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COMBINATION WATER AND SPACE HEATER

Filed Sept. 7, 1965

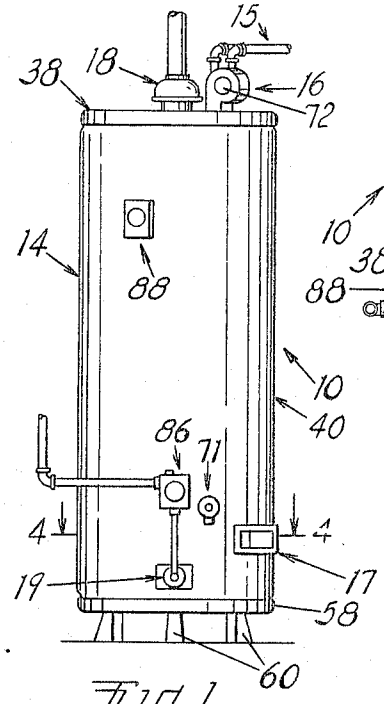


Fig. 1

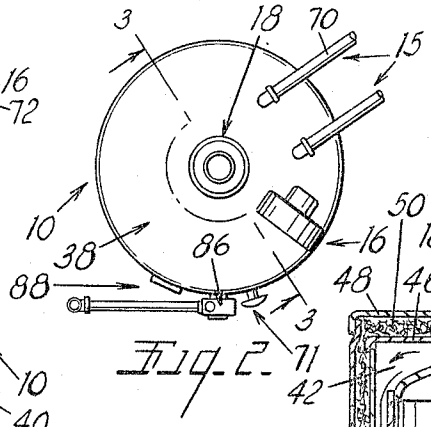


Fig. 2

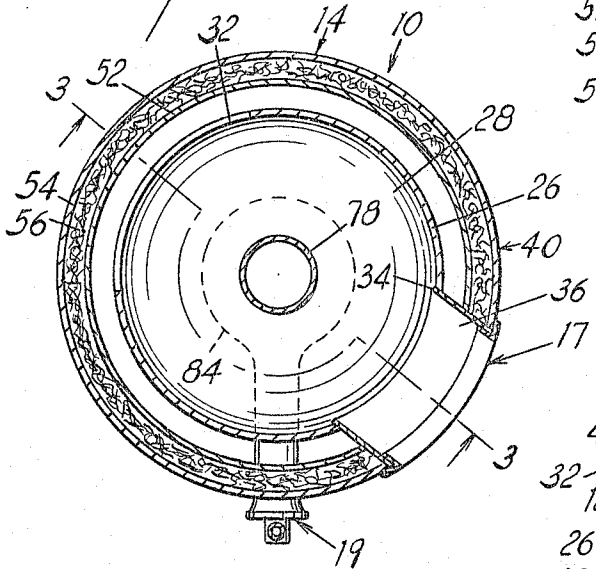


Fig. 4

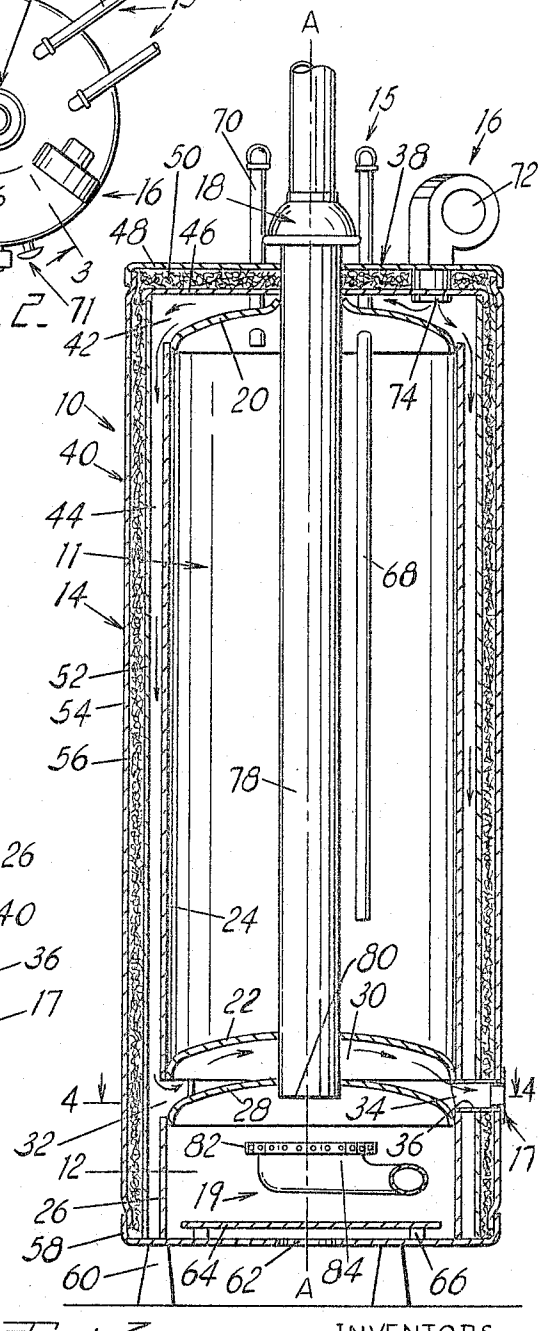


Fig. 3

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COMBINATION WATER AND SPACE HEATER

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This invention resides in the mechanical arts. More particularly, it relates to combination water and space heaters.

In the U.S. Patent No. 2,833,267, to Handley, there is disclosed a combination water and space heater. This is a heating apparatus having structure which functions not only to heat water, but also to provide heated air. Such an apparatus has utility in milk houses, on dairy farms, in house trailers, tourist cabins, and the like.

An object of this invention is to improve the combination water and space heater structure disclosed in the Handley patent.

A specific object of this invention is to provide a combination water and space heater with improved efficiency of operation.

Still another specific object of this invention is to provide such a combination water and space heater with improved simplicity of construction and economy of manufacture.

These and other objects as appear as this specification proceeds are achieved by this invention.

This invention is described in relation to the drawing which comprises a material part of the disclosures. In the drawing:

FIG. 1 is a view in elevation of a preferred, specific embodiment of the improved combination water and space heater of this invention;

FIG. 2 is a plan view of the specific, combination water heater and space heater of FIG. 1;

FIG. 3 is a view of a vertical section of the heater of FIGS. 1 and 2, which view has been taken as indicated by the sectioning lines 3—3 in FIGS. 2 and 4; and

FIG. 4 is a view of a horizontal section of a lower portion of the heater of FIGS. 1 and 3, which view has been taken as indicated by the sectioning lines 4—4 of FIGS. 1 and 3.

In greater detail, the drawing illustrates an improved combination water and space heater **10**. As shown in FIG. 3 it has a normally vertical axis A—A and it comprises a hot water tank **11**, a fuel combustion chamber **12**, housing **14**, water inlet and outlet means **15**, air blower means **16**, hot air outlet means **17**, combustion gas vent means **18** and fuel burner means **19**.

The hot water tank **11** comprises a top wall **20**, a bottom wall **22** and a cylindrical side wall **24**. These walls are coaxially disposed relative to the vertical axis A—A of the heating apparatus **10**. These walls are joined together as by weldments to form a water tight structure. The bottom wall **22** is preferably arcuate. In the specific embodiment shown it is such that the bottom of the tank as viewed from inside the tank is convex while the bottom of the tank as viewed from below the tank is concave. The bottom wall **22** is spaced upwardly from the normally bottom end of the cylindrical side wall **24**, whereby the lower portion of the cylindrical side wall **24** extends below the bottom wall **22** of the tank and forms a skirt portion **26**.

The fuel combustion chamber **12** which has a normally vertical axis coincident with the normally vertical axis A—A of the heating apparatus **10**, is defined by a top wall **28** and the skirt portion **26** of the cylindrical side wall **24**. The top wall **28** is joined as by gas tight weldment to the skirt portion **26**. Preferably, the top wall **28** is arcuate. In the specific embodiment shown its shape is in substantial conformity with that of the bottom wall of the hot water tank, whereby it is convex on top side and concave on the bottom side. The bottom side of the bottom wall **22** of the hot water tank **11** and the top side of the top wall **28** of the fuel combustion chamber **12** are vertically spaced from one another whereby there is provided an air heating chamber **30**. Between the bottom side of the bottom wall **22** of the hot water tank **11** and the top side of the top wall of the fuel combustion chamber the skirt portion **26** of the cylindrical side wall **24** around the air heating chamber **30** has therein an air inlet opening **32** and a diametrically disposed air outlet opening **34** in which is a hot air outlet duct **36**.

The heater apparatus housing **14** has a normally vertical axis coincident with the normally vertical axis A—A of the heater apparatus **10**. The housing **14** comprises a generally round top wall **38** and a cylindrical side wall **40**. The housing **14** encloses topwise and sidewise the hot water tank **11** and the fuel combustion chamber **12**. The top wall **38** of the housing **14** is vertically spaced from the top wall **20** of the hot water tank **11** and the cylindrical side wall **40** of the housing **14** is radially spaced from the cylindrical side wall **24** of the hot water tank **11**, the air heating chamber **30** and the fuel combustion chamber **12**. Consequently, there are provided between the top wall **20** of the hot water tank **11** and the top wall **38** of the housing **14** an air space **42**, and between the cylindrical side wall **24** of the hot water tank **11** and cylindrical side wall **40** of the housing **14** an annular air space **44** with the air space **42** merging into the air space **44**. The top wall **38** of the housing **14** comprises an inner shell **46** and an outer shell **48** with thermal insulation **50** in between, while the cylindrical side wall **40** comprises an inner cylindrical shell **52** and an outer cylindrical shell **54** with thermal insulation **56** in between. The housing **14** also comprises bottom closure means in combination with the skirt portion **26** below the air inlet opening **32** through the skirt portion **26**, which means encloses the annular air space at the normally bottom end thereof. In the embodiment shown the bottom closure means comprises a generally round, pan-like base **58** fastened to downwardly extending support legs **60** and fastened to the bottom end of the cylindrical side wall **40** of the housing **14**. The bottom end of the skirt portion **26** rests on the base **58** and preferably is fastened thereto by a suitable connection. The center of the base **56** preferably has an opening **62** therethrough for the passage of air into the combustion chamber **12**. The opening is covered by a floor protection plate **64** within the fuel combustion chamber **12**, which plate is spaced from the base **58**. It rests on supports **66** extending upwardly from the base **58**.

The water inlet and outlet means **15** comprise a cold water intake pipe **68** and a hot water discharge pipe **70**. Both pipes are disposed in air tight relationship through openings in the top wall **38**, through the top air space **42**, and in water tight relationship through openings through the top wall **20** of the hot water tank **11**. The intake end of the hot water discharge pipe **70** is disposed in the region of the top wall **20** while the discharge end of the cold water intake pipe **68** is disposed in the region of the bottom wall **22** of the tank **11**. Preferably, there is also provided at the bottom of the tank a drain pipe which extends therefrom through the cylindrical side wall **40** of the housing **14** to an exterior drain valve **71** (see FIG. 1).

The air blower means **16** of the space and water heater **10** of this invention are generally mounted on the top side of the top wall **38** of the housing **14**. The air blower means **16** in general comprise a casing within which is a fan mounted on the shaft of an electrically powered

drive motor, which casing has an air intake opening 72 disposed outside of the housing 14 of said space and water heater 10, and a pressure air discharge duct 74. The pressure air discharge duct 74 extends preferably in substantially air tight relationship through an opening through the top wall 38 of the housing 14 and into the top air space 42 between the top wall 20 of the hot water tank 11 and the top wall 38 of the housing 14. The internal structure of the air blower means 16 employed in the specific embodiment shown in the drawing is of conventional structure and, therefore, need not be further described herein.

The hot air outlet means 17 comprises the hot air outlet duct 36. This duct extends from the air outlet opening 34 through the skirt portion 26 of the cylindrical side wall 24 and in air tight relationship through a suitable opening in the cylindrical side wall 40 of the housing 14 to the exterior of the housing 14.

The combustion gas vent means 18 comprises a normally straight, cylindrical, heat exchange and vent pipe 78 disposed with its axis substantially coincident with the normally vertical axis A—A of the space and water heater 10 of this invention. The pipe 78 extends downwardly in air tight relationship through the top wall 38 of the housing 14 in water tight relationship through the top wall 20 of the hot water tank 11, through the hot water tank 11, in water tight relationship through the bottom wall 22 of the hot water tank 11, through the air heating chamber 30 and in air tight relationship through the top wall 28 of the fuel combustion chamber 12. Under the concepts of this invention the intake opening 80 of the combustion gas vent pipe 78 is positioned within the fuel combustion chamber 12 and substantially spaced downwardly from the top wall 28 or dome of the fuel combustion chamber 12. One reason for this is to maximize heat exchange between burning fuel in the fuel combustion chamber 12 and the top wall 28 of the fuel combustion chamber 12.

The fuel burner means 19 are centrally disposed in the fuel combustion chamber 12 and preferably are arranged and constructed so as to eject fluid fuel towards the skirt portion 26 surrounding the fuel combustion chamber 12. In the embodiment shown in the drawing, the fuel burner means comprises a gas burner of conventional construction with burner jets 82 being disposed about the circumference of a horizontally disposed, ring manifold 83, the normally vertical axis of which is substantially coincident with the axis A—A of the heating apparatus 10. The burner jets 82 face towards the skirt portion 26 surrounding the fuel combustion chamber 12. The fuel burner means 19 include a conventional, hot water thermostat 86 (see FIG. 1) mounted on the outside of the housing 14. The thermostate 86 has a thermostatic element (not shown) extending through the side wall 40 of the housing 14 and hot water tank side wall 24 into the hot water tank 11.

The air blower means 16 also comprise an air thermostat 88 mounted on the exterior of the cylindrical side wall 40 of the housing 14 and so mounted at a point thermally remote from the hot air outlet means 17. The air thermostat 88 is electrically associated with the air blower motor, the wiring being disposed within the housing 14. Of course, it is within the concepts of this invention for the operation of the air blower motor to be controlled manually either with or without the simultaneous, automatic control of the air thermostat. Also it is within the concepts of this invention for the air thermostat 88 to be mounted on the wall of the room in which the heating apparatus 10 is located, or elsewhere, rather than on the cylindrical side wall 40 of the housing 14, or to have in addition to the air thermostat 88 on the cylindrical side wall 40 another air thermostat 88 either in the same room as the heating apparatus 10 or elsewhere, with the two air thermostats being electrically hooked up in parallel to the air blower motor.

Under normal operative conditions, water in the hot water tank 11 is heated by heat from the fuel burner means 19, which heat is conveyed through the top wall 28 of the fuel combustion chamber, the air heating chamber 30 and the bottom wall 22 of the hot water tank 11, and through the combustion gas vent pipe 78. The temperature of the water in the hot water tank 11 and the operation of the fuel burner means 19 are controlled by the water thermostat 86. When the air thermostat 88 actuates the air blower motor, air is sucked through the air intake opening 72 of air blower and is blown through the air discharge duct 74 into the air space 42 between the top 70 of the hot water tank 11 and the housing 14. The air passes down into the air space 44 about the hot water tank side wall 24, acquiring heat from the hot water tank 11, through the air inlet opening 32 in the skirt portion 26 and into the air heating chamber 30. The air passes through the air heating chamber 30 picking up more heat therein, and then passes through the hot air means 17 into the room in which the combination water and space heater 10 is located. When the space about the heater 10 has arrived at the temperature set by the air thermostat 88, the air blower motor is turned off.

Thus there is provided an improved, combination space and water heater. Not only is the construction improved, but the efficiency is substantially improved. For example, in a gas fired, combinataion water and space heater of the structure disclosed in the Handley patent, wherein the water storage capacity was 30 gallons, the air volume throughput was 101.6 cubic feet per minute, the gas burner input was 24,895 B.t.u. per hour and hourly recovery (based on a 70% efficient minimum requirement input divided by 1190) was 21 gallons, the warm air output at a selected burner "on" and "off" cycle was 4,594 B.t.u. per hour. In a gas fired, combination water and space heater of this invention wherein the water storage capacity was 40 gallons, the air volume throughput was 116.04 cubic feet per minute, the gas burner input was 25,309 B.t.u. per hour and the hourly recovery was 21 gallons, the warm air output at the same burner "on" and "off" cycle was 11,260 B.t.u. per hour. Hence, the heating apparatus of this invention is substantially more efficient.

These and other features, advantages and specific embodiments of this invention will be readily apparent to to those in the exercise of ordinary skill in the art after reading the foregoing disclosures. In this connection, while a specific embodiment of this invention has been described in considerable detail, variations and modifications of this embodiment can be effected without departing from the spirit and scope of the invention as disclosed and claimed.

We claim:

1. An improved combination space and water heating apparatus which comprises:

a hot water tank defined by top, bottom and cylindrical side walls and comprising cold water inlet means and hot water outlet means, said tank having a normally vertical axis;

a fuel combustion chamber defined by top, bottom and cyclindrical side walls, said chamber having a normally vertical axis coincident with said axis of said tank, said top wall being below said bottom wall of said tank and spaced therefrom, the space between said bottom wall of said tank and said top wall of said fuel combustion chamber forming an air heating chamber;

a housing comprising a top wall and a cylindrical side wall surrounding said tank, said housing having a normally vertical axis coincident with said axis of said tank, said top wall of said housing being spaced from said top wall of said tank and said side wall of said housing being spaced from said side wall of said tank, whereby there is provided air space between the top and side walls of said housing and the top and

side walls of said tank and at least said side wall of said fuel combustion chamber in the region of said top wall thereof, said air space being in air flow communication with said air heating chamber, said housing further comprising bottom closure means in combination with said side wall of said fuel combustion chamber, which bottom closure means enclose said air space at the normally bottom end thereof;

hot air outlet means in combination with said air heating chamber and comprising a duct disposed through said housing for the passage of hot air from said air heating chamber to outside of said housing;

air blower means in communication with the air space between the top wall of said tank and the top wall of said housing for introducing air into said air space from outside of said housing;

combustion gas vent means comprising a pipe disposed along said axis through said top wall of said housing, top wall of said tank, said tank, said bottom wall of said tank and said top wall of said combustion chamber with the intake end thereof being disposed in said fuel combustion chamber and substantially spaced normally downwardly from said top wall of said fuel combustion chamber; and

fuel burner means centrally disposed in said fuel combustion chamber, said means being functionable to eject fuel transversely relative to said axis of said chamber toward said side wall of said chamber.

2. An apparatus according to claim **1** wherein at least normally the bottom side of said top wall of said fuel combustion chamber is arcuate.

3. An apparatus according to claim **2** wherein the normally bottom side of said top wall of said fuel combustion chamber is concave relative to said chamber.

4. An apparatus according to claim **2** wherein both the normally top and bottom side of said top wall of said fuel combustion chamber are arcuate and both the normally top and bottom sides of said bottom wall of said tank are arcuate.

5. An apparatus according to claim **2** wherein the normally bottom side of said top wall of said fuel combustion chamber is concave relative to said fuel combustion chamber, the normally top side of said top wall of said fuel combustion chamber is convex relative to the air heating chamber, the normally bottom side of said bottom wall of said tank is concave relative to said air heating chamber and the normally top side of said bottom wall of said tank is convex relative to the interior of said tank.

6. A heater according to claim **5** wherein said cylindrical side wall of said hot water tank forms the cylindrical side wall of said fuel combustion chamber and of said air heating chamber, and has an opening therein diametrically opposed to said duct, whereby air in the air space between the cylindrical side wall of said housing and the cylindrical side wall of said tank can flow into said air heating chamber.

7. A heater according to claim **6** wherein said housing walls contain thermal insulation.

8. An improved combination space and water heating apparatus which comprises:

a hot water tank defined by top, bottom and cylindrical side walls and comprising cold water inlet means and hot water outlet means, said tank having a normally vertical axis;

a fuel combustion chamber defined by top, bottom and cylindrical side walls, said chamber having a normally vertical axis coincident with said axis of said tank, said top wall being arcuate, below said bottom wall of said tank and spaced therefrom, the space between said bottom wall of said tank and said top wall of said fuel combustion chamber forming an air heating chamber;

a housing comprising a top wall and a cylindrical side wall surrounding said tank, said housing having a normally vertical axis coincident with said axis of said tank, said top wall of said housing being spaced from said top wall of said tank and said side wall of said housing being spaced from said side wall of said tank, whereby there is provided air space between the top and side walls of said housing and the top and side walls of said tank and at least said side wall of said fuel combustion chamber in the region of said top wall thereof, said air space being in air flow communication with said air heating chamber, said housing further comprising bottom closure means in combination with said side wall of said fuel combustion chamber, which bottom closure means enclose said air space at the normally bottom end thereof;

hot air outlet means in combination with said air heating chamber and comprising a duct disposed through said housing for the passage of hot air from said air heating chamber to outside of said housing;

air blower means in communication with the air space between the top wall of said tank and the top wall of said housing for introducing air into said air space from outside of said housing;

combustion gas vent means comprising a pipe disposed along said axis through said top wall of said housing, top wall of said tank, said tank, said bottom wall of said tank and said top wall of said combustion chamber with the intake end thereof being disposed in said fuel combustion chamber; and

fuel burner means centrally disposed in said fuel combustion chamber, said means being functionable to eject fuel transversely relative to said axis of said chamber toward said side wall of said chamber.

9. An apparatus according to claim **8** wherein the normally bottom side of said top wall of said fuel combustion chamber is concave relative to said chamber.

10. An apparatus according to claim **8** wherein both the normally top and bottom side of said top wall of said fuel combustion chamber are arcuate and both the normally top and bottom sides of said bottom wall of said tank are arcuate.

11. An apparatus according to claim **8** wherein the normally bottom side of said top wall of said fuel combustion chamber is concave relative to said fuel combustion chamber, the normally top side of said top wall of said fuel combustion chamber is convex relative to the air heating chamber, the normally bottom side of said bottom wall of said tank is concave relative to said air heating chamber and the normally top side of said bottom wall of said tank is convex relative to the interior of said tank.

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JAMES W. WESTHAVER, *Primary Examiner.*