July 4, 1939. G. W. WATSON 2,164,482

ELECTRIC STEAM GENERATOR

Filed Jan. 16, 1939

Fig. 1.

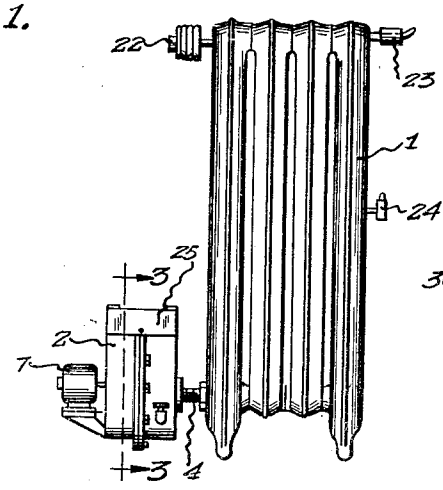


Fig. 6.

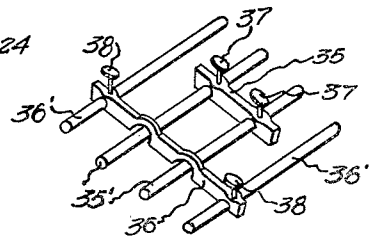


Fig. 2.

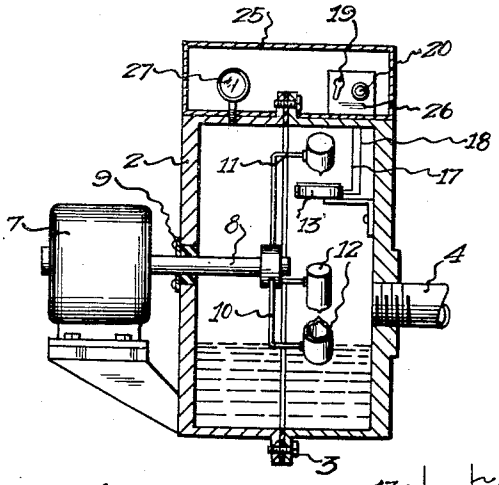


Fig. 3.

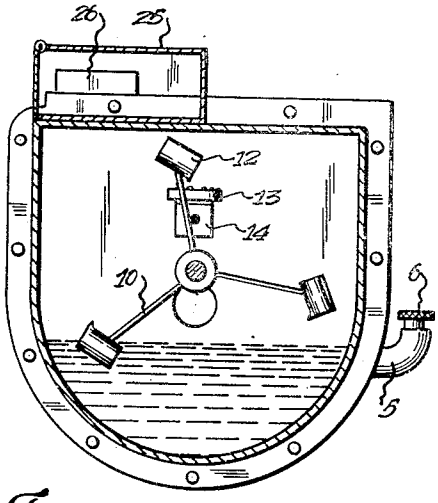


Fig. 4.

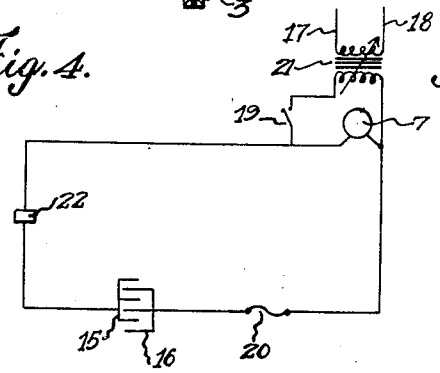
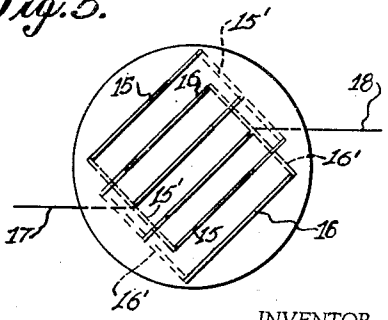


Fig. 5.



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ELECTRIC STEAM GENERATOR

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2 Claims. (Cl. 219—40)

The present invention pertains to a novel apparatus for and method of generating steam. While the invention involves the use of an electric current in generating steam, it does not depend on the electrical heating of the conductors.

One of the important results of the invention is that steam is generated almost instantaneously. Another important result is that no large body of water is heated, and the usual losses by radiation from such a body of water are avoided.

The heating element according to the invention consists essentially of spaced conductors suitably mounted in an insulating block. Alternate conductors are connected to one side of the current line, and the remaining or intervening conductors to the other side of the line, with no permanent current path between adjacent conductors. Such a path is, however, established when water is deposited on the element, the current then flowing through the water. No conducting agent in the water is necessary when the variables of the system have been properly determined. However, it will be understood that the ordinary water supply contains a sufficient amount of a purifying addition, such as chlorine, to make it conductive to some extent, or if desired a proper amount of a conducting agent may be added to the water in the apparatus.

Due to the fact that there is no flow of current when the element is dry, the apparatus cannot be damaged by failure to replenish the water supply. Also, the device is extremely economical in operation, since it consumes current only when producing steam.

In order to generate steam instantly, a proper relation must be maintained, with respect to the requirements of the apparatus, between the length of the conductors, the spacing therebetween, the rate of water supply to the heating element, and the current employed. The rate of water supply is such as to avoid immersing the conductors. The usual 110 volt current can ordinarily be used without a transformer. The remaining factors can readily be determined by trial and adjustment, one specific example being given herein.

One of the important uses of the invention is in connection with steam radiators. The steam outlet is merely connected to the radiator, and provision is made for the return of the condensed steam back to the generating apparatus at a level below the electrical element. A suitable elevating device is employed to lift water and drop it upon the element at the proper rate. In this application of the invention, as well as in others which will readily be suggested, a comparatively small supply of water is required and need not be frequently replenished, owing to the circulation described above. In connection with radiators it will be evident also that the invention provides a steam heating system that does away with boilers, pipes, and other expensive and inefficient appliances.

The invention is fully disclosed by way of example in the following description and the accompanying drawing, in which:

Figure 1 is an elevation of a radiator equipped according to the invention;

Figure 2 is a longitudinal section on the generating apparatus in a plane parallel to that of Figure 1;

Figure 3 is a section on the line 3—3 of Figure 1;

Figure 4 is a wiring diagram;

Figure 5 is a plan view of the heating element enlarged, and

Figure 6 is a section of the adjustable element on an enlarged scale.

Reference to these views will now be made by use of like characters that are employed to designate corresponding parts throughout.

In Figure 1, the numeral 1 designates a steam radiator of conventional design. Adjacent thereto is supported or secured a casing consisting preferably of two similar flanged sections 2 bolted together at 3. The casing is connected by a pipe 4 to the radiator. In the lower portion of the casing is a filling spout 5 positioned to determine the maximum level of water that can be poured into the casing. The spout is normally closed by a knurled screw 6 as shown in Figure 3.

At one end of the casing 2 is suitably supported a small electric motor 7 having a shaft extending into the casing and suitably packed in the casing wall at 9.

The end of the shaft within the casing carries a water wheel or elevator in the form of a plurality of spokes 10, each having its free end extended at 11 in a direction parallel to the shaft 8 and carrying a bucket 12. As shown in Figures 2 and 3, the buckets are arranged to pass below the water level determined by the spout 5 to be filled and to empty their contents when approximately at the top of their path.

In this area of discharge is a heating or vaporizing element including an insulating block 13 supported on a bracket 14 secured to an inner wall of the casing 2. The block is so positioned that the buckets 12 empty their contents of water thereon. This element further includes spaced

bars 15 of a suitable conducting material alternating with like bars 16 of another series. The bars 15 are interconnected at both ends by bus bars 15', and similarly the bars 16 by bus bars 16'. The bars 15 are connected to one side 17 of the electrical circuit, and the bars 16 to the other side 18, as shown in Figure 5 and diagrammatically in Figure 4. No current can flow through this device unless the bars 15 and 16 are bridged by a conducting medium, which, in this case, is water treated with a dissolved conducting agent at the purifying plant or elsewhere.

The electrical circuit also includes the motor 7, a main switch 19, and preferably a fuse 20, as shown in Figure 4. It is also desirable to provide a variable transformer 21 to change the line voltage if desired or necessary.

The radiator 1 is also preferably equipped with a pressurestat 22 of the bellows type with electrical contacts included in the circuit. This device is of well known construction and will open the circuit when the steam pressure in the radiator reaches a pre-determined maximum. The radiator is also equipped with a safety valve 23 which operates in the event that the pressurestat is not properly set or is out of order. The radiator also carries the usual air vent 24.

Upon the casing 2 is preferably mounted a housing 25 having in its front wall a panel 26 carrying the main switch 19 and the fuse 20. In the same wall may also be mounted a pressure gauge 27 connected to the interior of the casing.

The entire generating unit may be built within the radiator, if desired, with suitable means for delivering water to the electrical element.

In the operating of the device, when the switch 19 is closed, the motor 7 operates and causes the buckets 12 to lift water from the bottom of the casing and pour it upon the bars, 15, 16. The water will permit current to flow between the bars when the proper relation is established between the bar surface area, the spacing between bars, the voltage, and the rate of water supply. In a specific example, operating at 110 volts, eight bars having an average length of 1½ inches are spaced approximately ⅛ inch apart. The buckets 12 and their rate of discharge on the vaporizing element are determined so that the latter is at no time covered by more than a film of water. In other words, the rate of water supply to the element is approximately equal to the maximum rate of evaporation thereby, the speed of the motor being adjusted or geared down accordingly. However, if the liquid should overflow the element, the excess merely returns to the reservoir. As the steam condenses in the radiator, the condensate returns to the reservoir in the bottom of the casing 2. Consequently a large quantity of water is not necessary, and replenishing is required only at infrequent intervals. This is true for whatever use the generated steam is utilized, as in the operation of steam engines and other machinery.

If the conductors 15 and 16 are comparatively short, for example, ¾ of an inch or less in the system described above, only one bus bar 15' or 16' is required for each set of conductors. In other words, the conductors of each series are interconnected only at the end joined to the line and are free or unconnected at the other end.

The provision for varying the spacing between the conductors or rods is shown in Figure 6. One set of conductors 35 has its ends slidably mounted on the corresponding bus bars 35'. For this purpose, the ends of the conductors are drilled and fitted with set screws 37 to secure the adjustment. Similarly, the conductors 36 of the other series are slidably mounted on their bus bars 36' and provided with set screws 38.

The length of the conductors and the volume of current are ordinarily constant, although they must be properly related to the other factors of the system. The proper relationship can be established by adjustment of the spacing of the conductors by the means described and the adjustment of the water supply rate by regulating the speed of the water delivery device.

Although the invention is described herein as a device for generating steam from water, the device is also adapted for generating various liquids such as medicaments. As a steam generator, the device can be used for running engines, sterilizing instruments, and for various other purposes.

The generating unit may be cleaned from time to time to remove any solid matter accumulated thereon. A stiff hair brush or tooth brush is suitable for this purpose, and it is merely a matter of mechanical design to construct the outer casing 2 so that the element may be easily reached with the brush. Also, a generating unit or system may be built with any desired number of separate generating elements such as described and the elements may be of various sizes, although the relations described above must be maintained.

I have observed that water and other liquids unadulterated by any conducting agent are converted into steam by the invention when the spacing of the conductors is not more than slightly in excess of the arcing distance. The operating distance between conductors may, however, be increased beyond this point and the liquid converted if the latter is a fairly good conductor of current.

It has been stated above that the electrical element is at no time covered by more than a film of water. This film expands, while the portion of the element beneath it becomes almost dry. Since there is no current flowing on the dry part of the element, it follows that the heat for expanding the bubble with steam is produced only by the flow of current in the wall of the bubble. The bubble finally bursts and liberates steam. This is a unique method of generating steam from water. There is a myriad of such steam bubbles constantly forming, some with a diameter of half an inch.

What I claim is:

1. The method of generating steam consisting in delivering liquid to spaced and insulated conducting members divided into two series, each series being connected to a different side of an electric circuit, and regulating the length of said members, the spacing therebetween, the volume of current and the rate of liquid delivery, relatively to each other, so that the liquid establishes a current path between adjacent members of the two series and generates steam before there is any substantial accumulation of liquid.

2. The method of generating steam consisting in delivering liquid to spaced and insulated conducting members divided into two series, each series being connected to a different side of an electric circuit, and regulating the length of said members, the spacing therebetween, the volume of current and the rate of liquid delivery, relatively to each other, so that the liquid joins adjacent members of the two series and generates steam before there is any substantial accumulation of liquid.

GLENN W. WATSON.