Jan. 2, 1951 J. F. LIVINGOOD 2,536,949

STEAM GENERATOR

Filed Sept. 11, 1947 2 Sheets-Sheet 1

Fig. 1

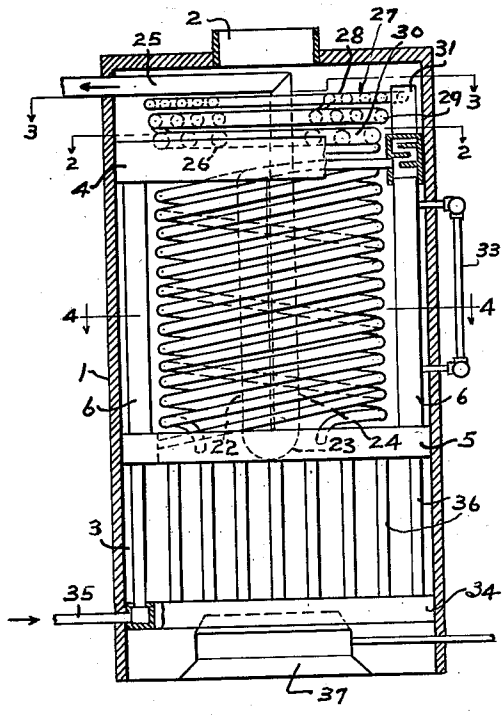


Fig. 2

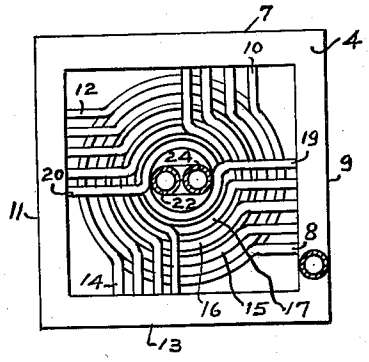


Fig. 3

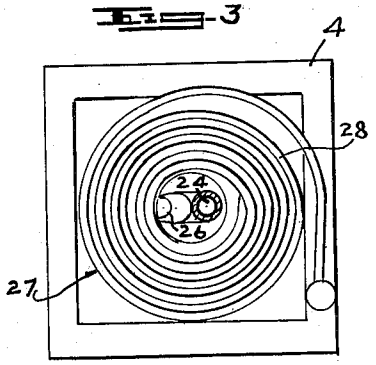


Fig. 4

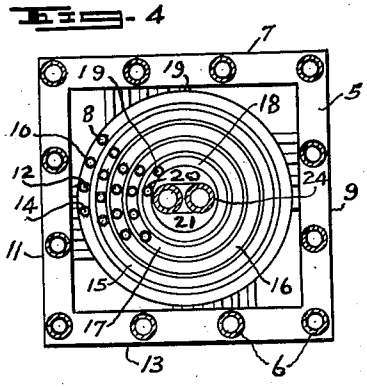
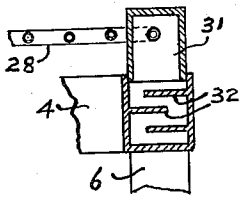


Fig. 5



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Fig. 6

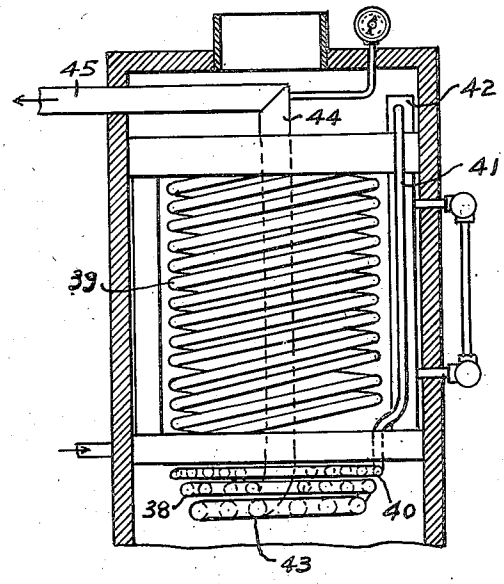
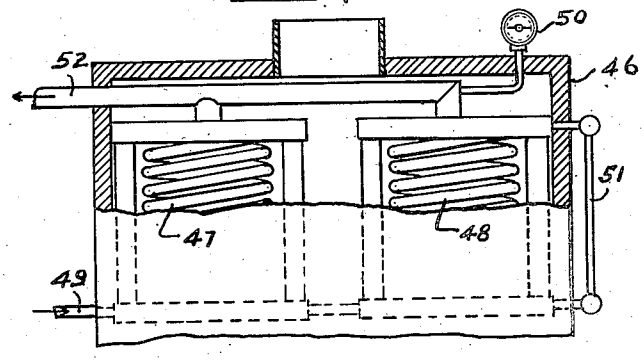


Fig. 7



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STEAM GENERATOR

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1 Claim. (Cl. 122—250)

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My invention relates to new and useful improvements in steam generators, and has for an object to produce a steam generator that may efficiently be used in the steam-heating of homes and buildings or may be adapted for use with steam engines or other machinery requiring the use of steam fluid pressure.

Another object of the invention is to provide a steam generator through which the water and steam may rapidly circulate, thus doing away with the necessity of scale traps or frequent cleaning of the circulating system.

A further object of the invention is to provide a novel steam generator wherein the rapid circulation of water through the system does not permit any impurities, such as lime, in the water to settle in the system and thus be injurious to the various pipes or tubes.

A further object of the invention is to provide a steam generator that is especially adapted to be used in the steam-heating of small dwellings and homes, and due to the rapid circulation through the system, there is no necessity for mechanical pumps or other mechanisms to force the water through the heating system.

Still another object of the invention is to provide a steam generator so that the water and steam, travelling through the coils in an upward direction, will be in contact with the heat five times before the heat reaches the stack, thereby greatly increasing the efficiency of the said generator.

Still another object of the invention is to produce a generator wherein super-heated steam will be supplied when the same is used for high pressure work.

Still another object of the invention is to provide a steam generator in which there is a maximum amount of tubing employed, so that the water in the generator will be subjected to as much heat as possible when in the generator.

Still another object of the invention is to provide a steam generator with five series of spiral coils, which series fit within each other, the series, in turn, comprising four tubes in four instances and two tubes or center coils in the fifth instance, the coils thus substantially filling the entire generator.

Still another object of the invention is to construct the generators so that they may be easily coupled to thus provide double the amount of steam from the one system.

With these and other objects in view, the invention consists in certain new and novel arrangements and combination of parts, as will be

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hereafter more fully described and pointed out in the claims.

In the drawings showing a preferred form and two slight modifications:

Figure 1 is a vertical sectional view partly in elevation of my improved generator and showing only one spiral series for clearness of illustration.

Figure 2 is a sectional view taken on the line 2—2, of Figure 1 and inwardly of the casing.

Figure 3 is a sectional view taken on line 3—3 of Figure 1 inwardly of the casing.

Figure 4 is a sectional view taken on line 4—4 of Figure 1 inwardly of the casing.

Figure 5 is a fragmentary detail of a portion of the header and the steam dome.

Figure 6 is a vertical sectional view partly in elevation showing a slight modification of the invention.

Figure 7 is a still further modification showing two of the generators within one casing.

Referring now to the drawings, and more particularly for the moment to Figure 1, there is illustrated the preferred type of my invention, in which there may be seen a casing 1, which may be, of course, lined with asbestos. The top of the casing is provided with a central stack 2 and the combustion chamber 3 is located in the lower part of the casing.

Also fitted within the casing 1 is the rectangular hollow boiler frame consisting of a top or header 4 and a like lower section 5 spaced beneath the same. These two sections 4 and 5 are fluidly connected by a plurality of relatively large pipes 6, which may be seen in Figures 1 and 4. Thus, the water may flow to and from the sections 4 and 5 by way of the various connecting pipes 6. In this way, there is provided a rectangular hollow bird-cage like boiler for the water.

Fitting within and substantially filling this frame is a plurality of coiled copper tubes, and although I have shown only one coil in Figure 1, it will be understood that there is a plurality, as shown in Figures 2 and 3, but to try to illustrate these various coils in Figure 1 would confuse the figure.

Glancing at Figure 4 for the moment and to the side 7, it will be noticed that a tube 8 (in cross section) is shown, which makes three and three-quarters turns before it reaches the adjacent side of the top section 4 of the frame to which it is fluidly connected. From the other adjacent side 9 of the header will extend another tube that is shown as 10 (cross section), and this tube also forms the outermost coil series. In like manner, from the side 11 of the header extends another

tube which is represented by the tube 12, and finally from the side 13 of the header extends the tube 14, which makes four tubes or coils in this outer vertical series of spiral coils.

In the same way, the next three series of coils 15, 16, and 17 are formed, that is, one tube from each of the four sides of the header is arranged to form each respective series of nested coils, and to repeat, each series of coils, in turn, consists of four separate tubes extending from the respective four sides of the header.

However, forming the center coil 18 are two tubes 19 and 20, which originate from the sides 7 and 11 of the bottom section 4, as from these two sides emanate five tubes rather than four as on the sides 9 and 13.

Thus, in reality, the four series of nested coils are, in turn, made up of four tubes from the various sides of the frame, while a fifth center coil is made up of two tubes from opposite sides of the frame that have five tubes leading therefrom.

By each of the tubes making three and three-quarters turns throughout its length, it permits of space for the four coils making up this outer series to be placed spirally one beneath each other. Thus, in each of the series of coils 8, 15, 16, and 17, we have the water flowing into these coils from the four sides of the boiler frame, thus providing maximum circulation of the water from the different parts of the frame and pipes and through the said coils.

It will be noticed that there is a circular space 21 within the center of the coils, in which is fitted a pipe 22 that extends downwardly to make a U-bend 23 at its lower end and then again upwardly at 24, where it extends to the left, as at 25, this pipe being the steam outlet. The upper end of the pipe 22 is connected to an end 26 of a horizontally located coil 27, which is arranged in three layers 28, 29, and 30.

There will also be noticed in the header the steam dome 31, from which emanates or leads the beginning of the coil 28. Thus, the steam, after passing into the dome 31, will enter the horizontal coils where it is, of course, subjected to the heat from the heating source and will pass into the heretofore-mentioned pipe 22 and will flow downwardly and then again upwardly through the steam outlet, thus further subjecting the steam to a drying action and producing the super-heated steam.

Referring to Figure 5, the header 4, which is rectangular in top plan and also rectangular in cross section, is preferably made of two like angle sections that may be welded together, and in each of these sections will be provided baffle plates 32, which will prevent the water from rushing into the steam dome 31. It will be understood that other forms of baffle plates than those shown may be used just so the steam will have a tortuous entrance into the steam dome and prevent the water from being forced therein.

A water gauge 33 may be seen in Figure 1 that will extend within the outer casing 1 and be connected to one of the upright tubes 6, so that the amount of water in the boiler may always be determined.

As far as the specification has proceeded, it will be seen that within the bird-cage like boiler or frame, there will be located five series of spiral coils of tubing, two tubes forming the inner series of coils and four tubes making up the other series of coils, so that the entire frame is substantially filled with tubing, thus presenting a maximum amount of heating surface. Also, it will be noticed that there are no sharp bends in the tubing and the water may flow freely through the hollow frame and may also flow freely through the plurality of series of spiral coils, while the steam may then flow rapidly through the horizontal coils, then downwardly and upwardly centrally of the coils and frame and thus obtain a super-heated steam.

Mounted in the lower end of the combustion chamber 3 is a hollow frame 34, which extends along the inner face of the casing 1 and is connected with the water supply pipe 35. The frame 34 is fluidly connected with the bottom section 5 by a plurality of vertically disposed pipes 36. Any suitable type of burner 37, using either gas or oil for fuel, is mounted at the lower end of the combustion chamber centrally of the frame 34. By this arrangement the water will be preheated prior to its entrance into the bottom section 5 and thereby further augmenting the efficiency of the boiler.

I have found that with a medium size generator designed and built as shown, I can obtain fifty pounds of steam from cold water in two minutes after the heat is applied. I have also found that the temperature of the steam is about three hundred degrees with a heat input of 110,000 B. t. u. I have further found that with the steam pressure at one hundred and eighty-five pounds and permitting the steam to escape through a one-eighth inch pipe, the generator will produce as much steam as is exhausted and the pressure will not drop in hours of continuous use. I have still further found that the heat contacting with the steam or water five times before the heat passes out of the stack 2 greatly increases the efficiency of the generator.

In Figure 6 there is shown a slight modification of my steam generator, and in this instance, rather than having the horizontal coils at the top of the boiler, as shown in the preferred form, I position these horizontal coils 38 beneath the series of spiral coils 39, as may be readily seen. From the top layer 40 of the coil 38 I extend the small tube 41 up into the steam dome 42. Thus the steam that has been generated in the series of coils 39 and has passed into the steam dome 42 will be forced through the pipe 41, through the three layers of coils 38, where it will then pass from an end 43 of the coils 38 into the central, pipe 44, up through the center of the coils 39 and connect with the steam outlet 45.

It will, of course, be understood that the series of spiral coils 39 and the pipes connecting the upper and lower sections of the modified form of boiler will be identical to those of the preferred form and the principle of operation will be identical.

In Figure 7 I have shown how two of these steam generators may be coupled, there being but the one casing 46 and two interconnected coils 47 and 48, there being a common inlet 49 for the water, a steam gauge 50, a water gauge 51, and a steam outlet 52 that, of course, is common to both the generators. In like manner, there will be separate flames for each of the boilers 47 and 48. It will be understood that in all instances, the tubing, forming both the spiral coils and the horizontal coils, will be well riveted or otherwise secured to the frame to thus form tight connections with the frame to withstand the high pressure of steam to which they are subjected.

From the foregoing, it will be seen that I have

provided a steam generator, which consists essentially of a rectangular boiler made up of upper and lower sections, which are interconnected by relatively large pipes, there being baffle plates in the upper section or header. Also, there is the steam dome and preferably four series of spiral coils, all nested within the other, together with a series of horizontal coils, so that a maximum amount of conducting surface is presented to the heat to thus give speed and efficiency to the generator.

I have also found that by forming the boiler as above described, the circulation is so fast through the boiler and tubes that there is no necessity for scale traps, nor do any impurities or foreign substances in the water have time to form a scale within the various parts.

I have further found that the water will remain at a constant level within the steam generator and that due to the extremely rapid circulation there is no necessity for pumps to be installed within the system.

Finally, it will be understood that although I have illustrated one manner in which the various tubes, which form the series of coils, may lead or extend from the several sides of the boiler frame, and although I have stated that the tubes make three and three-quarters turns, it may be desirable to have them make three and one-half turns or three and one-quarter turns. Likewise, it might be possible to have three separate tubes form the inner coil, and I do not wish to be limited to the exact number of tubes or the number of bends illustrated in the drawings.

What I claim is:

In a steam generator of the class described,

comprising the combination of a rectangularly-shaped hollow upper frame section provided with baffle plates, a similar shaped lower frame section, a plurality of vertically disposed pipes communicably joining said sections together and in conjunction with the latter providing a substantially cage-like frame structure, a plurality of series of nested spiral heating coils mounted in said structure, the upper ends of each of said series of heating coils being communicably joined with a different side of said upper frame section, the lower ends of each of said series of heating coils being communicably joined with the next transverse adjacent side of said lower frame section.

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