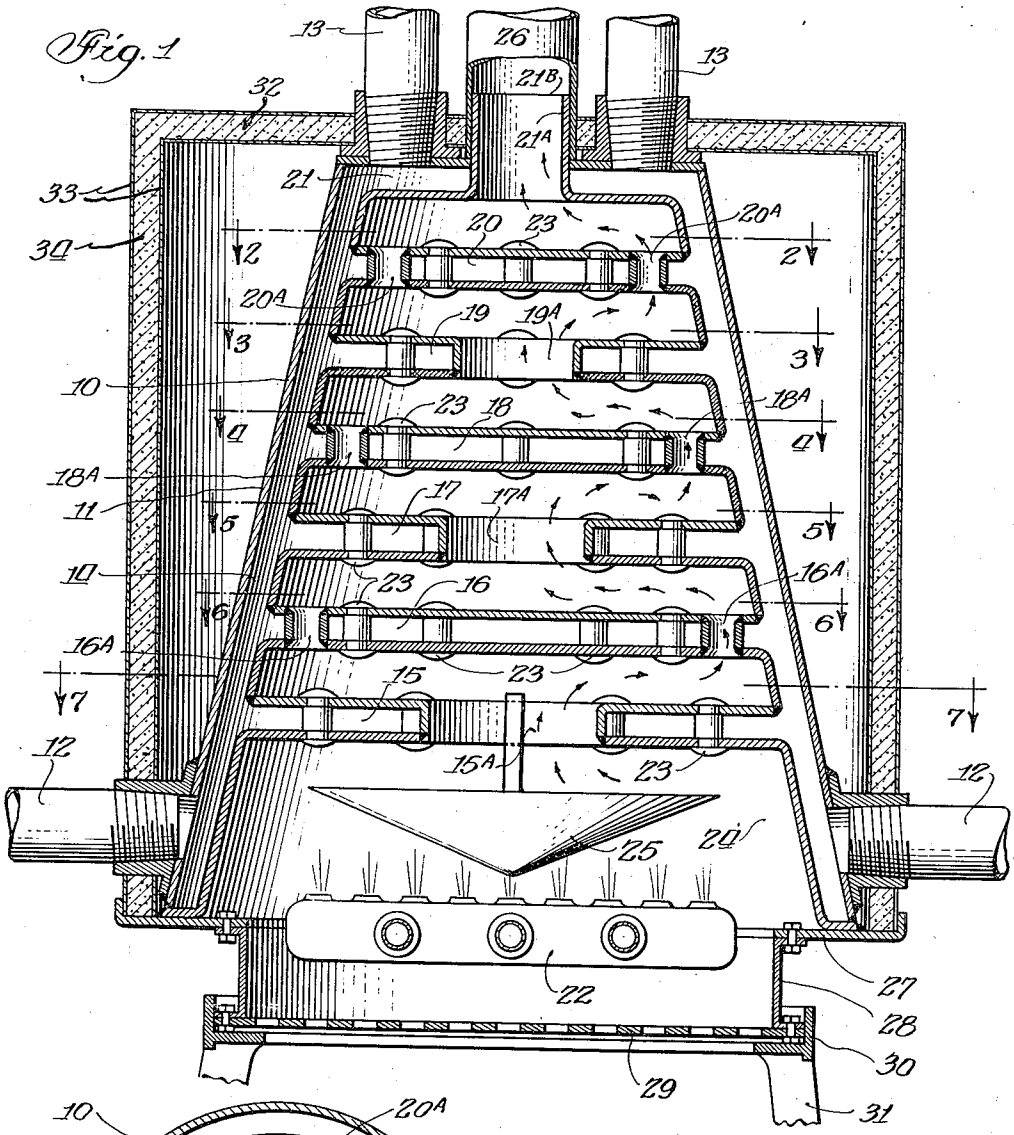
Jan. 28, 1941. M. A. THOLEN 2,229,686

WATER HEATER

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Fig. 1



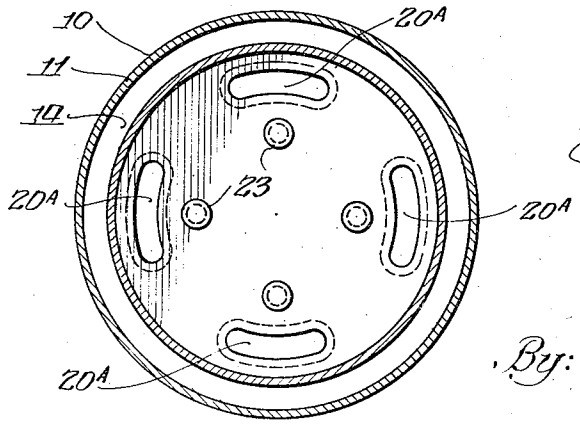


Fig. 2

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WATER HEATER

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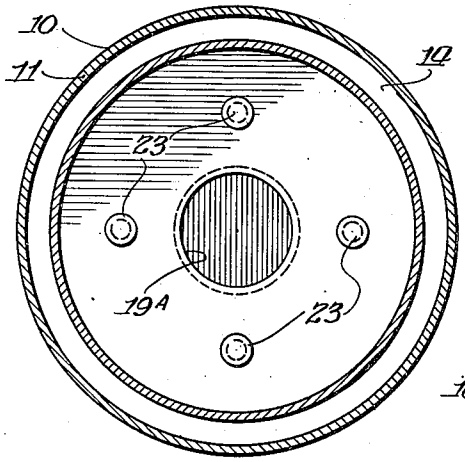


Fig. 3

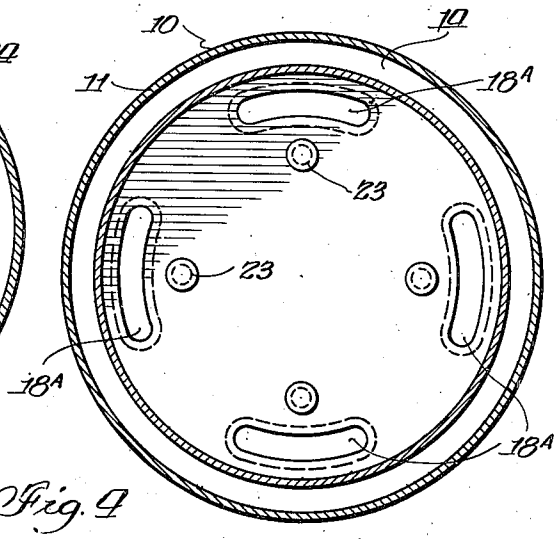


Fig. 4

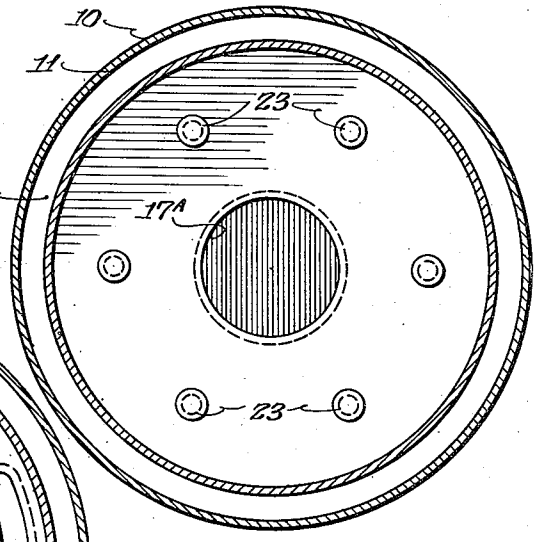


Fig. 5

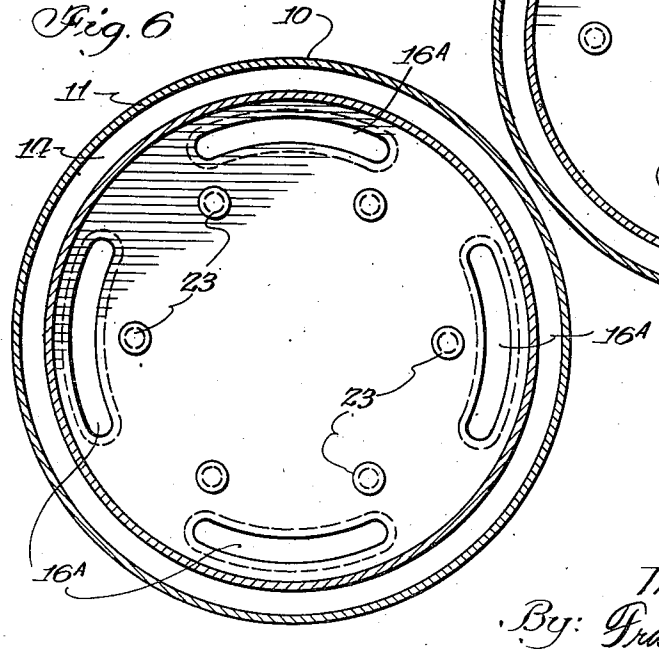


Fig. 6

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WATER HEATER

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Fig. 7

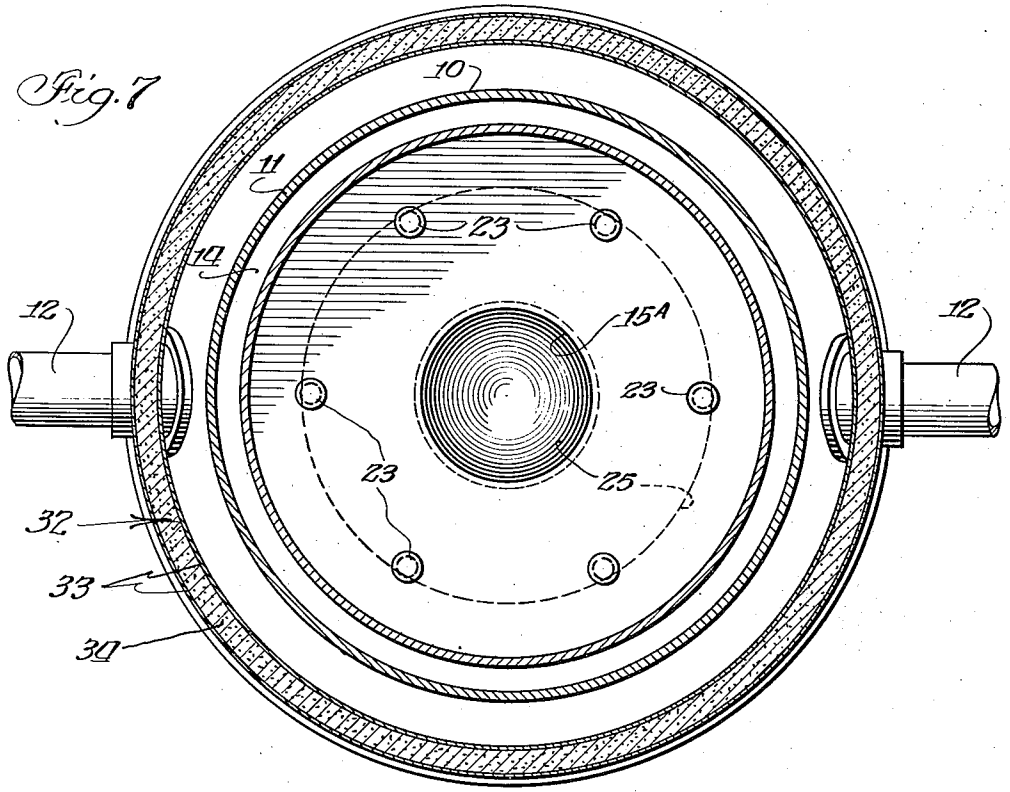


Fig. 8

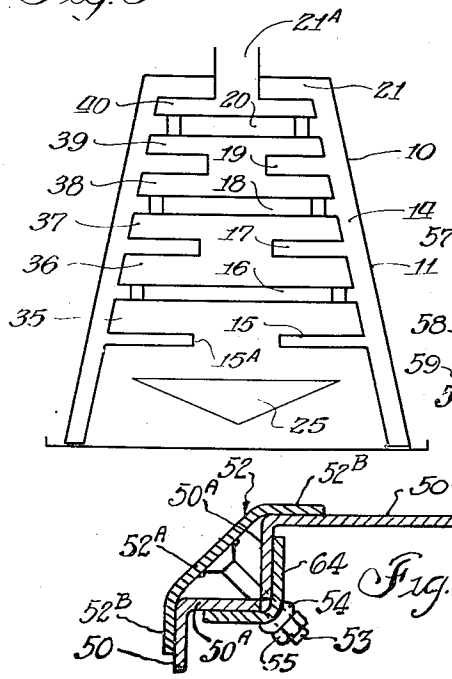


Fig. 9

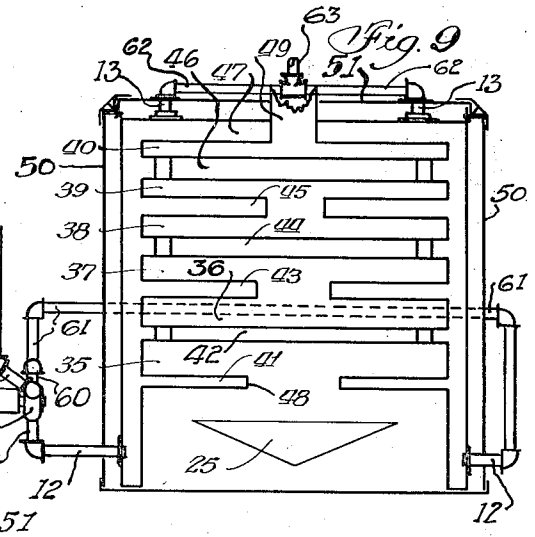


Fig. 10.

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Patented Jan. 28, 1941 2,229,686

UNITED STATES PATENT OFFICE

2,229,686

WATER HEATER

Matthew A. Tholen, Berwyn, Ill.

Application November 29, 1937, Serial No. 177,004

7 Claims. (Cl. 122—165)

This invention relates generally to hot water heaters and has particular reference to gas-fired water heaters adapted for use in hot water heating plants or for hot water tanks.

Among the objects of my invention is to provide a hot water heater of simple construction having a novel form, construction and arrangement of the body and heat-absorbing lateral sections affording comparatively low cost of manufacture and efficient low cost operation and particularly adapting such heater for use with gaseous or fluid fuels.

Another object of my invention resides in the provision of a fluid-fired water heater which shall have a comparatively small water capacity, substantially large heat-absorbing surfaces, and shall be constructed of generally frusto-conical form having marginally and circularly interconnected series of laterally disposed superimposed water sections having progressively upwardly decreasing areas of heat-absorbing surfaces; the sections having passages for the burnt gases disposed in staggered arrangement relatively to adjacent sections so that the products of combustion are caused to traverse over the greater portions of the heat-absorbing side faces of such sections and the wall of the surrounding frusto-conical water chamber; the gas passages extending transversely through each of such lateral superimposed sections decreasing in total cross-sectional area progressively upwardly of the heater, somewhat correspondingly to the progressively cooled products of combustion, but providing in such design due consideration for the proper flow of such gases and for the maintenance of the temperatures of the gases above "dew point" temperature particularly within the upper portions and outlet of the heater or within the chimney.

A further object of my invention is found in the provision of a novel construction in an outside casing for the heater.

A further object of my invention is to provide a water heater having features of design adapting same to construction from steel plates fabricated to form lateral water sections joined together by welding.

A still further object of my invention is found in the adaption of the principles of my invention to water heaters of cylindrical form.

With the above and other objects in view, my invention consists in the novel combination, construction and arrangement of the parts and members shown in preferred embodiments in the attached drawings, described in the following specifications and defined in the appended claims.

In the drawings, in which like reference characters denote like or corresponding parts:

Fig. 1 is a vertical section through a water heater embodying my invention;

Figs. 2, 3, 4, 5, 6 and 7, are cross-sections taken respectively on lines 2—2, 3—3, 4—4, 5—5, 6—6 and 7—7 of Fig. 1;

Fig. 8 is a diagrammatic illustration of a modification of the heater shown in Fig. 1;

Fig. 9 is a diagrammatic illustration of a cylindrical type of water heater embodying my invention, and

Fig. 10 is a cross-section showing a detail of the construction of the casing shown diagrammatically in Fig. 9.

Referring to the heater shown in Figs. 1 to 7 inclusive, 10 indicates a heater body of generally frusto-conical form having a frusto-conical outer wall 11 provided with water inlets 12. The outlets 13 and inlets 12 communicate with the water chamber 14 which communicates with the lateral vertically spaced water chambers 15, 16, 17, 18, 19, 20 and 21. As clearly shown in the illustrations, these chambers and their heat-absorbing walls decrease in areas progressively upwardly from the lowermost lateral section or chamber 15.

The spaced lateral walls of the lateral water sections 15 to 21 inclusive, constitute baffles for the hot burned gases and are provided with alternately arranged or staggered central and marginal openings to afford contact of the hot gases with the maximum areas of the heat-absorbing surfaces of such lateral walls; the lowermost parts of the heater wherein the cold water enters the heater being subjected to the hottest gases.

The chamber 24 below the lowermost lateral water section 15 for the gas burner 22 must obviously be designed to accommodate and suit the particular type of burner used, the type of gas used and the necessary space and air requirements to insure proper combustion therein and the flow of the burned gases through the heater.

The walls of the lateral sections may be preferably made of formed steel plates welded together and also preferably provided with shouldered rivet spacers 23 as additional means for retainment thereof.

The products of combustion from the gas burner 22 engage an inverted conical deflector 25 to thereby deflect same outwardly against the lower portion of the wall of the water chamber 14 from whence said gases pass under the lower face of the lower lateral water section 15 and thence in a winding manner through the alternately spaced

central and marginal openings within the lateral water sections. The progressively upwardly decreasing set of central openings is respectively indicated by 15A, 17A, 19A and 21A. The marginal openings are indicated by 16A, 18A and 20A.

Each of the sections 16, 18 and 20 is preferably provided with four equally spaced and preferably elongated marginal openings.

The opening areas of the respective lateral sections decrease upwardly from the largest opening 15A to the smallest opening 21A in the upwardly extended portion 21B of the top section 21 for the stack pipe 26. The total area of the marginal openings in any of such lateral sections 16, 18 or 20 being greater than the area of the central opening in the lateral section above same, and less than the area of the central opening in the lateral section below same so that the products of combustion pass upwardly through progressively restricted passages.

Any suitable means of supporting the heater body 10 may be provided, I have preferred to show in Fig. 1 a circular flanged plate 27 bolted to the top of a circular channel section 28 supported on a perforated plate 29 carried on a cast iron base 30 having legs 31.

A suitable heat-conserving casing 32 composed of spaced light sheet metal walls 33 having a filler therebetween of any suitable heat-insulating material 34, such as expanded vermiculite, may be used to encase the heater 10.

Suitable safety gas control and automatic temperature control may be provided but since these features are not a part of my invention they are not shown.

In the modification of my invention shown diagrammatically in Fig. 8, the spaces 35, 36, 37, 38, 39 and 40 in the heater between the lateral sections decrease in height progressively upwardly and the lateral water sections 15, 16, 17, 18, 19, 20 and 21 increase in thickness progressively upwardly. The openings in the sections decrease in area progressively upwardly from the maximum at 15A to the minimum at 21A.

The modification shown diagrammatically in Fig. 9 illustrates an adaption of my invention to a cylindrical type of heater wherein the spaces 35, 36, 37, 38, 39 and 40 between the lateral water sections 41, 42, 43, 44, 45, 46 and 47 decrease in height successively progressively upwardly of the heater and the said sections increase in thickness or cross-section successively upwardly of the heater. The openings in the water sections decrease in area progressively upwardly from the maximum at 48 to the minimum at 49 in the stack opening.

Although the heater shown in Fig. 9 is of cylindrical construction, it may be provided with a casing of rectangular construction as shown in Figs. 9 and 10. The type of construction shown in Figs. 9 and 10 consists of metal side and end plates 50 and a top plate 51 connected together at adjacent sides in a novel manner by novel securing means permitting same to be easily disassembled to afford access to all parts of the heater.

In the rectangular type of construction employed, the typical corner formed by the right-angularly disposed side and end plates 50 (or by the top plate 51 and an adjacent side or end plate 50) is shown in enlarged detail in Fig. 10 and consists in inwardly right-angularly bent marginal portions 50A interlocked together by corner strips 52 and 64 and spaced securing bolts 53. The securing strip 64 is of right-angular cross-section and embraces the inner faces of the adjacent bent plate portions 50A. The plate 52 consists of a central portion 52A extending between and over the corners formed by bent margins of the plates 50 and the central portion 52A is disposed at substantially an angle of 45 degrees to the plates 50. The longitudinally extending marginal portions 52B are bent at substantially 45 degrees to overlap the outside faces of the plates 50 and the heads of the bolts 53 are welded to the inner face of the portion 52A and extend through openings in the edges of the bent portions 50A and through openings in the strip 64. A suitable angular washer 54 may be provided under each tightening nut 55.

In addition to the novel interlocking construction embodied in the rectangular casing, the outside corner strips 52 may be chromium plated to present an artistic bevel effect of contrasting color to that of the plates.

In the event it is desired to simplify the pipe system and to use smaller diameter hot and cold water piping, a water-circulating pump 56 may be installed in the cold water pipe system. This feature is indicated in Fig. 9 wherein 57 and 58 indicate pipe connections leading from the cold water radiator outlets to the pump 56 which is driven by electric motor 59. The outlet of the pump 56 is connected by the pipe 60 to branch pipes 61 connected to the two inlet pipes 12, or the pump outlet pipe 60 may be connected to a single heater inlet pipe 12 and the other inlet pipe dispensed with. Likewise, the heater hot water outlet pipes 13 may be connected by suitable branch piping 62 to a single common water outlet pipe 63 when a single hot and cold water pipe system is used in connection with a circulating pump.

I claim:

1. A hot water heater comprising an outer frusto-conical shell comprising a single sheet of metal, and a fabricated frusto-conical inner shell spaced from said outer shell to provide a water chamber therebetween, said inner shell comprising a plurality of horizontally disposed vertically spaced pairs of wall sections welded together and defining horizontal water compartments, said pairs of sections having relatively alternately staggered marginal and central passages for the combustion gases extending through said compartments, the total combustion gas passage area of each of said horizontal compartments being successively decreased upwardly from the largest gas passage area in the lowermost horizontal compartment to the smallest gas passage area of the chimney outlet of the heater.

2. A hot water heater comprising an outer frusto-conical shell comprising a single sheet of metal, a fabricated frusto-conical inner shell spaced from said outer shell to provide a water chamber therebetween, said inner shell including a plurality of laterally extended vertically spaced pairs of wall sections defining lateral water compartments, said compartments alternately having relatively vertically staggered substantially marginal and central passages for the combustion gases extending through said compartments, the total areas of said passages progressively successively decreasing upwardly from the largest passage area in the lowermost compartment to the smallest passage area in the heater stack outlet, and said compartments increasing in cross-sectional depths upwardly from the smallest depth of the lowermost com-

partment to the greatest depth in the uppermost compartment.

3. A hot water heater comprising an outer shell having a side wall made of a single piece of metal of frusto-conical form, an inner shell spaced from said outer shell to provide a water chamber therebetween, said inner shell being formed to provide a plurality of laterally extended vertically spaced pairs of wall sections defining circular lateral water compartments of progressively upwardly decreasing diameters, said compartments having transverse combustion gas passages arranged in relatively vertically staggered marginal and central portions thereof.

4. A hot water heater of frusto-conical form comprising an outer wall of a single steel plate, an inner shell of steel plate spaced from said outer shell to provide a water chamber therebetween, said inner shell being formed of a plurality of shaped sections of steel plate welded to form a series of vertically spaced lateral water compartments constituting successively upwardly decreasing areas of heat-absorbing compartments, said compartments having transverse passages for the combustion gases disposed in staggered arrangement relatively to adjacent sections, and the total cross-sectional area of the passage of passages in the said compartments decreasing successively progressively upwardly of the heater.

5. A hot water heater as embodied in claim 2 and including a casing enclosing said heater, a hot water outlet pipe connected to the heater at the uppermost lateral chamber, and a cold water inlet pipe connected to the heater below the lowermost lateral water compartment, said hot and cold water pipes extending through said casing.

6. A hot water heater comprising a frusto-conical exterior wall, vertically spaced interior wall portions spaced from said exterior frusto-conical wall defining a frusto-conical water chamber of annular cross-section, vertically spaced pairs of horizontally disposed walls extending from the spaced adjacent ends of said spaced interior wall portions defining spaced horizontal circular water chambers, each of such horizontal circular chambers successively decreasing in amount of water content upwardly of the heater and each communicating with said frusto-conical annular water chamber, and wherein alternately disposed horizontal circular water compartments have relatively vertically staggered marginal combustion gas passages extending through such alternately disposed horizontal circular water compartments, and wherein the other horizontal circular water compartments have vertically aligned central combustion gas passages.

7. A hot water heater as embodied claim 6, and wherein the total combustion gas passage area of each of said horizontal circular water compartments is successively decreased upwardly from the largest gas passage area in the lowermost horizontal water compartment to the smallest gas passage area in the uppermost horizontal water compartment.

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