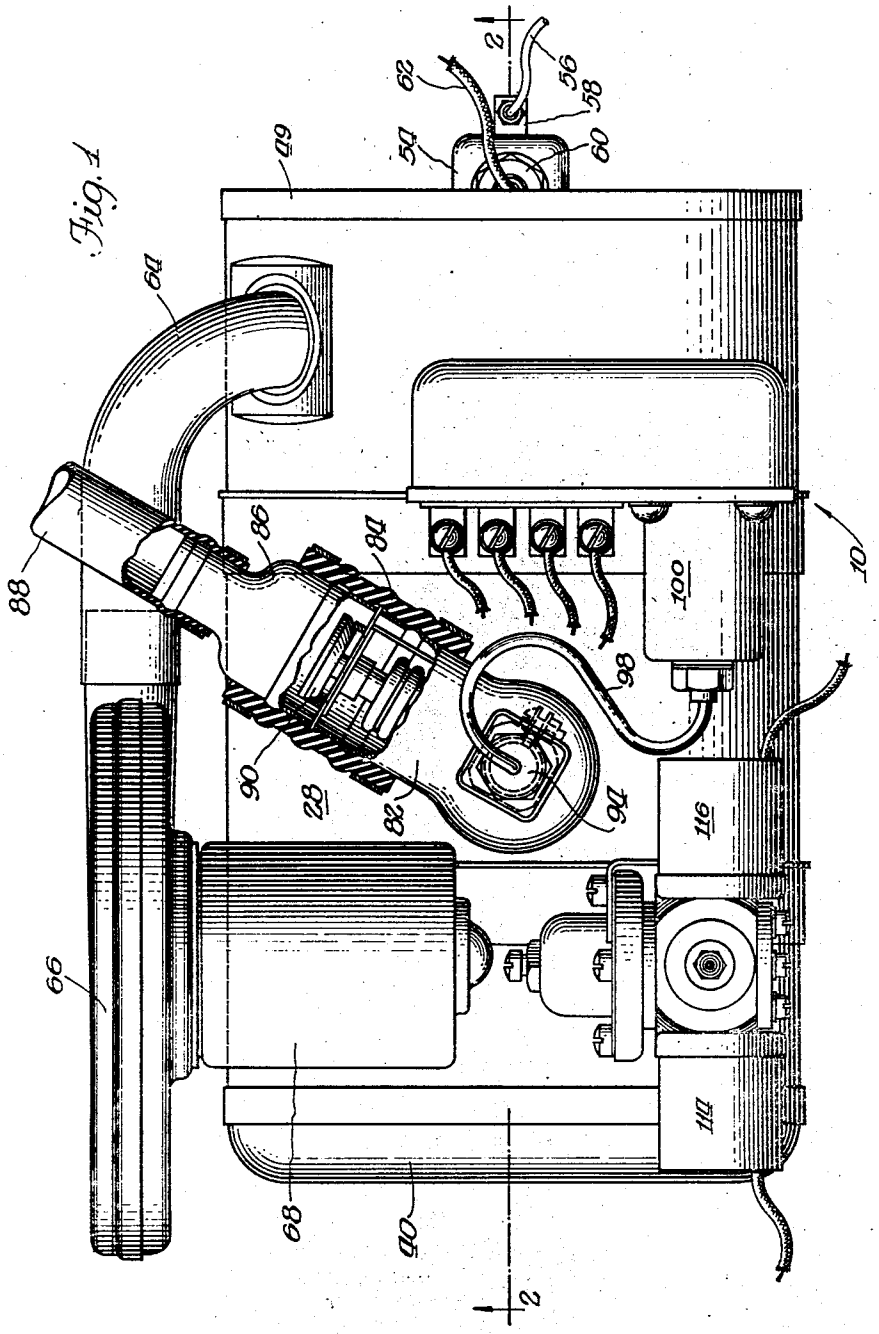
Nov. 28, 1950 W. A. MARSHALL, JR 2,531,459

WATER HEATER

Filed May 4, 1946 3 Sheets-Sheet 1

Fig. 1



Inventor:
William A. Marshall, Jr.

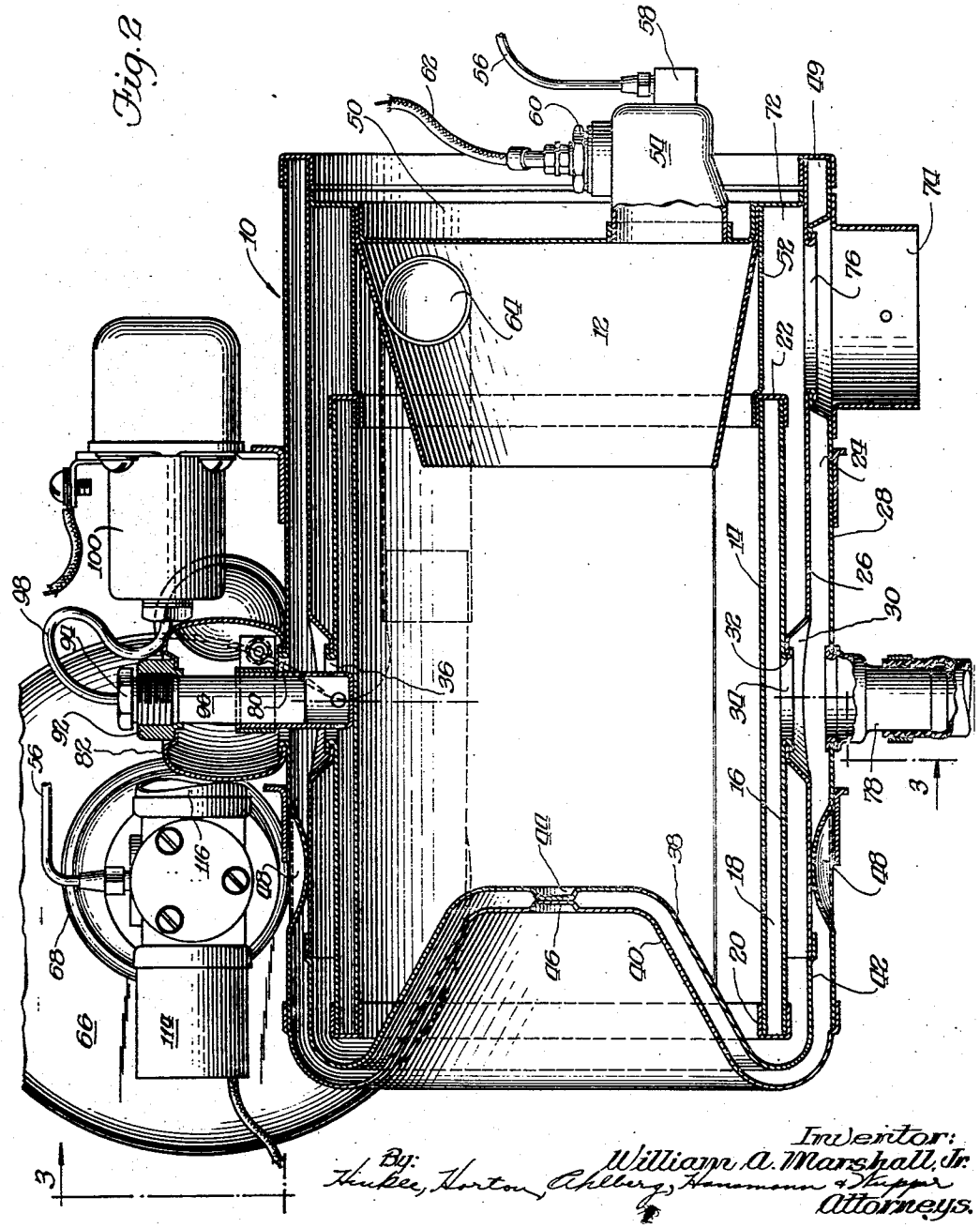
By: Kinkle, Horton, Ahlberg, Hausmann & Hupper
Attorneys.

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WATER HEATER

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Fig. 2



Inventor:
William A. Marshall, Jr.

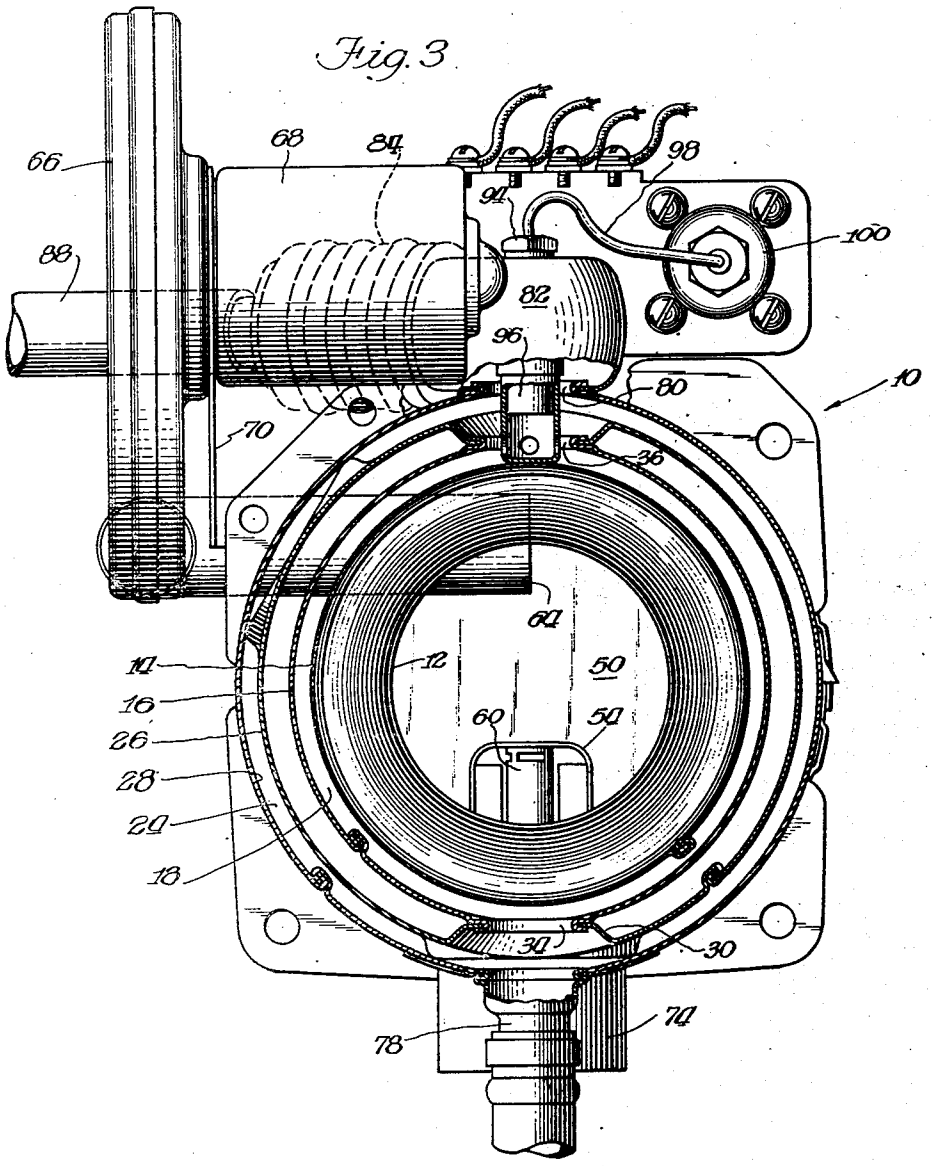
By: Hinkle, Horton, Ahlberg, Hansmann & Hopper
Attorneys.

Nov. 28, 1950 W. A. MARSHALL, JR 2,531,459

WATER HEATER

Filed May 4, 1946 3 Sheets-Sheet 3

Fig. 3



Inventor:
William A. Marshall, Jr.

By: Hinkle, Horton, Ahlberg, Hausmann & Skupa
Attorneys

Patented Nov. 28, 1950

2,531,459

UNITED STATES PATENT OFFICE

2,531,459

WATER HEATER

William A. Marshall, Jr., Indianapolis, Ind., assignor to Stewart-Warner Corporation, Chicago, Ill., a corporation of Virginia

Application May 4, 1946, Serial No. 667,421

5 Claims. (Cl. 122—136)

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The present invention relates to water heaters and more specifically to a type of small liquid fuel burning water heaters designed for insertion in the line between an automobile engine cylinder block and a heating radiator of the hot water type located within the driver's compartment or the passenger compartment of the vehicle.

Although the heater shown and described is primarily for the purpose of giving quick heat in an automobile, it will be appreciated that the invention relates more generally to hot water heaters and may also be applicable to apparatus for heating other liquids.

Conventional hot water heating systems for automobiles usually comprise a heat exchanger or radiator located in the driver's or passengers' compartment of the vehicle and connected to receive hot water from the engine cylinder block and to discharge the water back to the cylinder block in a closed circuit. Water heated by the engine is, therefore, passed through the heat exchanger or radiator and a portion of the heat is removed therefrom for heating the vehicle; radiation of this heat from the heat exchanger is commonly facilitated by an electric fan which passes air to be heated through or over the heat exchanger. However, with such a system no heating effect is produced until the temperature of the water in the engine cooling system rises a substantial amount.

The heater of the present invention is inserted in the hot water line which leads from the engine block to a hot water radiator or heat exchanger which may be like that of the conventional system just mentioned; thus, all the water passing to the heating radiator must pass through the device of the present invention. This device includes a combustion chamber in which liquid fuel, such as gasoline, is burned at a comparatively high rate so that heat can be transferred to water passing through the device at a rate of approximately 50,000 B. t. u. an hour. In this way the water passing to the heat exchanger or heating radiator in the vehicle body is raised to a substantial temperature within a few seconds after the device of the present invention is started.

One object of the invention is to provide an improved hot water heater of the type above-indicated which is compact in proportions while affording a maximum of heat exchanging surface through which the heat generated by combustion in the heater is transferred to the water for circulation.

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Another object of the invention is to provide a novel hot water heater adapted to be manufactured at a comparatively low cost and by simple and conventional methods.

It is also an object of the invention to provide a novel water heater of the type indicated which is safe and sure in operation and unlikely to require any substantial attention for maintaining it in service.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a top view of a hot water heater embodying the present invention with a portion of the liquid connection broken away to show interior structure;

Fig. 2 is a longitudinal sectional view of the heater illustrated in Fig. 1 and may be considered as taken substantially along the line 2—2 of Fig. 1 in the direction indicated by the arrows;

Fig. 3 is an irregular transverse sectional view which may be considered as taken substantially along the line 3—3 in the direction indicated by the arrows on Fig. 2.

The heater indicated generally by the numeral 10 comprises a conical burner 12 located within a cylindrical inner shell 14 which forms the combustion chamber for the heater with the large end of the burner toward one end of the shell while the smaller end thereof empties into the generally cylindrical space in the shell 14. The shell 14 together with a concentric larger sleeve 16 forms an inner water jacket 18 which is closed at its ends by means of annular flanged rings 20 and 22 soldered or brazed to the cylindrical sleeves 14 and 16. This inner water jacket 18 is surrounded by an outer water jacket 24 spaced therefrom and comprised of a pair of generally cylindrical concentric spaced sleeves 26 and 28. At the bottom of the heater the inner of these sleeves 26 is formed to provide a depressed cone 30 which is brought into contact with the sleeve 16, this depressed cone being punched to provide a circular opening, through which a portion of the metal of the sleeve 16 is extruded and rolled over to form a circular seam 32 around the opening, which provides communication between the outer water jacket 24 and the inner water jacket 18. To prevent leakage, this seam is soldered. At the bottom of the heater this opening or passage is indicated by the numeral 34 while at the top of the heater a similarly formed passage is indicated by the numeral 36.

At the end of the heater opposite the burner 12, the outer water jacket is extended to form a re-entrant portion by means of inner and outer cones 38 and 40, respectively. As will be seen in Fig. 2, the inner cone 38 is rolled over near its outer edge to provide a cylindrical portion 42 which is soldered to the end of the sleeve 26. Similarly, the outer cone 40 is rolled over and soldered to the end of the outer shell 28. In order to space the cones 38 and 40 a proper distance apart to provide a water jacket, these cones near their centers are provided with mutually abutting extrusions 44 and 46 which prevent the cones from approaching each other more than a predetermined distance. Similarly, extrusions 48 are provided in the outer shell 28 so as to space this shell from the next adjacent shell 26.

At the burner end of the heater, a flanged ring 49 acts as a cap to provide a closure for the end of the outer water jacket space 24 while a stepped cup 50 closes the space between the shell 26 and a cylindrical baffle 52 which acts to prevent products of combustion from flowing directly from the burner to the exhaust connection. The central portion of the cup 50 also acts as the closure for the back of the burner 12.

Near the bottom of the burner 12 the closure cup 50 is provided with a pocket 54 into which liquid fuel flows by way of a tube 56 and fitting 58. This pocket also is equipped to receive an igniter 60 of the hot wire type energized through an igniter wire 62. The igniter when energized acts to vaporize gasoline or other liquid fuel in the pocket 54 and subsequently ignites the combustible vapor to start the fire in the burner 12. After the fire has been started, the igniter may be de-energized. Air for combustion is introduced through a tube 64 which enters the burner tangentially at the top thereof. This tube extends through baffle 52 and the shells 26 and 28 forming the outer water jacket 24. Outside the heater case it is bent at right angles and is connected to the outlet of a centrifugal blower 66. This blower is driven by a small electric motor 68 which is secured to the heater case by means of a suitable bracket 70.

When the burner is operating, products of combustion flow from the burner 12 into the cylindrical combustion chamber formed by the inner sleeve 14 and heat the latter. Heat is therefore transferred to the water within the jacket 18. The hot products of combustion also flow against the conical surface 38 and heat the water jacketed between this cone and the outer cone 40. After transferring a considerable portion of heat to the water as above indicated, the products of combustion flow around the end of the ring 20 and between the shells 16 and 26, thereby transferring more heat to the water within the jacket 18 and to the water within the outer jacket 24. At the burner end of the heater the products of combustion are collected within the annular plenum chamber 72 and pass outwardly through an exhaust spud 74 which communicates with the plenum chamber 72 through an opening 76 in the shells 28 and 26, this opening being sealed against water leakage in the same manner as the openings 34 and 36.

Water is introduced into the outer jacket space 24 by means of a tubular fitting 78 rolled over the edge of an opening in the shell 28, the fitting then being soldered in place to insure against leakage. Water flowing into the heater, therefore, directly enters the outer jacket 24 and

passes into the jacket 18 by way of the opening 34. At the top of the heater the outer water jacket 24 is provided with an outlet opening 80 directly opposite the passage 36 which communicates between the inner and outer jackets. The metal around the opening 80 is extruded outwardly and rolled over to form a connection with an elbow fitting 82, the joint being sealed with solder to prevent leakage. Elbow fitting 82 is connected at its outlet by means of a rubber sleeve 84 with an adapter 86 which in turn is connected to a rubber hose 88 which carries the hot water away from the heater. In a conventional installation the hose 88 will be connected to a conventional hot water radiator located within the driver's or passengers' compartment. In order to control the flow of liquid through the system, the hose connection 84 contains a liquid thermostat 90 which may be of conventional type and which opens at a predetermined temperature, as an example, 140 degrees F., so as to permit water to flow through the system as long as the water temperature is above this predetermined level and to inhibit flow through the system until this level has been reached.

The top of the elbow fitting 82 in a position directly opposite the passages 80 and 36 is provided with a threaded boss 92 to receive the head 94 of a thermostatic bulb 96 which is connected by means of a capillary tube 98 with a pressure responsive control switch mechanism at 100. Whenever, with this system, the temperature of the bulb 96 rises, the vapor pressure therein will rise, thus raising the pressure in the tube 98 and in the pressure responsive switch 100. The bulb 96 contains a quantity of fluid with proper vapor pressure characterististics to operate within the temperature range desired. The tube 98 is connected to actuate the switch mechanism at 100 and this device controls the circuit for the igniter 60 and also controls the fuel feed through solenoid valves 114 and 116. When combustion has been started and a moderate temperature has been attained in the vicinity of the bulb 96, the igniter is switched off. At a somewhat higher temperature the fuel feed is restricted by opening the circuit of the valve 114 and allowing this valve to shift from full flow position to restricted flow position. At a predetermined maximum temperature the valve 116 is de-energized and allowed to close, cutting off the fuel supply and shutting down the heater until the temperature at the bulb 96 drops to a predetermined value. This control of the heater by means of the temperature responsive bulb 96 and the switch mechanism 100 forms the subject matter of the application of John H. Leslie, II, and William A. Marshall, Jr., Serial No. 636,743, filed December 22, 1945.

It will be noted that the construction of the heater is so planned as to facilitate assembly and to employ conventional operations in the formation of the parts. The cylindrical shell 14 and the sleeve 16 which form the inner water jacket are of equal length and are connected at their ends by the annular channel-shaped members 20 and 22. The cylinder 14 fits snugly around the inner flanges of these channels while the cylinder 16 fits snugly within the outer flanges of the channels so that the channels serve to space the cylinders 14 and 16 from each other and to maintain them in coaxial relation. Similarly the channel-shaped ring 49 connects and spaces the inner cylinder 26 and the outer cylinder 28 of the outer water jacket at one end.

At the end of the heater opposite the burner 12 the cylinders 26 and 28 are closed by the end walls 38 and 40 which fit telescopically over the ends of the two cylinders, respectively, with the truncated conical portions projecting into the combustion chamber. The mutually abutting bosses 44 and 46 centrally located in the flat end portions of these end walls 38 and 40 and secured together as by welding serve not only to space the truncated conical parts from each other but also to center them with respect to each other so that at their telescopic connections with the cylinders 26 and 28 they maintain the cylinders in properly spaced relation and keep them coaxial. To some extent, of course, this spacing of the two walls of the outer water jacket is supplemented by the extrusions or bosses 43 shown in Fig. 2.

While there is shown and described herein certain structure embodying the invention, it is to be understood that the invention is not limited thereto or thereby but may assume numerous other forms and includes all modifications, variations and equivalents coming within the scope of the following claims.

I claim:

1. In an internal combustion heater, a cylindrical shell forming a combustion chamber, a sleeve surrounding said shell and spaced therefrom to form an inner water jacket, annular members closing both ends of said jacket, a burner disposed at one end of said shell and adapted to discharge products of combustion toward the opposite end of the shell, an outer water jacket surrounding the inner jacket and spaced therefrom to provide a passage of annular cross section for products of combustion, said outer jacket having an end wall which includes a re-entrant portion extending around the said opposite end of the shell of said inner jacket in spaced relation thereto and having a truncated conical form projecting into the combustion chamber and tapering toward the burner, the re-entrant end portion of the outer jacket within the combustion chamber including flat circular walls formed with mutually abutting bosses which space them apart to provide a water space in communication with the remaining space of said outer jacket.

2. In an internal combustion heater which includes a cylindrical shell forming a combustion chamber and a burner disposed at one end of said shell, a water jacket spaced from said shell to provide a path for products of combustion, said jacket comprising an inner cylinder and an outer cylinder, an annular member of channel-shaped cross section closing one end of said jacket, the inner flange of said channel fitting snugly within the end of said inner cylinder and the end of the outer cylinder fitting snugly within the outer flange of said channel, and an end wall for the opposite end of each cylinder fitted telescopically over that end of each cylinder and including a re-entrant portion extending around the corresponding end of the combustion chamber shell in spaced relation thereto, said end walls being of truncated conical form nested in spaced relation and projecting into the combustion chamber toward the burner, and the smaller ends of said truncated conical parts having mutually abutting bosses secured together and holding said parts into axial relation.

3. In an internal combustion heater, a cylindrical shell forming a combustion chamber, a sleeve surrounding said shell and spaced therefrom to form an inner water jacket, annular members closing both ends of said jacket, a burner disposed at one end of said shell and adapted to discharge products of combustion toward the opposite end of the shell, an outer water jacket surrounding the inner jacket and spaced therefrom to provide a passage of annular cross-section for products of combustion, said outer jacket including an end wall which extends across the end of said inner jacket and combustion chamber opposite that at which the burner is located, said wall being spaced from said opposite end of the inner jacket to provide a connecting passage between the combustion chamber and the space between said jackets, means forming an exhaust outlet leading from said space, and means connecting the inner wall of the outer jacket to the outer wall of the inner jacket comprising an annular portion pressed out from one of said walls extending toward an opening in the other and connected to the rim of said opening in watertight relation, said connecting means providing communication between the inner and outer jackets and maintaining the space between them as a passage for the flow of products of combustion.

4. In an internal combustion heater, a cylindrical shell forming a combustion chamber, a sleeve surrounding said shell and spaced therefrom to form an inner water jacket, annular members closing both ends of said jacket, a burner disposed at one end of said shell and adapted to discharge products of combustion toward the opposite end of the shell, an outer water jacket surrounding the inner jacket and spaced therefrom to provide a passage of annular cross-section for products of combustion, said outer jacket including an end wall which extends across the end of said combustion chamber opposite that at which the burner is located, said wall being spaced from the corresponding end of the inner jacket to provide a connecting passage between the combustion chamber and the space between said jackets, means forming an exhaust outlet leading from said space, a connection between the inner wall of the outer jacket and the outer wall of the inner jacket comprising an annular portion pressed out from one of said walls extending toward an opening in the other and connected to the rim of said opening in watertight relation, a second and similar connection between the inner wall of the outer jacket and the outer wall of the inner jacket located at the opposite side of the axis of the heater from the first mentioned connection, a water inlet coupling secured in an opening in the outer jacket opposite one of said connections, and a water outlet connection secured in an opening in said outer jacket opposite the other of said connections.

5. In an internal combustion heater, a cylindrical shell forming a combustion chamber, a sleeve surrounding said shell and spaced therefrom to form an inner water jacket, annular members closing both ends of said jacket, a frusto-conical burner disposed at one end of said shell and adapted to discharge products of combustion toward the opposite end thereof, an outer water jacket surrounding the inner jacket and being spaced therefrom to provide a passage of annular cross-section for products of combustion, said outer jacket including a first end wall which extends across the end of said combustion chamber opposite that at which the burner is located, said first end wall being spaced from

the corresponding end of the inner jacket to provide a connecting passage between the combustion chamber and the space between said jackets, means forming an exhaust outlet leading from said space, a stepped circular end wall fitted within the end of said outer jacket opposite that in which the first mentioned end wall is located, said burner having a base adapted to be received over the step in said stepped circular end wall for supporting said burner inwardly of the said second mentioned end portion of said outer jacket and the corresponding end of said inner jacket terminating at a point inwardly of the innermost face of said stepped circular end wall, and a cylindrical baffle fitted onto said step around the base of said burner and extending therefrom into telescopic engagement with the

inner water jacket for supplementing said jacket as a partition between the combustion chamber and the annular passage through which products of combustion flow from said chamber to the exhaust outlet.

WILLIAM A. MARSHALL, JR.

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