Nov. 19, 1940. G. W. DAVEY 2,222,530

STEAM GENERATOR

Filed June 23, 1939 2 Sheets-Sheet 1

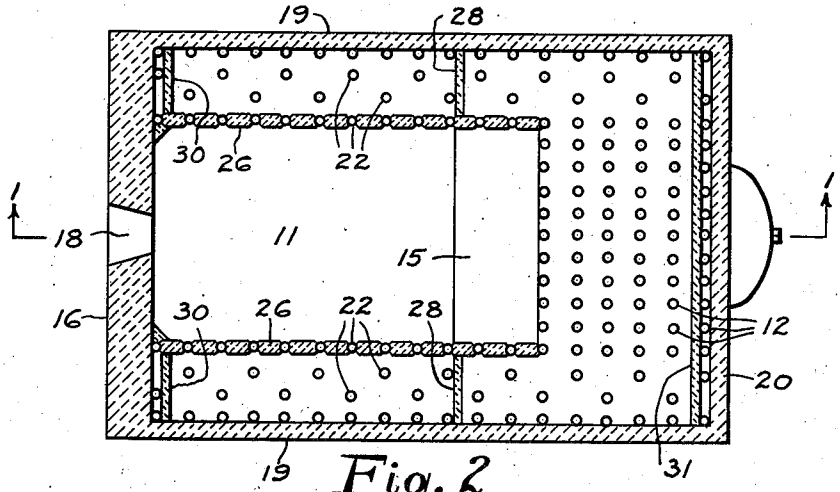


Fig. 2

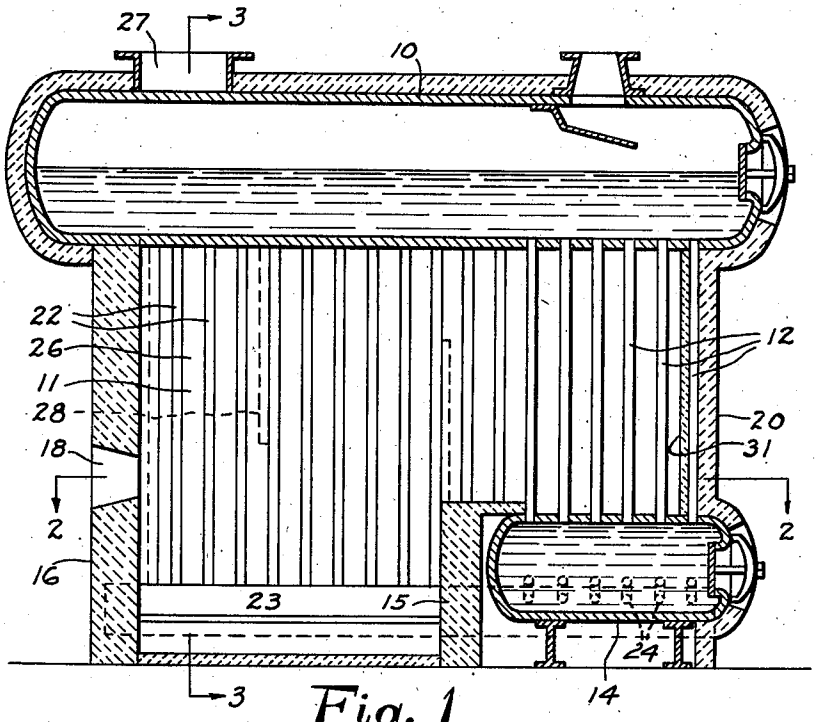


Fig. 1

Inventor.

GEORGE W. DAVEY

By Albert G. Blodgett

Attorney

Nov. 19, 1940. G. W. DAVEY 2,222,530

STEAM GENERATOR

Filed June 23, 1939 2 Sheets-Sheet 2

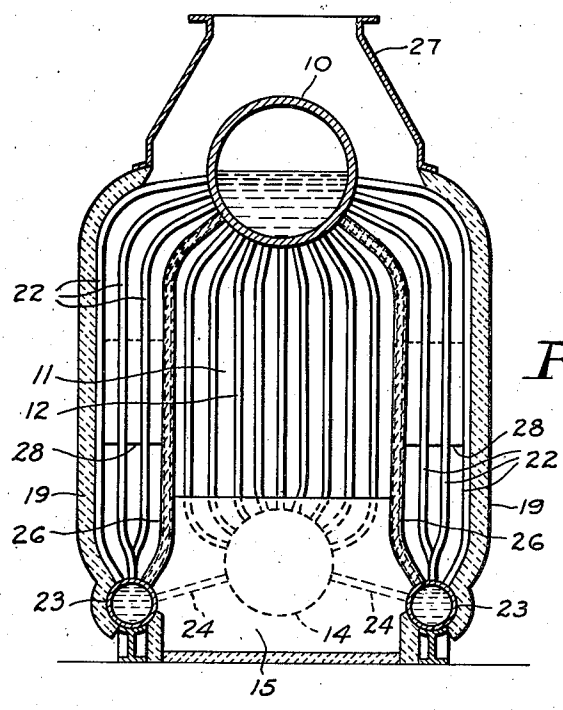


Fig. 3

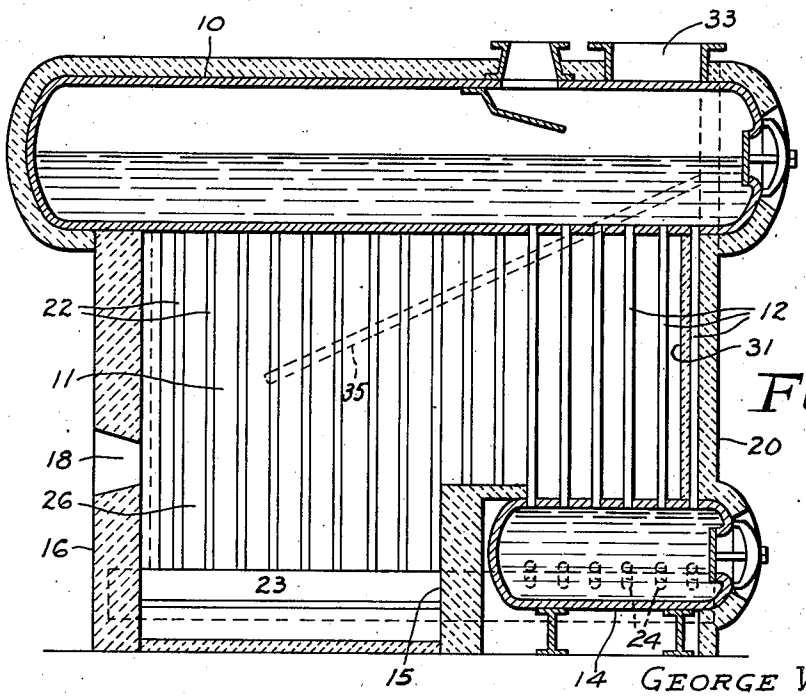


Fig. 4

Inventor

GEORGE W. DAVEY

By Albert G. Blodgett

Attorney

Patented Nov. 19, 1940 2,222,530

UNITED STATES PATENT OFFICE

2,222,530

STEAM GENERATOR

George W. Davey, Worcester, Mass.

Application June 23, 1939, Serial No. 280,829

4 Claims. (Cl. 122—347)

This invention relates to steam generators, and more particularly to steam generators of the water tube type.

It is one object of the invention to provide a steam generator which will have a large capacity in proportion to the floor space required for installation.

It is a further object of the invention to provide a steam generator which will afford a large water cooled combustion chamber.

It is a further object of the invention to provide a steam generator which will operate at high efficiency and which will be comparatively simple and inexpensive to manufacture.

With these and other objects in view as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawings illustrating one embodiment of the invention and in which like reference numerals indicate like parts,

Fig. 1 is a longitudinal section through a steam generator, the section being taken on the line 1—1 of Fig. 2;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 1; and

Fig. 4 is a view similar to Fig. 1, showing a modification.

The embodiment illustrated comprises a longitudinal steam-and-water drum 10, with a combustion chamber 11 located beneath the front portion of the drum and a central bank of upright water tubes 12 located beneath the rear portion of the drum, the upper ends of the water tubes being connected to the drum. The lower ends of the water tubes are connected to a comparatively short longitudinal water drum 14 considerably smaller in diameter than the upper drum 10 and having its axis in the same vertical plane as the axis of the upper drum 10, the front end of the lower drum being protected by a comparatively low bridge wall 15. The combustion chamber 11 is provided with a front wall 16 having an opening 18 therein for the introduction of oil or other suitable fuel. From the opposite ends of the front wall 16 two side walls 19 extend rearwardly, the rear ends of these side walls being connected by a wall 20 located in the rear of the tube bank 12.

On opposite sides of the combustion chamber 11 I provide two lateral banks of upright water tubes 22 which are connected at their upper ends to the upper drum 10 and at their lower ends to a pair of longitudinal headers 23. Preferably the water tube banks 22 and the headers 23 extend from the front wall 16 to the rear wall 20. The outermost rows of tubes 22 provide lateral support and water cooling for the side walls 19, while the rearmost of the tubes 22 and the rear row of tubes 12 perform the same function with respect to the rear wall 20. The rear portions of the headers 23 are connected to opposite sides of the lower drum 14 by means of water tubes 24.

Means is provided to direct the gases of combustion rearwardly from the combustion chamber 11 into contact with the water tubes 12, where the gases divide into two streams and flow forwardly in contact with the water tubes 22. For this purpose I seal the spaces between the innermost row of water tubes 22, on both sides of the combustion chamber, with refractory material 26 to provide water cooled side walls for the combustion chamber. This sealing is continuous from the front wall 16 to a point near the front of the tube bank 12, as shown particularly in Fig. 2, so that the gases are compelled to flow past the tubes 12 before passing among the tubes 22. A gas outlet or uptake 27 is provided above the front portion of the upper drum 10, this uptake extending downwardly on opposite sides of the drum, as shown in Fig. 3, to connect with the two gas passages. Preferably, upright baffles 28 are provided to direct the gases in a tortuous path among the tubes 22. As shown particularly in Fig. 2, a few of the tubes at the front of each tube bank 22 are protected from the hot gases by means of refractory material 30, so that these tubes will serve as downcomers in the operation of the steam generator. Similarly, refractory material 31 is shown in front of the rearmost of the tubes 22 and 12, so that these tubes likewise will serve as downcomers.

In Fig. 4 there is shown a slightly modified construction in which a gas outlet 33 is provided above the rear portion of the upper drums 10, in place of the gas outlet 27 of Fig. 1, and a baffle 35 is provided in place of the baffles 28 of Fig. 1. This baffle 35 slopes downwardly and forwardly and is so arranged that the gases are compelled to flow forwardly beneath the baffle and then upwardly and rearwardly above the baffle to the outlet 33.

The operation of the invention will now be apparent from the above disclosure. Fuel is burned in the combustion chamber 11, and the hot gases flow rearwardly over the bridge wall 15 into contact with the water tubes 12. Here the gases divide into two streams which flow later-

ally and thence forwardly in contact with the water tubes 22. In the embodiment shown in Fig. 1, the gases will be controlled by the baffles 28 and eventually escape through the gas outlet 27 at the front of the steam generator, while in the embodiment shown in Fig. 4 the gases will be controlled by the baffles 35 and eventually escape through the gas outlet 33 at the rear of the steam generator. With either construction there will be an efficient transfer of heat by radiation from the burning fuel to the inner rows of water tubes 22 at the sides of the combustion chamber and to the front row of water tubes 12 at the rear of the combustion chamber. This will be followed by the transfer of heat by convection from the hot gaseous products of combustion first to the water tubes 12 and then to the water tubes 22. Because of the comparatively long path through which the gases are compelled to travel, they will give up most of their heat to the boiler water, and steam will be generated in an efficient manner.

The gas outlet can be located either at the front or at the rear of the steam generator, whichever is more convenient for the particular installation. The two laterally positioned water tube banks 22 provide a considerable convection heating surface, so that the water tube bank 12 can be made with a much smaller heating surface than would otherwise be the case. This results in a substantial reduction in the overall length of the setting, facilitating the installation of the steam generator in cramped quarters, as well as reducing the length and cost of the drums. In the smaller sizes, my improved steam generator is well adapted for shop assembly and shipment as a unit to the place of installation.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A steam generator comprising a longitudinal steam-and-water drum, means providing a combustion chamber beneath the front portion thereof, a comparatively short longitudinal water drum located behind the combustion chamber and beneath the rear portion of the steam-and-water drum, a central bank of upright water tubes connecting the two drums and arranged to absorb heat from hot gases which flow rearwardly from the combustion chamber, two longitudinal headers near the lower portion of the combustion chamber on opposite sides thereof, the rear portions of the headers being located on opposite sides of the water drum, two lateral banks of upright water tubes connecting the respective headers with the steam-and-water drum, the rear portions of said lateral banks being located on opposite sides of the central bank, and means to direct the hot gases laterally and forwardly from the central bank among the tubes of the lateral banks.

2. A steam generator comprising a longitudinal steam-and-water drum, means providing a combustion chamber beneath the front portion thereof, a comparatively short longitudinal water drum located behind the combustion chamber and beneath the rear portion of the steam-and-water drum, a bank of upright water tubes connecting the two drums and arranged to absorb heat from hot gases which flow rearwardly from the combustion chamber, two longitudinal headers near the lower portion of the combustion chamber on opposite sides thereof, the rear portions of the headers being located on opposite sides of the water drum, a row of upright water tubes connecting each header with the steam-and-water drum, means sealing the spaces between the tubes of each row at the sides of the combustion chamber to form water cooled walls therefor, two side walls located outside of the water cooled walls and spaced therefrom to form passages which communicate at their rear portions with the inter-tubular spaces of the tube bank, and upright water tubes located in said passages and connected at their lower ends to the headers and at their upper ends to the steam-and-water drum, the last mentioned water tubes being arranged to absorb heat from the hot gases after they have passed the said tube bank.

3. A steam generator comprising a longitudinal steam-and-water drum, means providing a combustion chamber beneath the front portion thereof, a comparatively short longitudinal water drum located behind the combustion chamber and beneath the rear portion of the steam-and-water drum, the water drum being considerably smaller in diameter than the steam-and-water drum, a bank of upright water tubes connecting the two drums and arranged to absorb heat from hot gases which flow rearwardly from the combustion chamber, two longitudinal headers near the lower portion of the combustion chamber on opposite sides thereof, the rear portions of the healers being located on opposite sides of the water drum, a row of upright water tubes connecting each header with the steam-and-water drum, the tubes in the rear portions of the rows entering said drum above the tubes of said bank, means sealing the spaces between the tubes of each row at the sides of the combustion chamber to form water cooled walls therefor, two side walls located outside of the water cooled walls and spaced therefrom to form passages which communicate at their rear portions with the inter-tubular spaces of the tube bank, and upright water tubes located in said passages and connected at their lower ends to the headers and at their upper ends to the steam-and-water drum, the last mentioned water tubes being arranged to absorb heat from the hot gases after they have passed the said tube bank.

4. A steam generator comprising a longitudinal steam-and-water drum, means providing a combustion chamber beneath the front portion thereof, a comparatively short longitudinal water drum located behind the combustion chamber and beneath the rear portion of the steam-and-water drum, transverse rows of upright water tubes forming a central bank connecting the two drums and arranged to absorb heat from hot gases which flow rearwardly from the combustion chamber, means shielding the tubes in the rearmost of said rows from said gases to cause the tubes to serve as downcomers, two longitudinal headers near the lower portion of the combustion chamber on opposite sides thereof, the rear portions of the headers being located on opposite sides of the water drum, two lateral banks of upright water tubes connecting the respective headers with the steam-and-water drum, the rear portions of said lateral banks being located on opposite sides of the central bank, and means to direct the hot gases laterally and forwardly from the central bank among the tubes of the lateral banks.

GEORGE W. DAVEY.