It will be seen from the drawings that all the various designs of the heat exchange apparatus 2 are such that they are able relatively easily to be cleaned. The heat exchange walls 8 are in particular relatively easily cleaned and their entire surface area that faces outwardly is substantially visible rendering it that much easier to clean. The use of the heat exchange walls 8 also provide good efficiency in the transfer of heat.

It is to be appreciated that the embodiments of the invention described above with reference to the accompanying drawings have been given by way of example only and that modifications may be effected. The heat exchange apparatus may include components and parts that are usual and of standard design

for known types of heat exchange apparatus. Such known components and parts will not affect the operation of the heat exchange apparatus according to the present invention.

If desired, the exchange apparatus may be used for hot air systems. The heat exchange apparatus may also be used for heat recovery, where steam and fat for example, would be passing through the heat exchange apparatus from a kitchen or similar environment where air is extracted and is laden with smoke, steam, fat and the like.

CLAIMS

1. Heat exchange apparatus comprising a housing, a chamber in the housing through which hot gases flow in use of the heat exchange apparatus, and a heat exchange wall which is positioned in the chamber and which has a plurality of corrugations defining ridges and troughs over which the hot gases flow in order to increase the surface area in the chamber for heat exchange purposes.

2. Heat exchange apparatus according to claim 1 in which the corrugations in the heat exchange wall are V-shaped, U-shaped or rectangular in cross section.

3. Heat exchange apparatus according to claim 1 or claim 2 in which the heat exchange wall is formed as a rear wall of the housing.

4. Heat exchange apparatus according to any one of the preceding claims in which the heat exchange wall is made from a single sheet of metal.

5. Heat exchange apparatus according to any one of the preceding claims and including baffle means for fitting into the corrugations of the heat exchange wall to restrict

the flow of the hot gases through the chamber.

6. Heat exchange apparatus according to claim 5 in which the baffle means is a fixed baffle means.

7. Heat exchange apparatus according to claim 5 in which the baffle means is a movable baffle means which can be moved from a closed position in which substantially all the hot gases are restricted from flowing over the heat exchange wall, to an open position in which substantially all the hot gases are caused to flow over the heat exchange wall.

8. Heat exchange apparatus according to any one of the preceding claims in which the baffle means is made in one piece.

9. Heat exchange apparatus according to any one of the preceding claims and including a combustion chamber.

10. Heat exchange apparatus according to any one of the preceding claims and including a fan.

11. Heat exchange apparatus according to any one of the preceding claims and including plate means which is positioned outside the baffle means and which is for increasing radiant heat.

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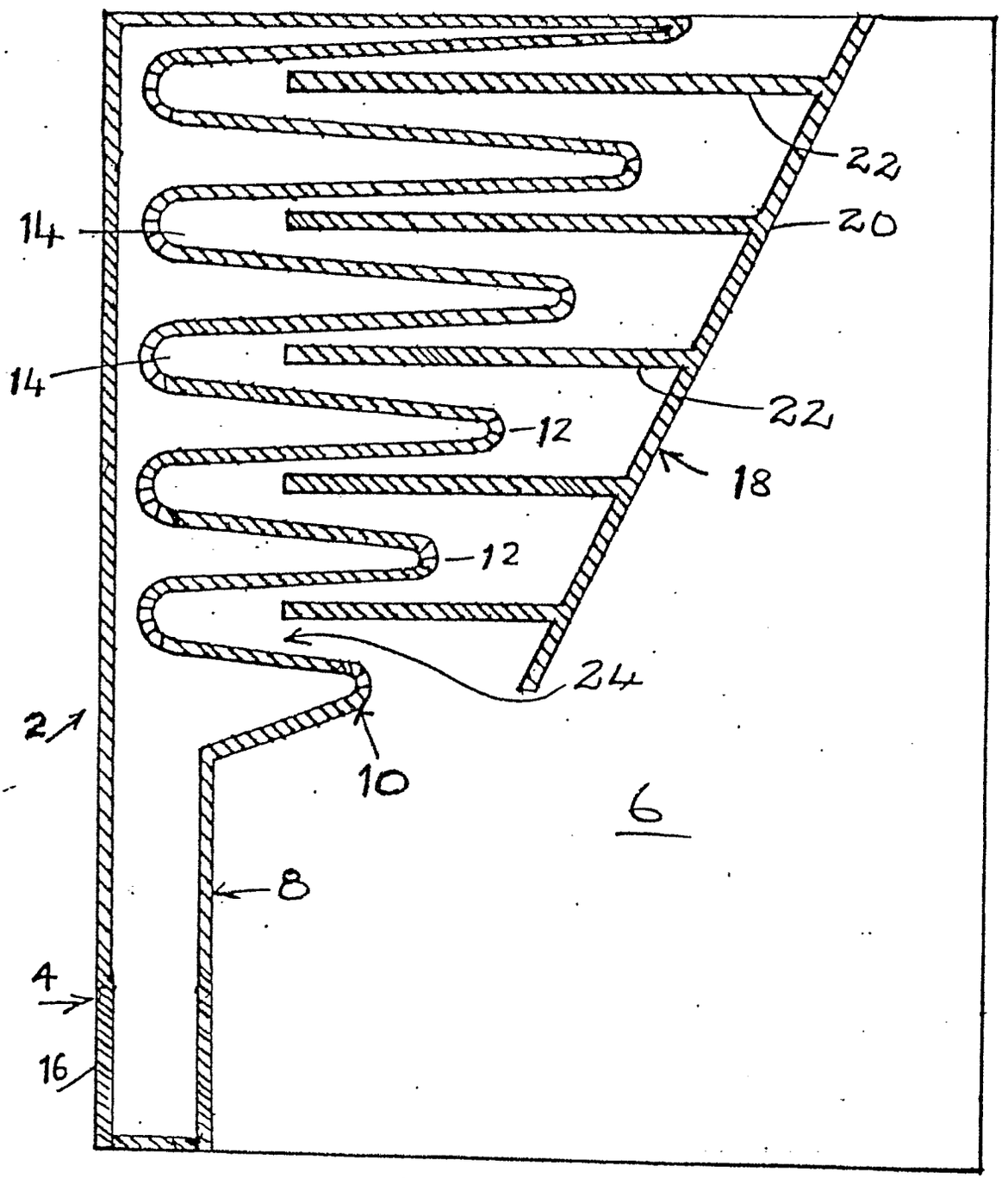

FIG. 1

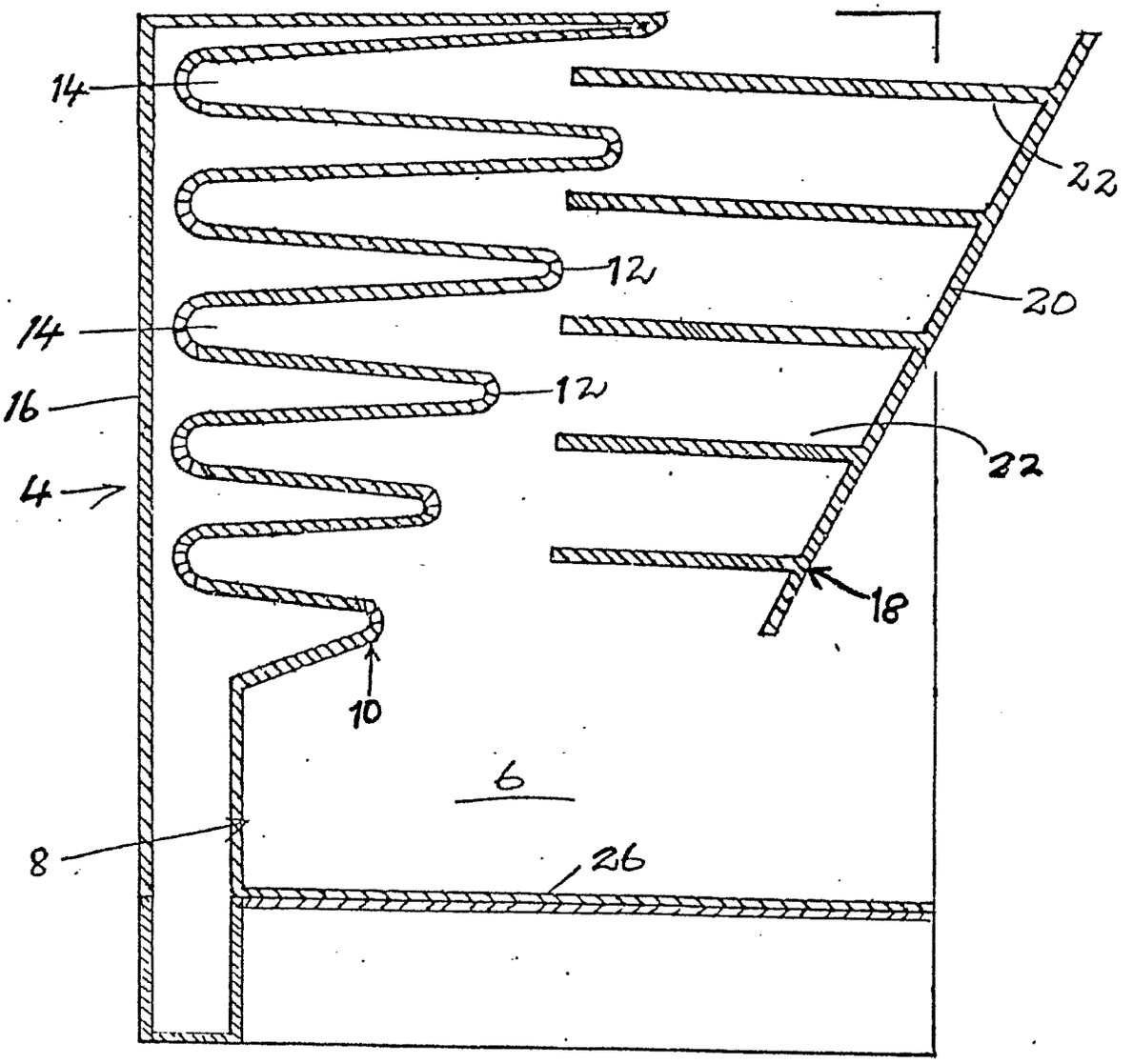

FIG 2

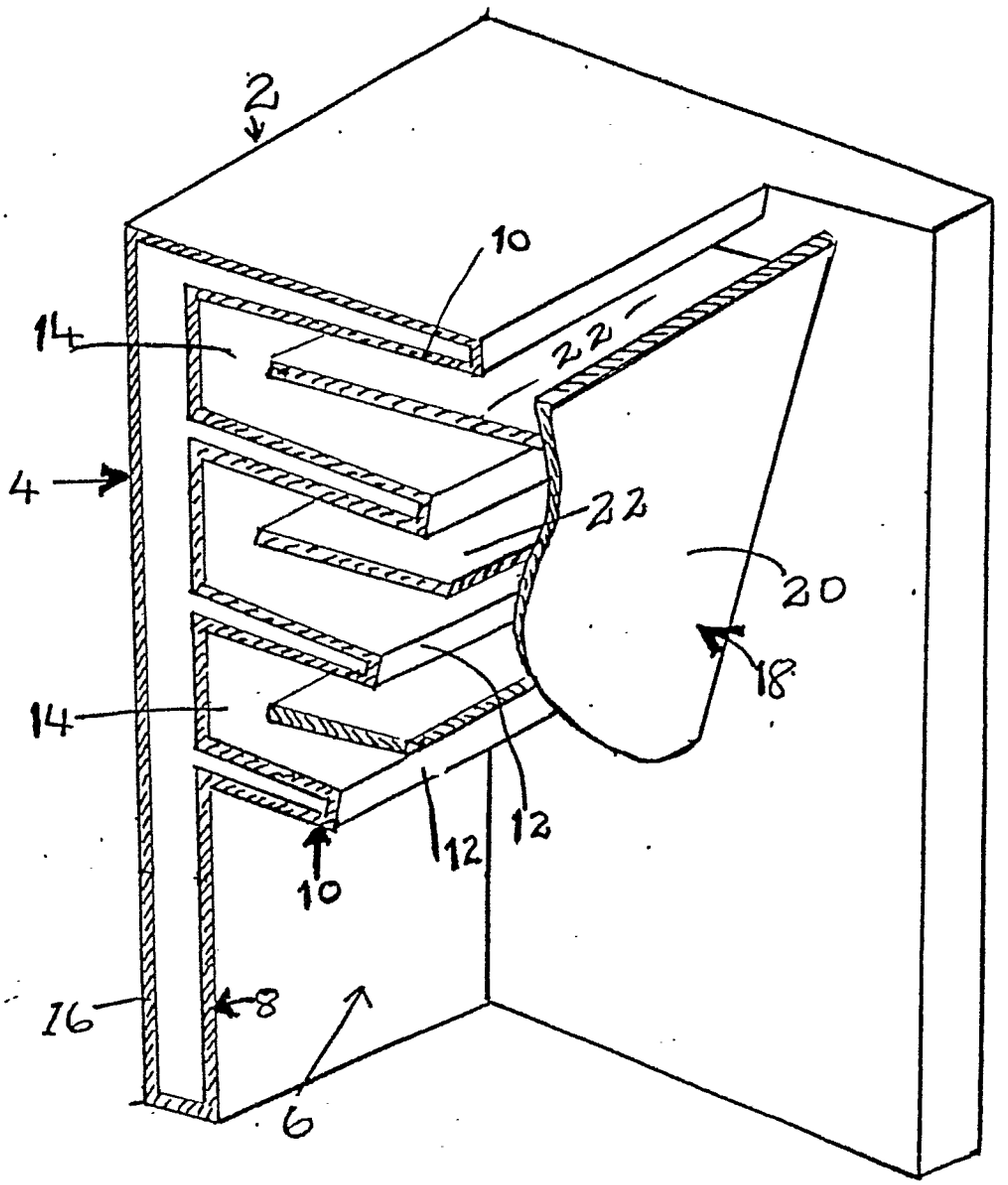

FIG 3

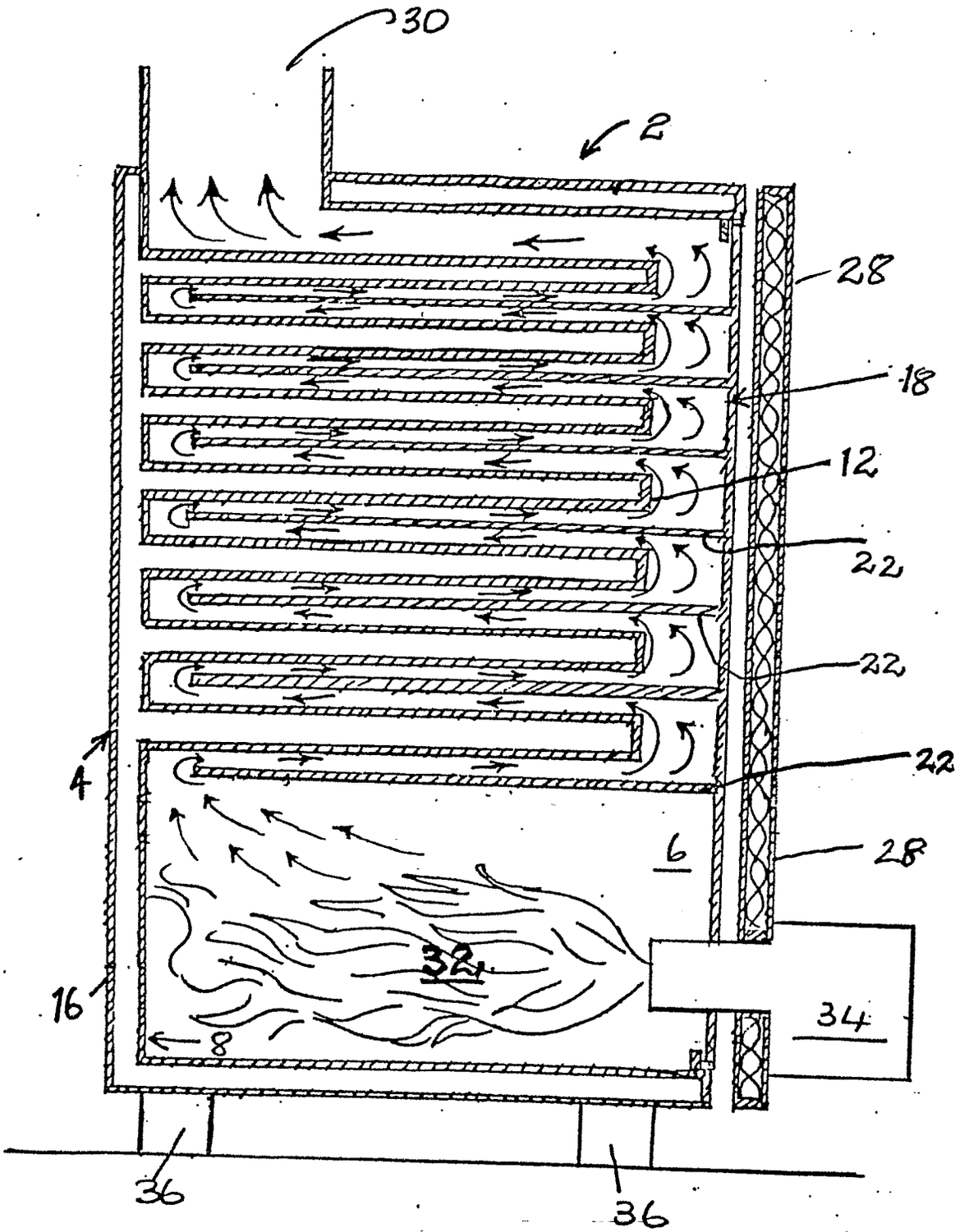

FIG 4

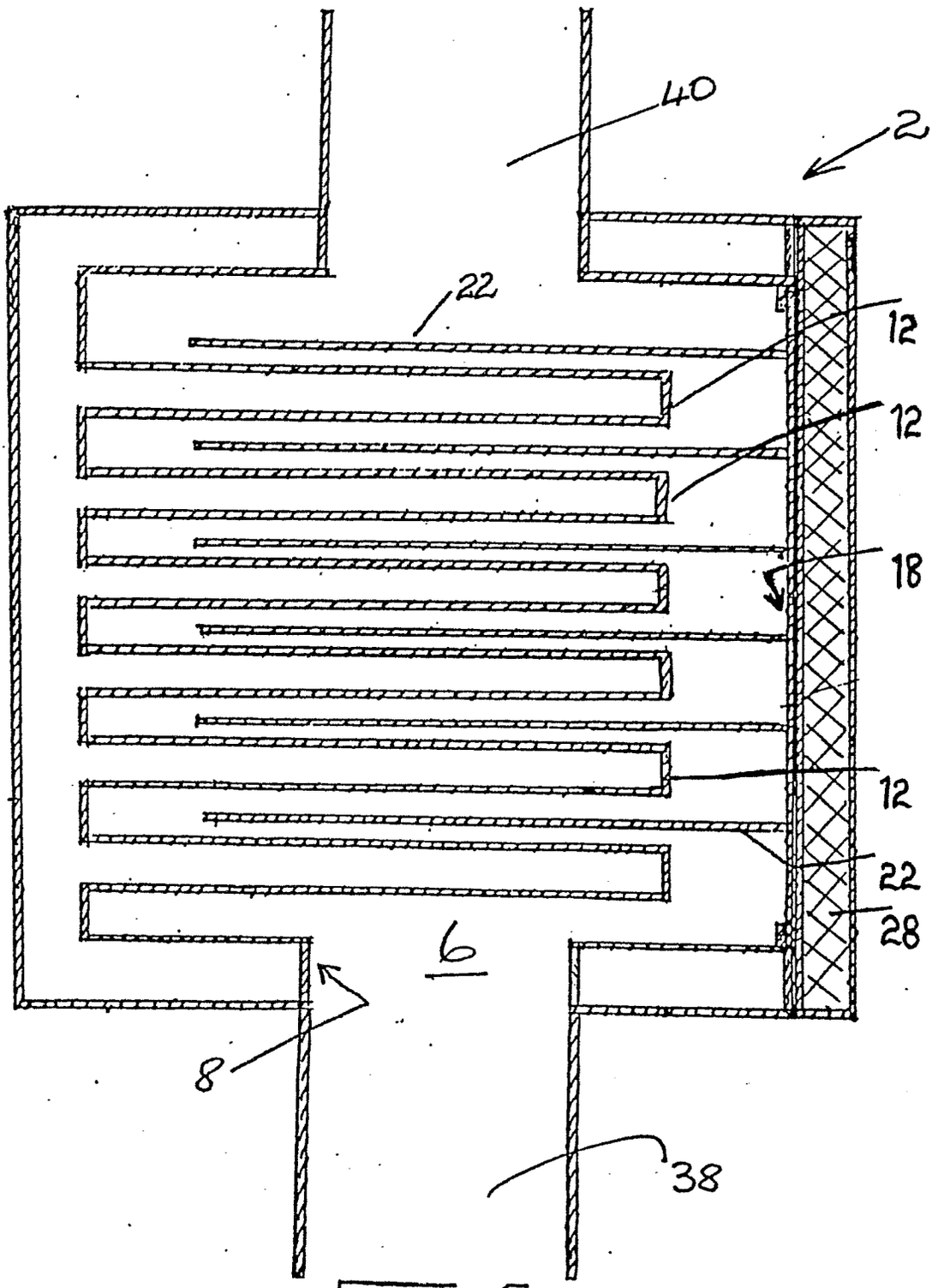

FIG 5

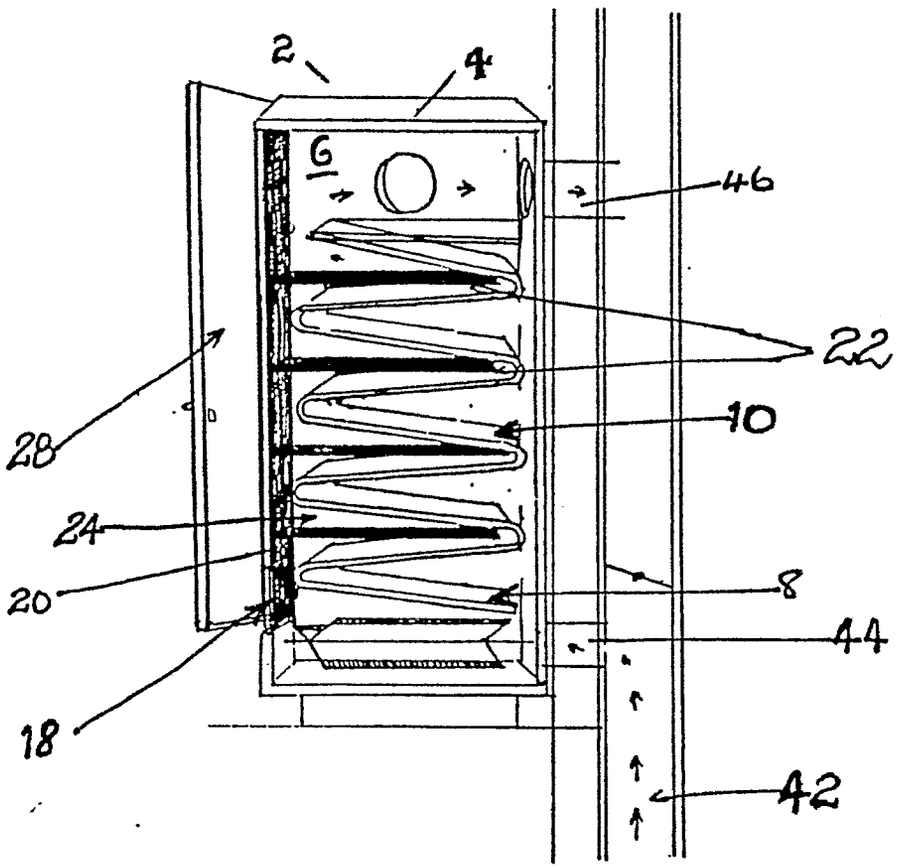

FIG 6

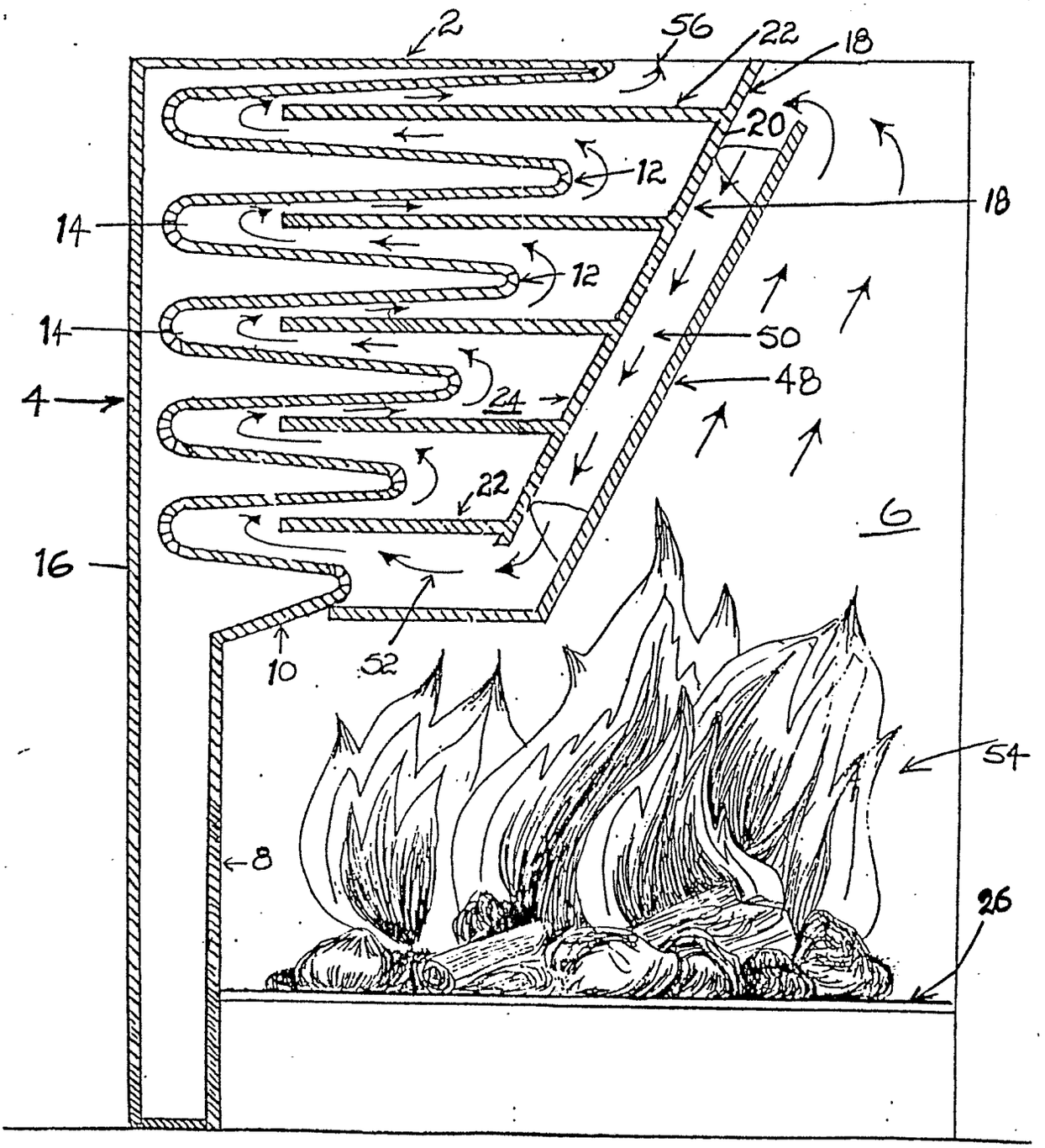

FIG. 7

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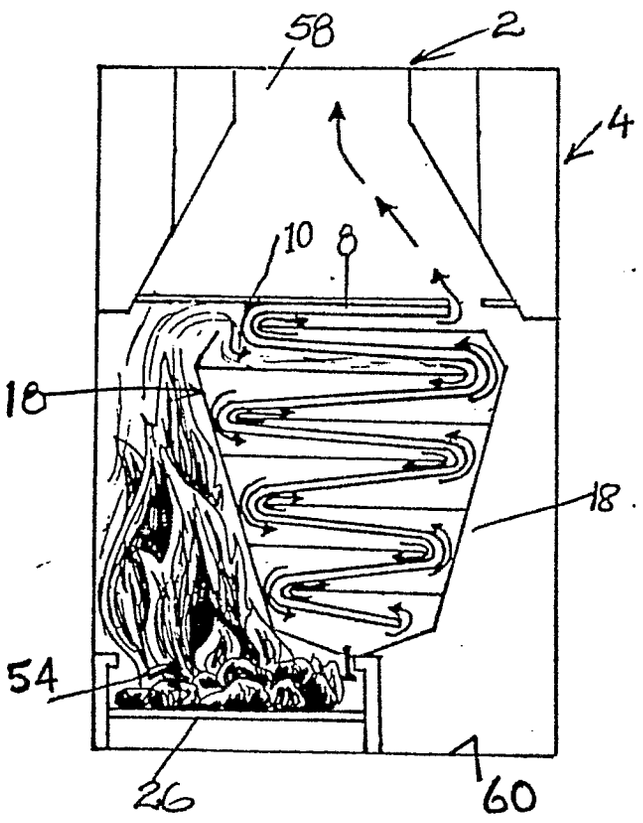

FIG 8

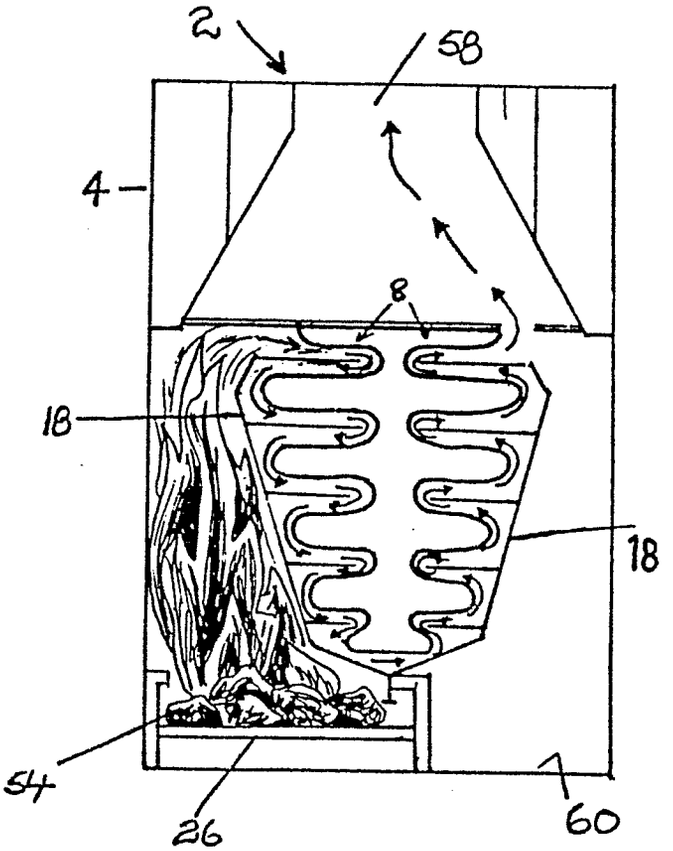

FIG. 9.

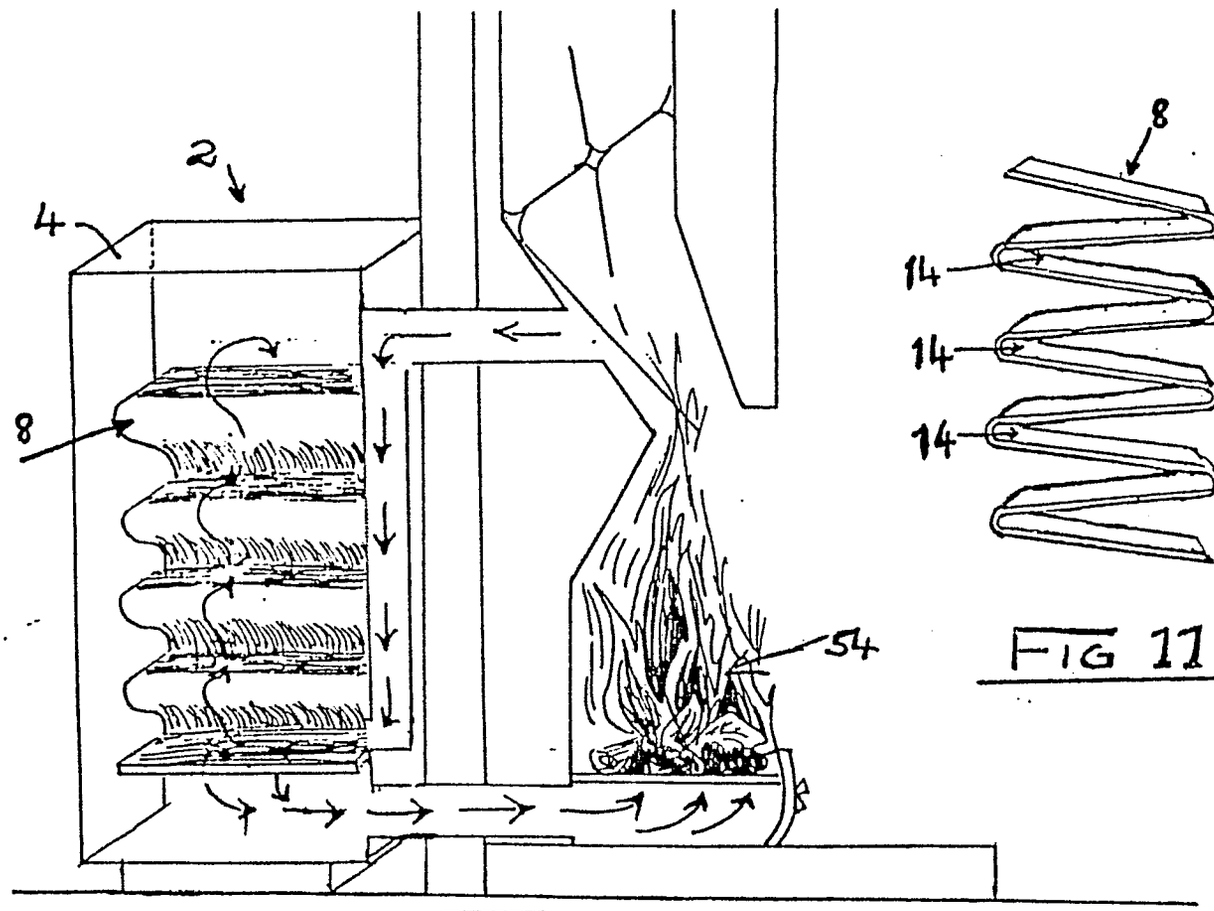

FIG 10

FIG 11

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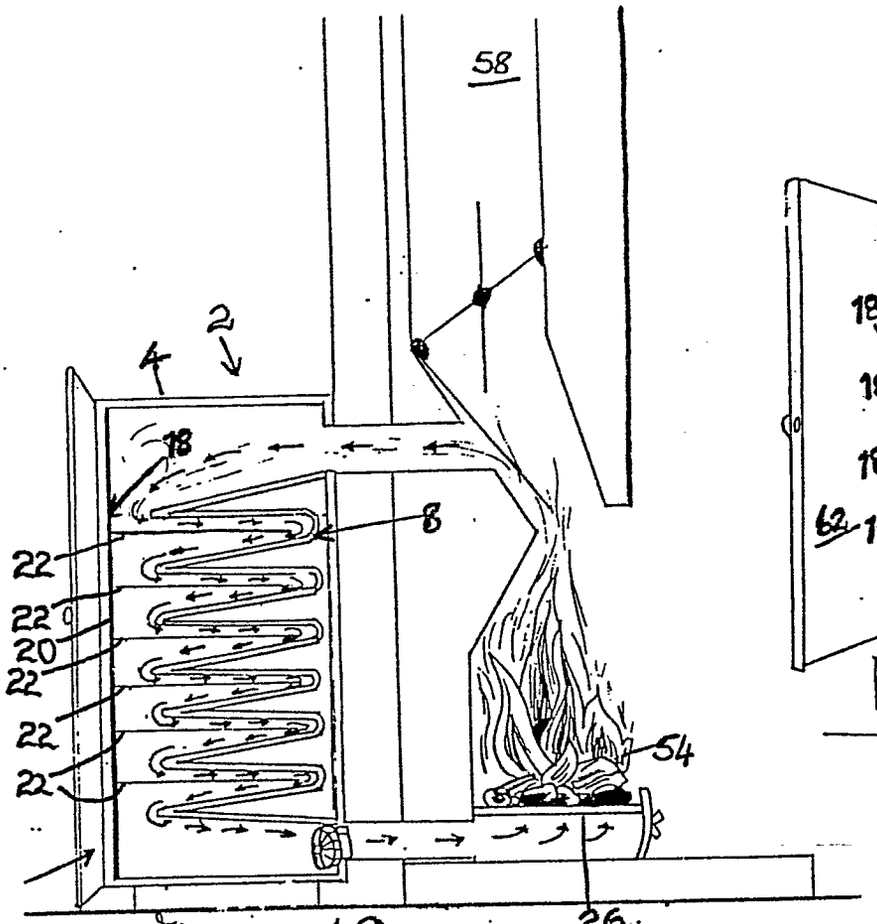

Fig. 12

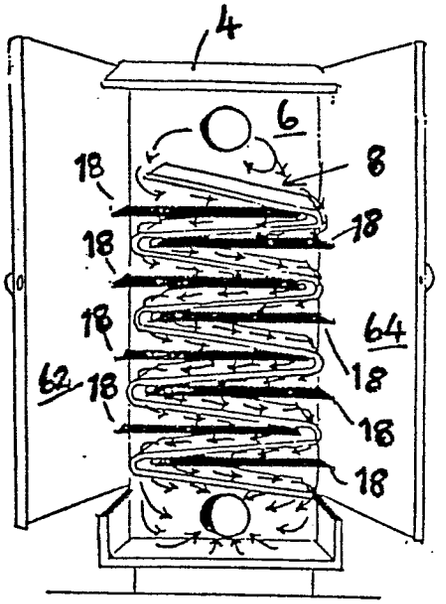

Fig. 15

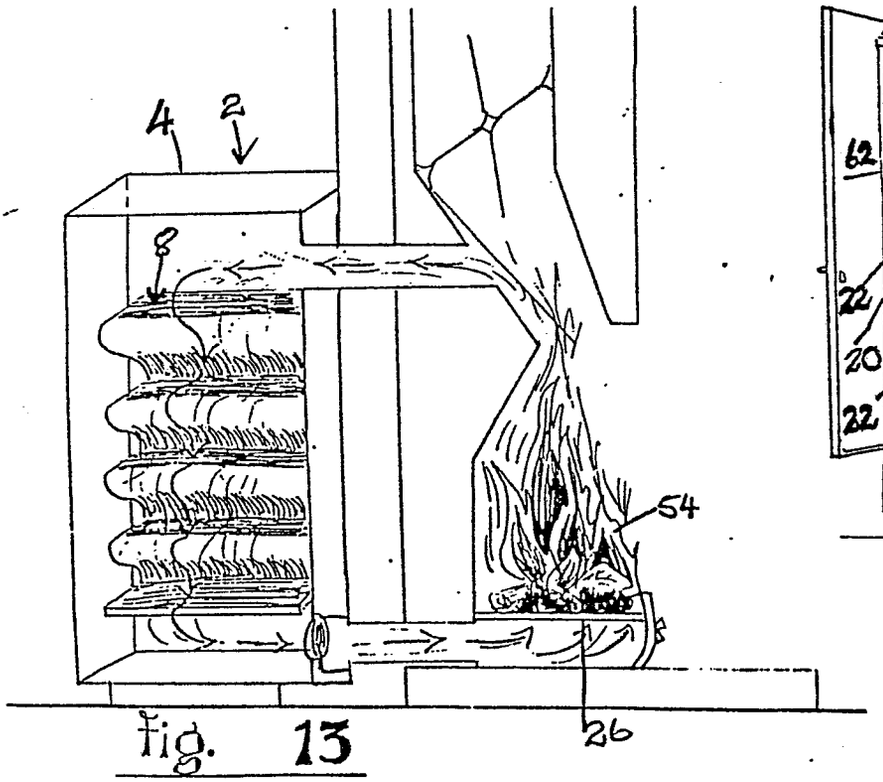

Fig. 13

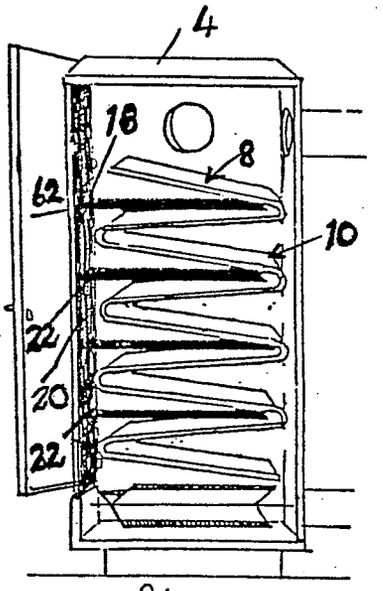

Fig. 14