May 9, 1944. J. R. WILSON 2,348,668

TUBE TYPE FLASH BOILER WATER HEATING DEVICE

Filed Oct. 4, 1941 2 Sheets-Sheet 1

Fig. 1.

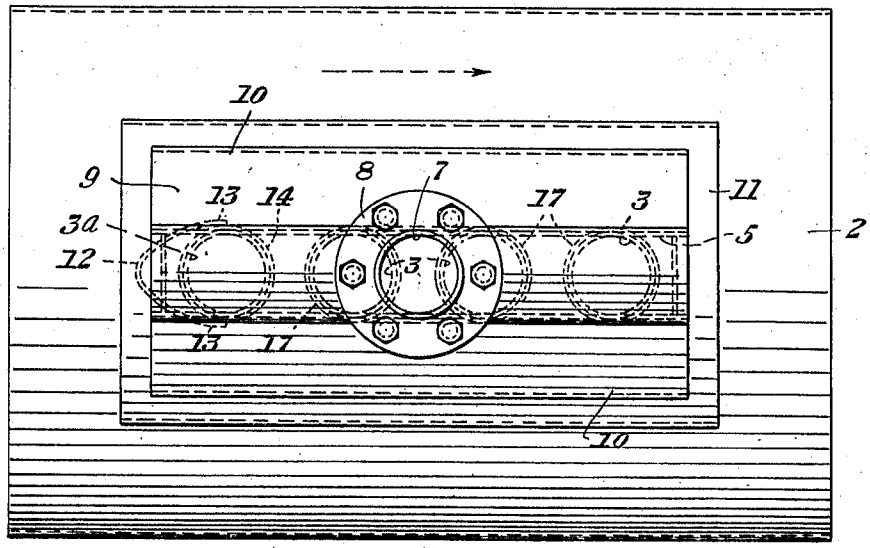
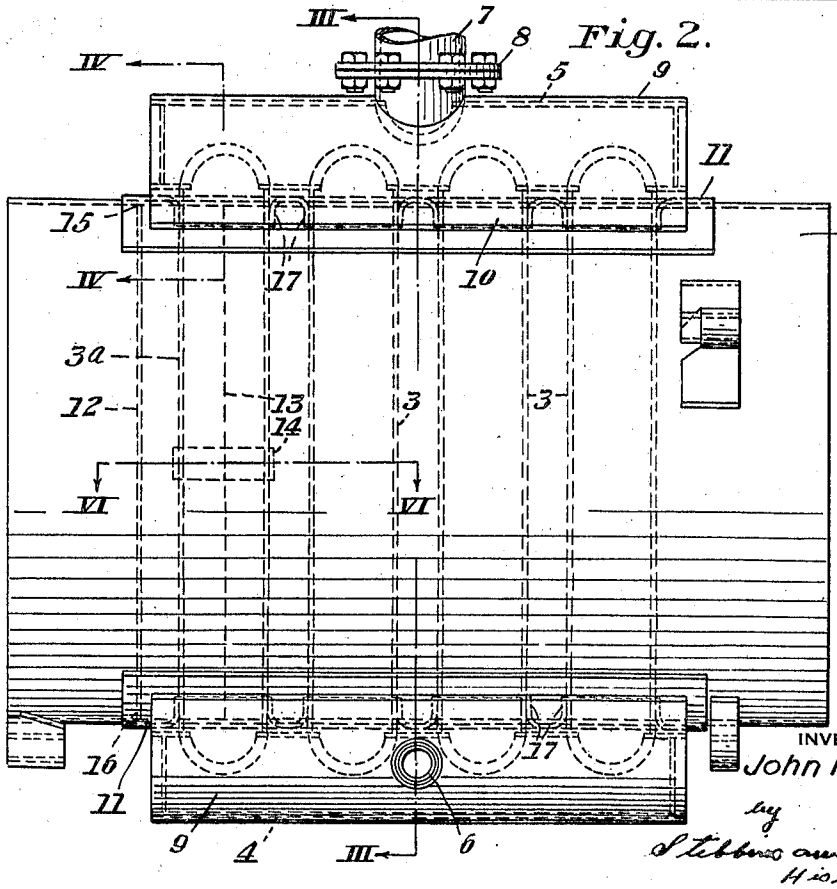


Fig. 2.



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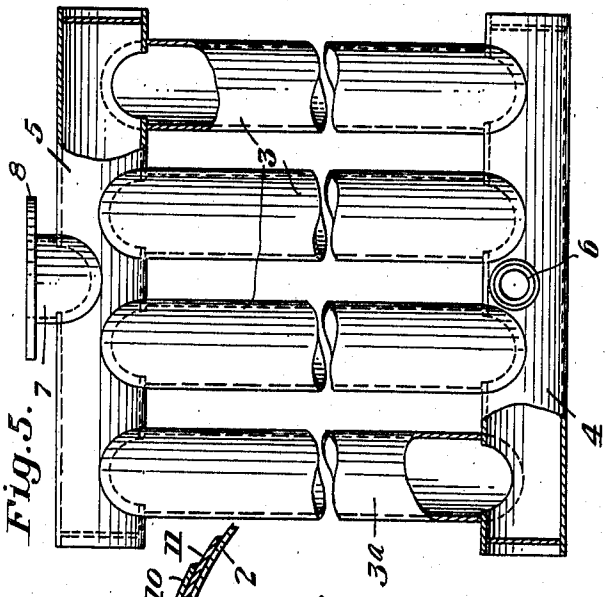


Fig. 5.

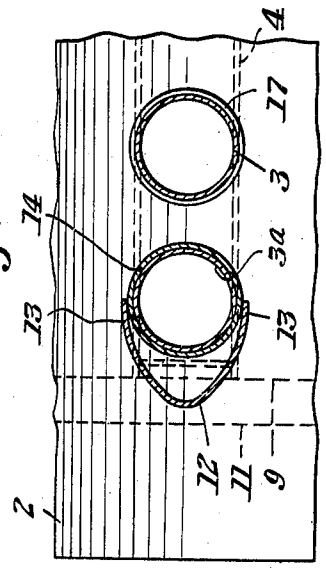


Fig. 6.

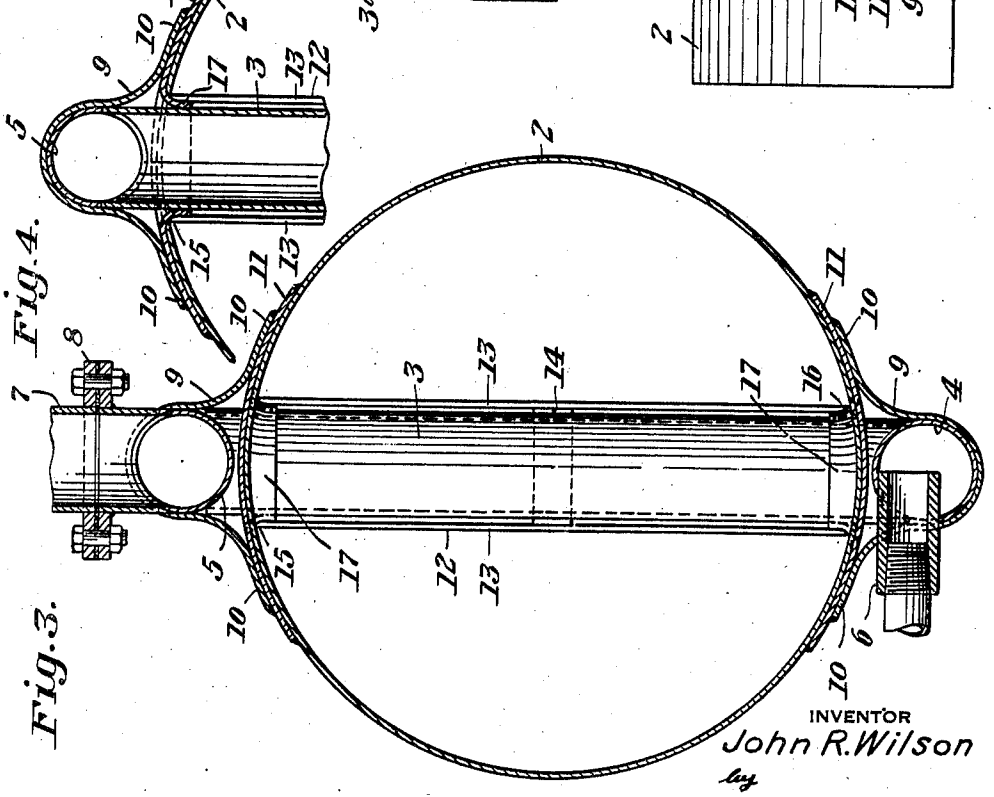


Fig. 4.

Fig. 3.

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UNITED STATES PATENT OFFICE

2,348,668

TUBE TYPE FLASH BOILER WATER HEATING DEVICE

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Application October 4, 1941, Serial No. 413,593

6 Claims. (Cl. 122—7)

This invention relates generally to tube type flash boiler water heating devices and, although of general applicability, will be described herein particularly as applied to a heating device or steam boiler to be used in connection with aeroplane engines. In this application, the water tubes are so located that they are heated by the gases flowing through the exhaust manifold of the engine.

Devices of the type contemplated by the present invention operate principally as flash boilers. By this it is meant that when no steam is required to heat the cabin of the aircraft the boiler is dry and at the temperature of the manifold, which may be from 1000° F. to 1400° F. or more but that when steam is required for heating the cabin the system is opened and cold water rushes to the boiler, which, being red hot, causes the water to flash into steam. This exerts extreme pressure and strains on the boiler. This cycle, that is running from red hot to the temperature of the incoming water, occurs many times during a flight, whereas if it were operating solely as a water heater, these extreme conditions would not exist.

In the accompanying drawings:

Fig. 1 is a plan view of the boiler or heating device;

Fig. 2 is a vertical front elevation of the device shown in Fig. 1;

Fig. 3 is a vertical transverse section taken on the line III—III of Fig. 2;

Fig. 4 is a vertical transverse section taken on the line IV—IV of Fig. 2;

Fig. 5 is a vertical front elevation illustrating the construction of the water tubes and headers; and

Fig. 6 is a longitudinal horizontal section taken on the line VI—VI of Fig. 2, illustrating a baffle secured to the forward water tube.

Heretofore in tube type heaters provided with inlet and outlet headers for the water passing through the tubes, it has been the practice to locate the headers within the exhaust manifold through which the heated gases pass and to support the headers from the inside of the manifold shell by welding the headers directly to the inside or outside of the shell. This practice has led to considerable difficulties, because the extreme changes in temperature within the shell cause considerable expansion and contraction of the headers and the water tubes to which they are connected. This contraction and expansion has caused the welds to crack or the metal to pull apart from the welds.

In accordance with the present invention, I overcome or at least decrease this tendency of the headers to pull apart from the welds to the shell by locating the headers outside of the shell, where they are not subjected to such extreme changes in temperature, and in addition I mount the headers on supports operatively secured to the outside of the shell, these supports having sufficient resiliency to prevent cracking or breaking away of the weld, due to contraction and expansion of the parts. The tubes extend through the shell and are connected to the headers which are mounted on the outside of the shell. Other features of the invention will become apparent from the following detailed description:

Referring more particularly to the accompanying drawings, the exhaust manifold, which forms the shell in which the water tubes are located and through which the heated gases from the engine pass, is designated by the reference numeral 2. The heated gases from the engine flow through the manifold or shell in the direction indicated by the arrow in Fig. 1, i. e., from left to right as viewed in this figure. A plurality of water tubes 3 extend vertically through the shell 2, four of such tubes being shown in the drawings, but it will be understood that any suitable number may be employed. Each of these tubes extends through openings in the top and bottom of the shell and is connected to a bottom header 4 and a top header 5. Water to be heated is supplied to the inlet header 4 through the connection 6 and after flowing through the tubes 3 passes into the header 5 and from the outlet header through an outlet pipe 7, which is connected by a flanged coupling 8 to the outlet header. An important feature of the present invention is the mounting of the headers 4 and 5 on the outside of the shell 2. Each of these headers is spaced from the outside of the shell a sufficient distance to enable air to flow past the headers, in order to cool them. Each of the headers is mounted on the outside of the shell 2 in a similar manner, so that a description of the mounting of the outlet header 5 will be sufficient. This header is supported by a strap or plate 9, which passes over the top of the header and is welded thereto. The ends 10 of the strap are welded to a baffle support plate 11, which likewise is welded or otherwise secured to the outside of the shell 2. The strap 9 or equivalent supporting means for the headers is preferably made of metal which is sufficiently thin and of such character as to provide a somewhat resilient mounting for the header, in order that the header may move, due

to contraction and expansion, without injuring the connection between the header and the resilient support or the connection between the resilient support and the shell.

In order to distribute the heated gases more evenly, so as to prevent the leading water tube 3a from becoming more highly heated than the other water tubes, the leading water tube 3a is provided with a baffle 12. As shown most clearly in Fig. 6, the side edges 13 of the baffle are secured to a ring 14 secured to the tube 3a at a point about midway between the top and bottom of the tube, as shown in Fig. 3. The top 15 and bottom 16 of the baffle are welded or otherwise secured to the inturned flanged portions 17 of the baffle support plate 11. It will be noted that the baffle support plate 11 is provided with the inturned flange portions 17 which extend inwardly of the manifold 2 adjacent the openings through which the water tubes extend. The plates 11 which are located on the outside of the manifold 2 accordingly not only support the straps 9 which support the headers but they also support the baffle 12. This baffle spreads the heated gases flowing through the manifold so as to tend to equalize the distribution of heat to the different water tubes.

It will be seen from the above description that the inlet and outlet headers for the water tubes are mounted outside of the exhaust manifold or shell 2 through which the heated gas passes and that the headers are supported by resilient supports which allow for expansion and contraction of the parts, due to changes in temperature without causing the welds connecting the headers to the shell to crack or break.

A feature of the invention is that the diameter of the tubes 3 is made large enough to limit surging of the boiler. In the prior known boilers of the type contemplated by this invention, the inside diameter of the tubes is from about ¼" to ⅜". In such boilers, surging is a rather serious matter, the excessive surging being caused by the surface friction in the small diameter tubes. I make the tubes of an inside diameter which is sufficiently large so as to prevent excessive surging. The tubes shown in the drawings have an inside diameter of about 1½" but this may be varied considerably, depending upon the particular conditions of use. In general, the inside diameter of the tubes should be at least about ½" and preferably at least about 1". Although some surging may occur even with the tubes of large diameter according to my invention, the diameter of the tubes is great enough to allow the water to return promptly to the boiler rather than be carried through the steam lines to the radiator in the cabin. This reduces the strains on the steam lines and radiator and after the first flashing allows the boiler to operate as an ordinary steam boiler.

Although the invention has been particularly described as applied to an exhaust manifold of an engine, the invention is not restricted thereto. The mounting of the headers outside of the shell through which the heated gas flows and the use of resilient supports mounted on the outside of the shell are useful, irrespective of whether the shell is constituted by an exhaust manifold of an engine or is some other structure in which heated gases flow and in which water tubes may be located.

While I have illustrated and described a preferred embodiment of the invention, it is to be understood that the invention may be otherwise embodied or practiced within the scope of the following claims.

I claim:

1. A tube type flash boiler water heating device, comprising a shell, means for passing heated gas through said shell, water tubes extending through said shell, a baffle inside said shell for preventing direct impingement of the heated gas on said tubes, baffle support plates secured to the outside of said shell and having openings through which said tubes extend, said baffle support plates provided with flanges adjacent the openings, which extend inside said shell, said baffle being connected to said flanges, and an inlet header and an outlet header mounted on the outside of said shell and connected to said tubes.

2. A tube type flash boiler water heating device, comprising a shell, means for passing heated gas through said shell, water tubes extending through said shell, a baffle inside said shell for preventing direct impingement of the heated gas on said tubes, baffle support plates secured to the outside of said shell and having openings through which said tubes extend, said baffle support plates provided with flanges adjacent the openings, which extend inside said shell, said baffle being connected to said flanges, an inlet header and an outlet header connected to said tubes and located outside of said shell, and header supports connected to said baffle support plates.

3. A tube type flash boiler water heating device, comprising a metallic shell forming an enclosure for the passage of heated gases, a plurality of tubes extending through said shell with their ends extending outside of the shell, an inlet header positioned exteriorly of said shell and connected to and communicating with one end of each of said tubes, an outlet header positioned exteriorly of said shell and connected to and communicating with the other end of each of said tubes, and a resilient strap-like member operatively connected to said shell for supporting each header.

4. A tube type flash boiler water heating device, comprising a metallic shell forming an enclosure for the passage of heated gases, a plurality of tubes extending through said shell with their ends extending outside of the shell, an inlet header positioned exteriorly of said shell and connected to and communicating with one end of each of said tubes, an outlet header positioned exteriorly of said shell and connected to and communicating with the other end of each of said tubes, and a resilient strap-like member extending around each header, the ends of said members being securely connected to the shell, whereby the headers are supported by the shell exteriorly thereof.

5. A tube type flash boiler water heating device, comprising a metallic shell forming an enclosure for the passage of heated gases, a plurality of tubes extending through said shell with their ends extending outside of the shell, an inlet header positioned exteriorly of said shell and connected to and communicating with one end of each of said tubes, an outlet header positioned exteriorly of said shell and connected to and communicating with the other end of each of said tubes, said headers being spaced from the shell so as to provide for the flow of air between the shell and headers, and a resilient strap-like member for supporting each header, the resilient strap-like members being operatively connected to said headers and to said shell.

6. A tube type flash boiler water heating device, comprising a metallic shell forming an enclosure for the passage of heated gases, a plurality of tubes extending through said shell with their ends extending outside of the shell, each of said tubes having an inside diameter of at least ½'', whereby excessive surging is prevented, an inlet header positioned exteriorly of said shell and connected to and communicating with one end of each of said tubes, an outlet header positioned exteriorly of said shell and connected to and communicating with the other end of each of said tubes, and a resilient strap-like member for each header secured at its ends to the shell and formed intermediate its ends to extend around the adjacent header, whereby said headers are supported by the shell exteriorly thereof.

JOHN R. WILSON.