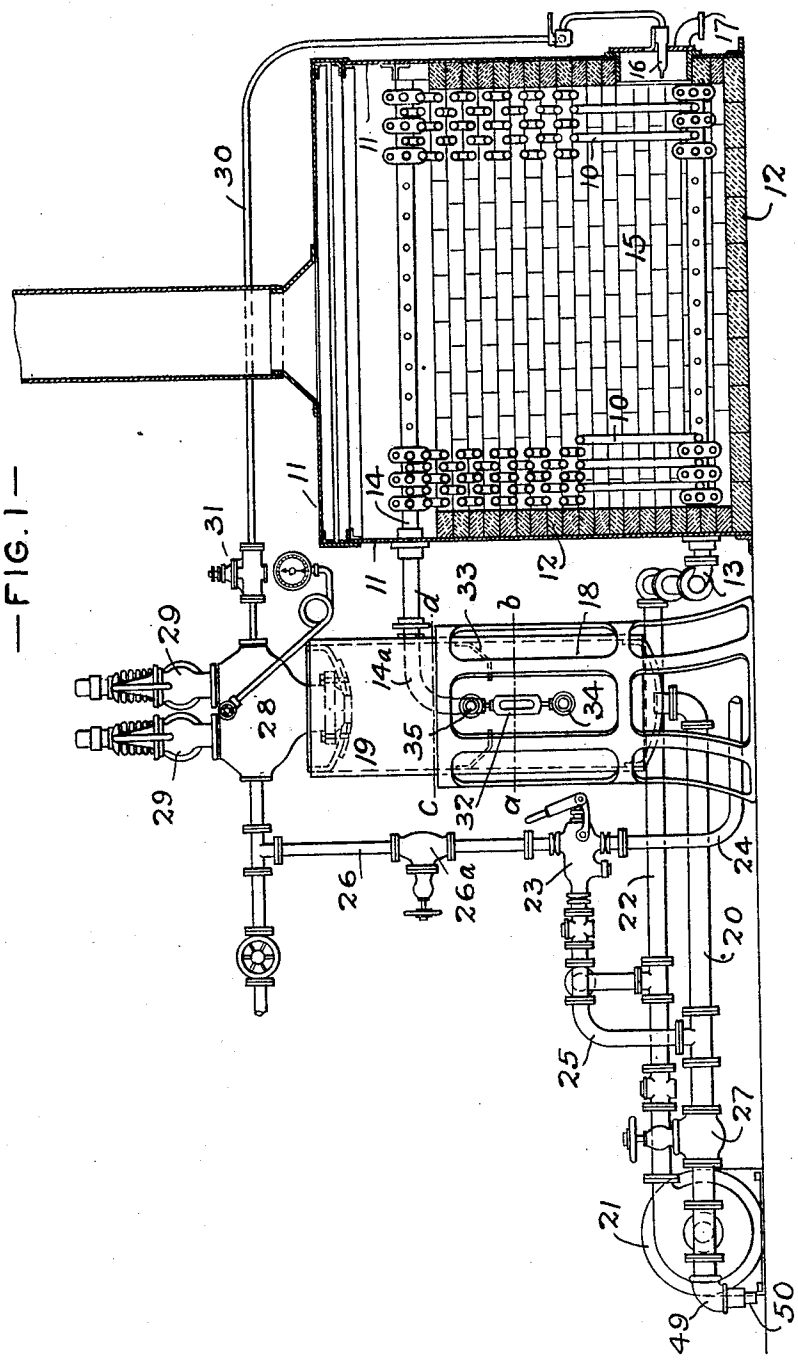
May 10, 1932. G. B. ASHWORTH 1,857,831

STEAM GENERATOR

Filed May 2, 1929 2 Sheets-Sheet 1



—FIG. 1—

INVENTOR
George B. Ashworth
BY
S. C. Yeaton
ATTORNEY

May 10, 1932. G. B. ASHWORTH 1,857,831

STEAM GENERATOR

Filed May 2, 1929 2 Sheets-Sheet 2

FIG. 4

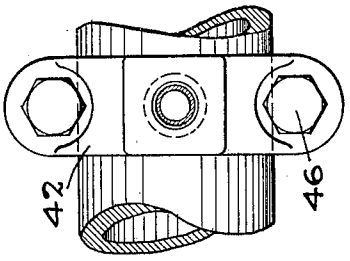


FIG. 3

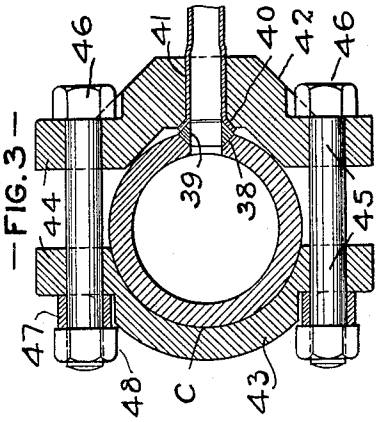


FIG. 6

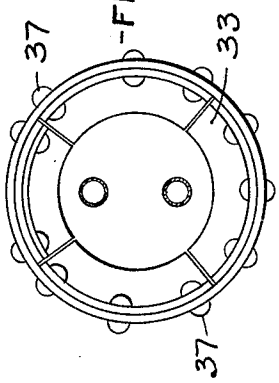


FIG. 5

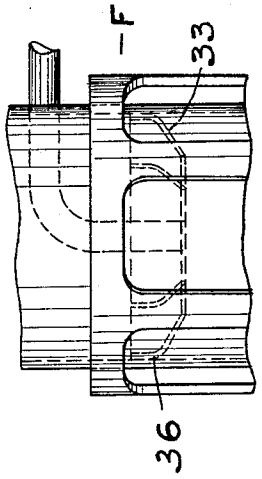
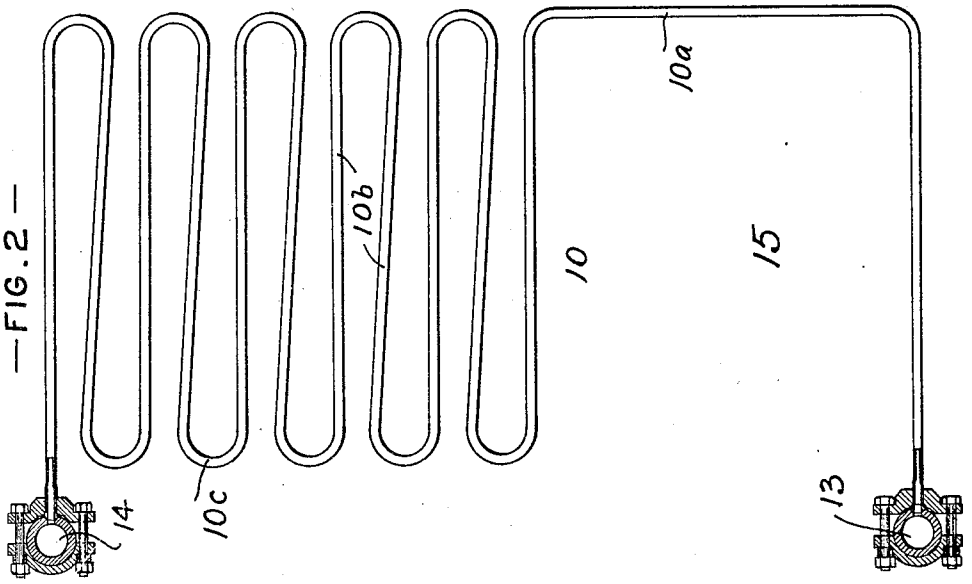


FIG. 2



INVENTOR
George B. Ashworth
BY S. C. Yeaton
ATTORNEY

Patented May 10, 1932 1,857,831

UNITED STATES PATENT OFFICE

GEORGE B. ASHWORTH, OF AMSTERDAM, NEW YORK

STEAM GENERATOR

Application filed May 2, 1929. Serial No. 359,973.

An object of my invention is to provide a steam generator, which will occupy a minimum of space, and give maximum thermal efficiency; which will enable a true reading of the water in the accumulator to be obtained at all times; and which will enable any one of the steam tubes to be easily removed for repair, without the necessity of disturbing the others.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a side view, partly in section, of a steam generator embodying my invention; Fig. 2, a side view, in elevation, on an enlarged scale of one of the steam tubes applied in the boiler, showing the manner of its connection to the water and the steam headers; Fig. 3, a transverse section on a still larger scale of one of the joints between the steam tube and a header; Fig. 4, a front view, in elevation, of the same; Fig. 5, a side view, in elevation, of the upper end of the accumulator, the baffle being shown in dotted lines; and, Fig. 6, a transverse section of the accumulator, taken on the line, VI—VI of Fig. 1, Figs. 5 and 6 being enlarged.

In the practice of my invention, referring descriptively to the specific embodiment thereof which is herein exemplified, the looped steam tubes, 10, are housed in a sheet metal shell, 11, of substantially rectangular form having a flue centrally disposed in its upper portion. The shell is lined with a wall of heat refractory material, 12. Water headers, 13, are disposed near the bottom of the shell, one near each side thereof, and extend from the front to the rear of the shell. Steam headers, 14, are disposed near the top of the shell, one near each side thereof, and extend from the front to the rear of the shell. A plurality of looped steam tubes, 10, connects each water header with the steam header disposed directly thereabove. Each steam tube comprises a substantially vertical riser, 10*a*, and a plurality of substantially horizontal laterals, 10*b*, superposed one above the other, each lateral being connected to the one next adjacent thereto, by a return bend, 10*c*. The disposition of the tubes is, first one connected to the headers on one side of the shell, then one connected to the headers on the opposite side of the shell, and so on throughout the group.

The space in the shell below the laterals constitutes a combustion chamber, 15, for the oil of the burner, 16, and the laterals are spaced apart from each other so as to permit the upward passage therebetween of products of combustion to the flue. To insure a proper supply of air for combustion purposes, an air pipe, 17, is provided at the front of the shell.

The accumulator, 18, comprising a water and steam chamber, 19, is located outside of the shell, to the rear thereof. A pipe, 14*a*, leads from each steam header into the upper end of the chamber, 19. The ends of these pipes have a downward bend, so that the steam will be directed toward the bottom of the accumulators. Normally, a supply of water reaching the line *a*—*b*, Fig. 1, is maintained in the accumulator. The water is circulated by a pump, 21, being withdrawn thereby from the accumulator, through the suction pipe, 20, and delivered to the water headers through the delivery pipe, 22.

To replenish the water evaporated into steam, and to maintain the water level in the accumulator at approximately the line *a*—*b*, Fig. 1, an injector, 23, is employed. The suction pipe, 24, leads from a suitable water supply, and its delivery pipe, 25, is connected to both the suction pipe, 20, and the delivery pipe, 22, of the pump. This disposition produces immediate mixing of the incoming water with the water already in circulation in the system. The injector is connected to a steam supply pipe, 26, in which is installed a shut-off valve, 26*a*.

To provide for maintaining circulation in the system, in the event that the circulating pump becomes inoperative, a shut-off valve, 27, is installed in the suction pipe, 20, which valve, when closed, will cause the injector to deliver directly into the pump delivery pipe, 22, instead of to the pump.

A steam turret, 28, is mounted on the top of the accumulator, and supports two safety valves, 29. To provide for atomizing the oil

in the burner, 16, a steam pipe, 30, leads from the turret to the burner, and has installed in its length, a reducing valve, 31.

To indicate the level of the water in the accumulator, a water gauge, 32, is mounted on the side of the accumulator shell. It has been found in practice that the steam impinging on the surface of the water, depresses it in the center and causes it to rise around the edges of the shell. To insure a proper registration by the gauge, irrespective of this tendency, there is installed in the accumulator, above the normal water lever, *a—b*, Fig. 1, a baffle, 33, which acts to check the rising of the water at the sides of the shell, and the bottom of the water gauge is tapped, as shown at 34, into the shell, below the normal water level, and the top of the gauge, is tapped, as shown at 35, above the bottom of the baffle. This construction prevents water from entering the top of the gauge, and insures the necessary supply of steam at the top thereof, to produce proper registration by the gauge.

The baffle is a substantially inverted frusto-conical shell, open at the bottom, and formed of four segments. It is provided, at its top, with a vertical annular flange, 36, by which it is secured, through rivets, 37, to the shell of the accumulator.

In order to provide for convenient removal of one of the steam tubes for repair, without disturbing the others, a novel jointure of the ends of the tubes to the headers, is provided. To this end, each header is provided with a plurality of spaced circular orifices, the walls of the outer ends of which are bevelled, to provide seats, 38, for the joint rings, 39. Each joint ring has a front and a rear bevelled seating face, the rear face seating on the bevelled face, 38, of the header, and the front face fitting snugly the inner bevelled face of the flared end, 40, of the tube. The ends of the tube are swaged to greater diameter than the remainder of the tube, as shown at 41.

To hold the tubes and joint rings in steam tight fit with the headers, a clamp, comprising front and rear gripping members, 42 and 43, respectively is employed. Each member is formed with a middle portion adapted to partially encircle the header, and two ears, 44, having openings, 45, for bolts, 46, by which the members are drawn toward one another to grip the tube to the header. The face of the midde portion of the rear gripping member, 43, which seats directly on the header, has a curve of slightly larger radius than the radius of the outside face of the header, so that the pull of the bolts, 46, will be exerted from the point, C, Fig. 3, midway between them, and on the horizontal axis of the tube, thus obviating pinching action on the tube. The front gripping member, 42, is formed with a cylindrical bore, which snugly receives the swaged end of the tube. The inner end of the bore is flared to correspond with the outer surface of the flared end of the tube.

In order to economize space, and to reduce weight, the bolts, 46, are placed close to the headers, and spacing washers, 47, are placed on the threaded ends of the bolts, between the nuts, 48, and the rear gripping member. The spacing washers give a clearance enabling the nuts to be turned. If they were not used, the ears of the rear gripping member would have to be made of a thickness equal to that of the ear shown plus the thickness of the spacing washers.

It is within the contemplation of the invention to make the steam headers of greater cubic capacity than the water headers, 13, the increase being proportionate to the increase in the volume of the steam at a predetermined pressure over the volume of the water.

A feature of the invention is the installation of a precipitator, in the pump suction pipe, 20, beyond the inlet to the pump. The precipitator comprises a downwardly turned elbow, 49, the end of which is closed by a threaded plug, 50. Sediment collected by the precipitator can be removed by unscrewing the plug.

An important advantage of my invention is that the heights of the risers, the number and length of the laterals, and the radius of the return bends can be readily varied to provide a tube unit adapted for installation in any available space. A further advantage of the invention is the convenience with which any one of the tubes can be removed for repairs, without disturbing the others. A further advantage is the correct registration, by the gauge, of the water level in the accumulator. A further advantage is the economy in space provided by the employment of two pairs of headers, 13 and 14, which permit a greater number of steam tubes to be employed when desired, for otherwise the number of tubes would depend upon the width of the clamping members used in securing the tube to the header.

While the accumulator is shown in the particular instance as located exterior of the boiler structure, it may however, be placed within the boiler structure in such manner as to be heated by the heat from the products of combustion coming from the fire box, or these gases may be fed to the accumulator structure when placed outside the boiler structure to impart their heat thereto before passing to the atmosphere. As is obvious the products of combustion should preferably act upon the accumulator throughout its whole length or at least down to a point below the low water level. To advantageously provide for this, the accumulator may be raised to the desired amount.

While one of the preferred embodiments

of the invention has been described it is to be understood that various changes in form proportions, material and assembly may be resorted to without departing from the spirit and scope of the invention pointed out in the appended claims.

I claim as my invention and desire to secure by Letters Patent:

1. An accumulator for steam generators, comprising a chamber having a steam space, and a water space; a steam inlet to the steam space; and a baffle, disposed in said chamber around the walls of the same, above the normal water level, and adapted to resist the tendency of the water to rise at the side walls of the chamber, when steam impinges on the surface of the water and providing a central open passageway for steam in said chamber.

2. An accumulator for steam generators, comprising a chamber, having a steam space and a water space; a steam inlet to the steam space; a baffle, disposed in said chamber, above the normal water level, extending inwardly from the side walls of said chamber and providing an open central steam passageway therein, and adapted to resist the tendency of the water to rise at the side walls of the chamber, when steam impinges on the surface of the water; and a water gauge having one end tapped into the water space of the chamber, and its other end tapped into the steam space of the chamber above the bottom of the baffle.

3. An accumulator for steam generators, comprising a substantially cylindrical chamber, having a steam space and a water space; and a baffle, disposed in said chamber, above the normal water level, and comprising a flange attached to a wall of the chamber, and an inverted frusto-conical shell open at the center, for the passage of steam.

4. In a steam generator, the combination of a steam generating chamber; an accumulator; a water header, and a steam header, within said chamber, said headers communicating with the accumulator; a plurality of steam generating tubes each communicating with the two headers; a water circulating pump; a passageway for withdrawing water from the accumulator and delivering it directly to the pump; a passageway for delivering water from the pump directly to the water header; and feed water supplying means comprising an injector and a branched conduit communicating with the injector, one of said branches leading to the passageway for withdrawing water from the accumulator, and the other of said branches leading to the passageway for delivering water from the pump to the water header.

5. An accumulator for steam generators, comprising a vertical cylindrical chamber having a steam space at its upper part and a water space below the steam space; a conduit for admitting steam into said steam space said conduit having its outlet end disposed so as to project steam downwardly of the chamber; and an inverted frusto-conical flange anchored to the side wall of the chamber and disposed within the steam space of the chamber, said flange being adapted to resist the tendency of the water to rise at the side walls of the chamber when steam is admitted through the steam inlet.

GEORGE B. ASHWORTH.