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GENERATING MIXED FLUID HEATING MEDIUM

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2 Sheets-Sheet 1

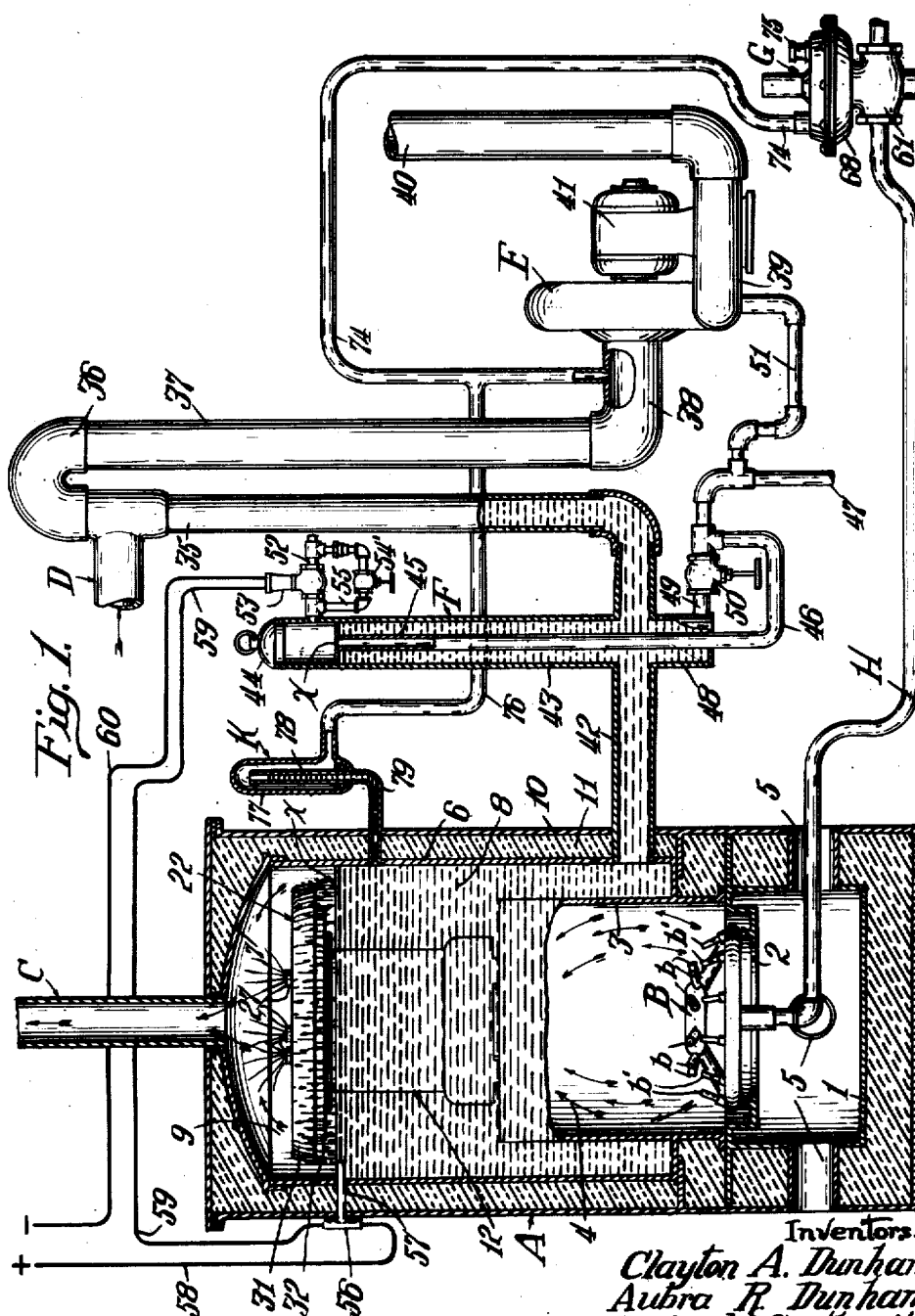


Fig. 1.

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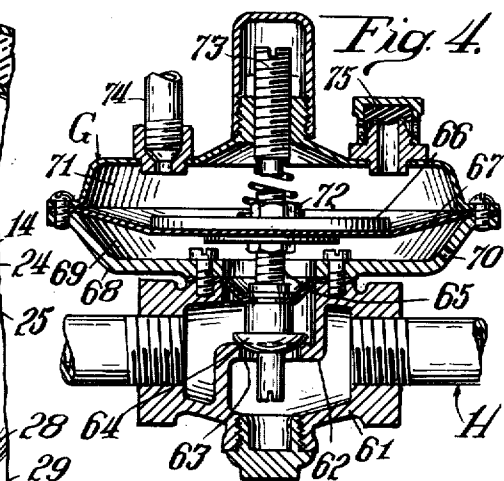
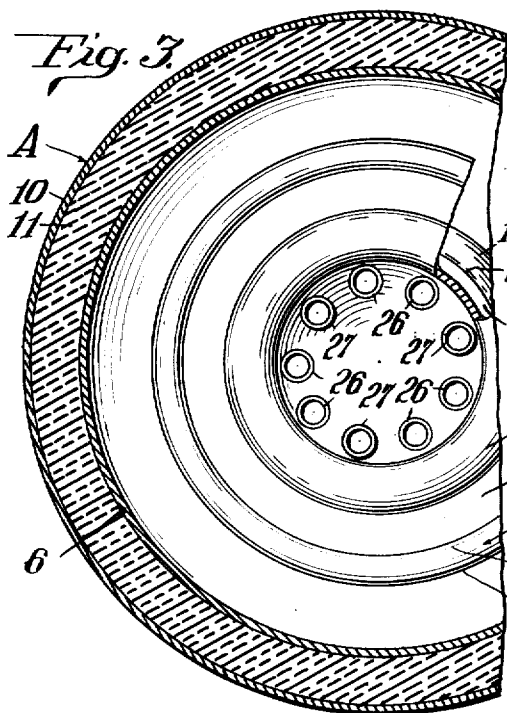
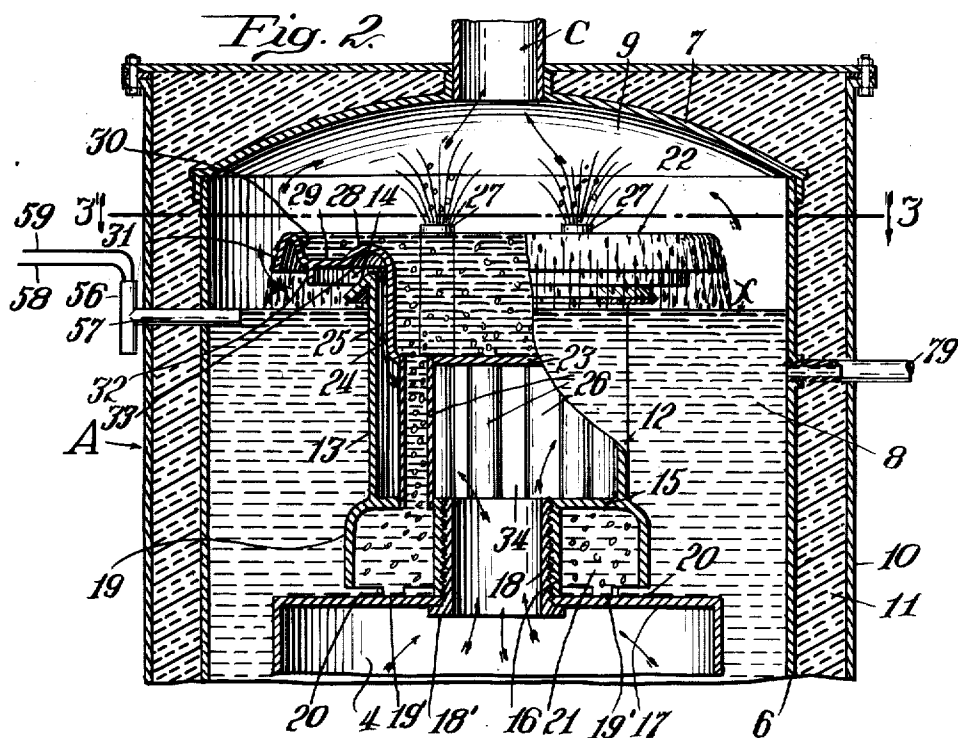
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UNITED STATES PATENT OFFICE

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GENERATING MIXED FLUID HEATING
MEDIUM

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14 Claims. (Cl. 60—45)

This invention relates to certain new and use-
ful improvements in generating mixed fluid heat-
ing medium, and more particularly to an im-
proved process and apparatus for producing a
heating medium consisting of a highly saturated
mixture of steam and hot products of combustion
for use in a heating system.

In the type of heating system to which this
invention relates, fuel is burned in proximity to
an enclosed body or bodies of water and the
products of combustion are passed in intimate
contact with the water so as to form steam, and
the heating medium consisting of the products
of combustion highly saturated with steam is
delivered into radiators wherein the steam is
condensed and a large portion of the heat from
the products of combustion is used for heating
purposes. The cooled non-condensable gases are
exhausted from the radiators thus producing a
partial vacuum and causing the continuous circula-
tion of heating medium, and the condensate
from the steam is returned to the generator to
be reconverted into steam.

There have been certain limitations and dis-
advantages in former means for generating this
mixed fluid heating medium, among which has
been the considerable time interval which has
elapsed after combustion has been started before
a mixture of the desired low temperature and
saturation is available at the outlet of the gen-
erator. A prevailing difficulty has been that a
highly super-heated mixture was first available,
some time prior to the production of a mixture
approaching saturation, these initial high tem-
peratures contributing to an oxidizing or corro-
sive condition that, especially when copper is
used, reduces the life of the equipment. Conse-
quently it is desirable to obtain a mixture which
is saturated almost immediately so that the pro-
duction of initially excessive high temperatures
is eliminated. It is desirable to arrange the
equipment so that a body of water of relatively
small volume is immediately available for va-
porization without requiring the exchange of con-
siderable quantities of heat. It is also desirable
to provide the maximum surface contact be-
tween the liquid and gases so as to facilitate and
expedite the vaporization of the liquid.

The present invention relates particularly to
an improved generator and process of generat-
ing the saturated heating medium suitable for
use in a heating system of the type hereinabove
briefly described. This generating apparatus
comprises a closed housing in which is confined a
combustion chamber wherein the fuel is burned

or into which the products of combustion are
directly introduced. This combustion chamber
is surrounded at the sides and top by a body of
water so that practically all of the heat not re-
tained by the products of combustion is absorbed
by the water. The exposed upper surface of this
body of water forms a portion of the lower wall
of a mixing chamber into which the products of
combustion are introduced from the combustion
chamber so as to directly contact with the sur-
face of the water. An auxiliary receptacle is so
positioned in this mixing chamber that its lower
surface is below the normal water level of the
main body of water, the auxiliary body being con-
nected through suitable tubes or conduits with
the main body of water so that a shallow pool
of liquid will always remain in the auxiliary re-
ceptacle at the same level as the main liquid body
when standing idle. When the body of water is
highly heated a portion of the main body will
be forced, as hereinafter described, into the aux-
iliary receptacle which will become filled and will
overflow into the main body of water. The heat-
ed gases from the combustion chamber are di-
rected beneath and around the auxiliary recep-
tacle so as to highly heat the water therein and
to pass through the water overflowing from the
auxiliary receptacle. Additional fountains of wa-
ter are sprayed up into the mixing chamber so
that a maximum surface contact with the com-
bustion gases is obtained and a highly saturated
mixture will be almost immediately produced
and delivered through the upper outlet conduit.

The principal object of the invention is to pro-
vide an improved process and apparatus for pro-
ducing a highly saturated mixed fluid heating
medium, as briefly described hereinabove and dis-
closed more in detail in the specifications which
follow.

Another object is to provide an improved gen-
erator that furnishes an almost instantaneous
heat exchange between the gases and liquid and
precludes, even during initial starting, any ap-
preciable degree of super-heat which would pro-
duce a corrosive atmosphere in the generator.

Another object is to provide an improved gen-
erator adapted to conserve a maximum propor-
tion of heat in the gases and liquid without the
production of excessive temperatures in the heat-
ing medium.

Another object is to provide a generator so con-
structed as to prevent liming or the deposition
of solids or scale deposits in those portions of
the apparatus where small passages would be
obstructed.

Other objects and advantages of this invention will be more apparent from the following detailed description of one approved form of apparatus constructed and operating according to the principles of this invention.

In the accompanying drawings:

Fig. 1 is an assembly view partly in elevation and partly in vertical section showing the improved generator, the means for returning water thereto and maintaining the water level, the means for exhausting the cooled gases, and the improved safety means for controlling the burner in response to an abnormal lowering of the water level in the generator.

Fig. 2 is a central vertical section, on a larger scale, through the upper portion of the generator.

Fig. 3 is a partial horizontal section taken substantially on the line 3—3 of Fig. 2.

Fig. 4 is a central vertical section through the automatic control valve in the fuel-feed pipe.

The assembly includes in general the improved generator A including the burner B, the outlet or supply conduit C through which the heating medium is carried to the radiating system, the return pipe D through which the cooled gases and condensate return from the radiating system, the exhauster E for drawing out the cooled non-condensable gases, the mechanism F for returning the condensate to the generator and maintaining the proper water level therein, the automatic cut off valve G in the fuel supply pipe H, and the mechanism indicated generally at K for controlling the valve G in response to abnormal variations in the water level within the generator.

The generator A is built up for the most part of metallic shells suitably insulated to minimize heat losses. The lower inner shell 1 communicates through central opening 2 with the upper inner shell 3 which encloses the combustion chamber indicated generally at 4. Shell 3 is completely closed at its sides and top except for the outlet pipe opening in the top hereinafter described. The burner B is supported in the lower portion of combustion chamber 4 directly above the central opening 2 leading from the lower air-feed chamber enclosed by casing 1, the combustion air flowing in through a suitable number of side openings 5. An intermediate metallic casing 6 encloses the greater portion of inner shell 3, and is provided with an upper domed cover 7 from which leads the outlet or supply conduit C. The intermediate shell 6 houses the main body of water 8 which encloses the sides and top of the combustion chamber, and has its normal water level at x . The surface of the water at x forms the lower wall of the mixing chamber 9 in the upper portion of the intermediate housing 6. This entire assembly is enclosed in an outer metallic shell or casing 10, and the space between this outer shell and the inner shell is filled with insulation 11 so as to minimize the heat losses.

The burner B may be of any desired form and is preferably located within the combustion chamber 4 as already described, although it might be positioned outside this chamber so as to project the flames or products of combustion thereinto. A fluid fuel is used, preferably gas, which is supplied through the pipe line indicated at H. As here shown, the burner comprises an annular series of substantially radially projecting nozzles b and a second annular series of upwardly projecting nozzles b' , the flames from these several nozzles impinging to form an annular sheet or

flame which is projected upwardly and outwardly toward and close to the inner walls of casing 3. The flames and hot products of combustion serve not only to heat the surrounding body of water but to scour the inner walls of the shell and keep them substantially free from soot or other deposits. The hot gases pass from combustion chamber 4 into the mixing chamber 9 through the mixing header now to be described.

This mixing header comprises a lower header member indicated generally at 12 and including an upper cylindrical shell portion 13 which projects somewhat above the normal liquid level x and has an open upper end surrounded by a downwardly and outwardly extending flange 14. The cylindrical outer wall 13 joins at its lower end with an intermediate annular horizontal web 15 which connects with a central cylindrical conduit portion 16 which rests on the top wall 17 of inner casing 3. The cylindrical portion 16 is internally threaded and receives the threaded fitting 18 having an outwardly extending bottom flange 18' which serves to clamp the lower header member 12 to the top wall 17 of the inner casing 3 so as to provide a water-tight joint. A skirt portion 19 extends outwardly and downwardly from the outer edge of web 15 and has a plurality of feet 19' resting on top wall 17 of casing 3, but for the most part a narrow passage 20 remains between the lower edge of skirt 19 and top wall 17 so that water can flow in from the main body of water 8 to supply the partially confined annular body of water 21 between skirt 19 and the central cylindrical tube 16.

The mixing-header comprises also an upper pan member indicated generally at 22 and comprising a central receptacle having a bottom wall 23 positioned somewhat below the normal water level x , and a cylindrical upwardly extending wall 24 spaced inwardly from the wall 13 of the lower header member so as to provide an annular gas passage 25 leading up into the mixing chamber. The upper header member 22 is supported from the lower header member by an annular series of upwardly extending pipes or conduits 26 and 27, the lower ends of which are fixed in openings in web 15. The upper open end portions of pipes 26 are also secured in the bottom wall 23 of the upper receptacle. The other pipe members 27 are intermediately secured in bottom wall 23 but extend completely upward through pan member 22 so that their upper ends terminate above this pan and serve as fountains to project highly heated water upwardly into the mixing chamber, as hereinafter described. These tubes may be bent to direct this spray as desired at the top of each. The pipes 26 serve to feed water from the confined portion 21 of the main body of water into the central receptacle of the pan member 22, and since bottom wall 23 is positioned below the normal water level x there will always remain a small quantity of water in this upper receptacle even when the burner is not in operation. It will be noted that in the example here shown there are six of the feed pipes 26 and three of the fountain pipes 27, although these numbers could be varied as desired.

The upper edge of cylindrical wall 24 of the central receptacle rounds outwardly at 28 to connect with a horizontal outwardly extending wall 29 provided with an outer upwardly extending rim 30 so as to maintain a shallow outer water receptacle. A downwardly and outwardly extending overflow lip 31 extends from the upper edge of rim 30. When the upper pan member is full

of water this water will overflow in a thin sheet over lip 31 as indicated in Figs. 1 and 2.

An annular rib 32 projects downwardly from horizontal wall 29 near the bottom of rim 30.

The water used generally has some solid material in solution, and in addition the gases carry some solids. Some of the solids in solution become less soluble on heating and will of course be precipitated out to some extent when the water is evaporated. To prevent the growth of these crystals at points where they might interfere with the operation of the generator, the depending ring 32 is provided so that any residual liquid which might tend to creep around the lip 31 will not be able to travel inwardly past the rib or ring 32. As a result no crystals or scale are formed close to the outlet 33 for the gases. Also these issuing gases exert a scrubbing action against the rib 32.

In operation, when burner B is started, the hot products of combustion will flow upwardly and outwardly in combustion chamber 4, as already described, preheating the surrounding body of water 8. These gases will flow up through central conduit 18 into the chamber 34 between and around the several pipes 26 and 27 and thence out through annular passage 25 and outlet 33, beneath the upwardly extending portion of pan 22 and into the mixing chamber 9. It will be noted that these hot gases flow around three sides of the confined body of water 21 so that this body of water will be quickly heated to a boiling temperature. The same is true of the small bodies of water in pipes 26 and in the central pan 24. It will be apparent that as the confined body of water 21 is raised substantially to a boiling temperature its density will be decreased and it will be displaced upwardly through pipes 26 so as to eventually completely fill the upper pan 22 which will overflow over the outer lip 31 and thence back into the main body of water 8. Water will also be displaced upwardly through the upper pipes 27 so as to form fountains or sprays of mixed water and steam that are dispersed into the mixing chamber 9 in intimate contact with the heated gases therein. It will be noted that the hot gases flowing out beneath the pan must pass through the downwardly flowing sheet of water dropping from lip 31 where additional intimate contact is obtained between the gases and small bodies of water. The gases also contact directly with the surface of the main body of water 8. This "percolating" action, or the upward displacement of water through pipes 26 and 27 will continue as long as the burner is in operation, water flowing in from the main body of water 8 through passage 20 to replenish the confined body of water in space 21.

Due to the positioning of relatively small bodies of water in intimate contact with the hot gases, the vaporization of the water and the saturation of the gases will begin almost immediately. This acts to lower the temperature of the gases (by heat transferred therefrom to the water and absorbed in the vaporization process) and also quickly saturates the gases thus minimizing corrosion and injury of the metallic parts due to contact therewith of superheated gases. It is also desirable that the mixed heating medium conducted from the generator through outlet C shall be saturated at all times so that an abundance of watery vapor is available to dilute any acids that might be deposited out and which might corrode the piping.

It will be understood that the mixed heating medium produced in the manner just described will flow or be drawn out through conduit C into a radiating system not here shown, but comprising a suitable number of radiators usually arranged in parallel. In this radiating system the steam will be condensed giving off its latent heat, and the non-condensable gases will also give off the greater portion of their heat. As a consequence the mixture that returns from the radiating system through return pipe D (see Fig. 1) will consist of water or condensate and cooled non-condensable gases.

The condensate will flow from return pipe D downwardly by gravity through stand pipe 35 and thence, as hereinafter described, into the generator A. The non-condensable gases are drawn from return pipe D upwardly through the looped fitting 36 and thence downwardly through pipes 37 and 38 into the exhaustor E from which the gases are expelled through pipe 39 and flue 40. It will be understood that the exhaustor E (which is driven by motor 41) will create a partial vacuum in the return pipe and the radiating system, this vacuum extending to a slight degree back through supply pipe C into the generator and thus maintaining the proper flow of heating medium through the system. The maintenance of this sub-atmospheric pressure throughout the system will also prevent any outward leakage of combustion gases into the space being heated.

The lower end of stand-pipe 35 is in communication through horizontal pipe 42 with the lower portion of casing 6 which houses the main body of water 8. Consequently, the condensate which drains back by gravity into stand-pipe 35 will flow into the generator. In order that the generator may operate at its highest efficiency it is preferable that the body of water therein be maintained at a substantially constant level, and in order to accomplish this automatically the apparatus indicated generally at F is provided. This comprises an upright tubular container 43, connected near its lower end into the horizontal pipe 42, and preferably provided at its upper end with a removable cover 44. Within container 43 is an overflow pipe 45 having its open upper end positioned at the desired water level x within the generator. The lower end of pipe 45 communicates through a water sealed drain pipe 46 with pipe 47 leading to the sewer or other point of discharge. The lower end of container 43 projects below the bottom of the water chamber in the generator so as to form a sediment collecting pocket 48 from which a pipe connection 49 provided with a normally closed valve 50 leads to drain pipe 47. By opening the valve 50 the sediment pocket can be flushed out, or if desired the entire water system can be drained. It will also be noted that a water sealed drain connection 51 leads from the lower portion of exhaustor E to the sewer connection 47 so that any water that may collect in the exhaustor from the gases drawn therethrough may be discharged. The discharge connection 51 will also serve to dispose of any water that may flow into the exhaustor from the safety connection K hereinafter described.

After the heating system is once started there will normally be a surplus of water in the system since the supply is augmented by the watery vapors formed in the process of combustion. This will normally offset the losses through leakage and the vapors which pass out through flue 40. Any such excess liquid returned along with the

condensate will be discharged through overflow pipe 45 while still relatively cool, thus avoiding the waste of heat through the drain.

However, it is desirable to add some additional fresh water to the system from time to time to insure a desired dilution of any acids that may accumulate in the system.

To accomplish this, a pipe 52 is provided, leading from the city water supply into the upper portion of container 43 and provided with a normally closed, electrically-operated valve 53. By opening this valve, or the hand-valve 54' in bypass 55, the apparatus may be filled with water, and additional water may be added whenever needed to re-establish the desired water-level in the generator. In the example here shown, valve 53 is controlled electrically by means of the thermostatically operated switch 56 comprising a thermostat 57 projecting into the body of water 8 directly below the normal water-level x . This thermostat will not be subjected to a temperature of over 212° Fahrenheit as long as the water is maintained at the desired level. When the water level falls, thermostat 57 will be exposed to the more highly heated gases in mixing chamber 9, thereupon functioning in well-known manner to operate switch 56 and close the circuit indicated by wires 58, 59 and 60 so as to open valve 53 and admit more water to the system. As soon as the desired water-level has been restored the temperature to which thermostat 57 is subjected will be lowered again to about 212° F. whereupon the circuit will be broken and valve 53 closed.

Now each time the generating process is restarted a quantity of water (mostly in the vapor state) will be retained in the piping and radiating system before the water commences to come back through the return main D. As a consequence the water-level in the generator will be lowered somewhat and fresh water will be added automatically by the opening of valve 53. This will provide a desired dilution of the water in the system, which of course will be augmented by the water formed in the combustion process, as already described.

The automatic control valve G positioned in the fuel supply pipe H comprises (see Fig. 4) a main valve casing 61 connected between adjacent sections of the fuel pipe H. Valve casing 61 is provided with an internal web 62 having a vertical port 63 with a seat at its top that may be closed by movable valve member 64. Movable valve member 64 is connected through stem 65 with a weight 66 carried by the central portion of a diaphragm 67 which divides valve casing 68 into a lower chamber 69 maintained at atmospheric pressure through vent 70, and an upper suction or low pressure chamber 71. The weight 66 (together with spring 72 compressed between this weight and an adjusting screw 73 if this spring is used) serves to normally force valve member 64 to its seat and thus close the valve and cut off the flow of fuel to burner B. When the pressure is reduced sufficiently in the upper chamber 71, atmospheric pressure acting on the lower face of diaphragm 67 will open the valve in opposition to the forces exerted by weight 66 and spring 72.

A pipe 74 leads from suction chamber 71 into exhaust pipe 33 at the low pressure side of exhaustor E, and when the exhaustor is in operation the suction through pipe 74 will sufficiently reduce the pressure in chamber 71 to hold the valve in open position and permit the free flow of fuel to burner B. An adjustable air leak 75

communicating with suction chamber 71 permits a sufficient leakage of air into this chamber and out through pipe 74 to keep the diaphragm chamber and piping dry.

This safety mechanism K also comprises a branch pipe 76 leading from pipe 74 into the lower portion of a vertical receptacle 77 into which extends the upright arm 78 of a pipe 79 leading from the water chamber 6 a predetermined short distance below the normal water level x . Since the pressure in the exhaust connections and the low pressure side of the system is considerably lower than that existing in the mixing chamber 9 of the generator, the water will normally extend up a considerable distance in vertical pipe 78, but will not normally overflow the upper end of this pipe. In case the pressure difference should become sufficient to cause this pipe to overflow, the water will flow down through pipe 76 into the exhaustor E and will thence be discharged through drain connection 51. The water standing in pipes 78 and 79 normally serves as a water seal at the upper end of branch pipe 76 so that the desired low pressure can be maintained in diaphragm chamber 71. However, in the event that the body of water 8 in the generator should fall materially below its normal level x , the water will drain out of pipes 78 and 79 thus breaking the water seal and placing pipe 76 in connection with the higher pressure mixing chamber 9. As a consequence the vacuum in diaphragm chamber 71 will be broken and the valve 64 will automatically close under the pressure exerted by weight 66 and spring 72. Consequently the burner B will not be permitted to operate when the water level has fallen sufficiently so that injury to the metallic parts might be caused by the superheating thereof. As soon as the proper water level has been reestablished in the generator, the water seal in pipe 78 will be reestablished and the exhaustor E will again function to cause valve G to open. It will also be apparent that the flow of fuel to the burner B will be cut off whenever the exhaustor E ceases to operate, since the vacuum in the upper diaphragm chamber will soon be broken.

It will be understood that a heating system of this type will usually be provided with automatically operating thermostatic burner controls so that the generator will be turned on and off at intervals to maintain a desired temperature in the space being heated. It will be understood that a pilot burner or ignition means for the main burner will be provided, as usual, to reignite the burner B as soon as the fuel supply is turned on. It will be noted that after each period of non-use a reserve supply of water will remain in the lower portion of the inner pan 24 and the pipes 26, so that these small supplies of water together with that confined in annular space 21 will be very quickly heated and the saturation process will begin almost immediately after the combustion gases commence to flow through into the upper mixing space 9 and before the construction can be overheated. Convection currents will be set up tending to quickly raise the temperature of all of the water in the receptacle, and substantially all of the water that is brought into intimate and dispersed contact with the gases will be turbulent and at a boiling temperature so that rapid vaporization will take place, and the gases will be completely saturated. The supply of water in the generator is normally maintained at a substantially constant and most efficient level by the return of condensate from

the system, and whenever this water level is lowered materially below its proper level extra water will be fed in to restore the water level and dilute the solution, or the burner will be automatically cut off thus preventing injury to the apparatus and the formation of an improperly saturated heating medium. This apparatus will require little attention over a long period of time. Those portions of the apparatus where "liming" or the deposition of solids may occur are isolated from the gas and liquid passages so that the free flow of fluid will not be disturbed and cleaning will be required only after long periods of use.

While the component parts of the generator have for the most part been described as cylindrical or of horizontally circular cross section (and are preferably so formed) it will be apparent that these elements could be given other cross-sectional configurations without departing from the general principles of this invention.

We claim:

1. A generator for a mixed fluid heating medium consisting of hot products of combustion and steam, comprising a housing enclosing a body of water and a mixing chamber thereabove, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, a passage for conducting hot combustion gases in heat exchange relation to the body of water and into the mixing chamber, means for partially confining a portion of the body of water closely adjacent the hot gases so that this water will be partially boiled, said confined portion being in communication with the main body of water and supplied with water therefrom, and a conduit projecting from this confined space through which a fountain of water is forced upwardly into the mixing chamber.

2. A generator for a mixed fluid heating medium consisting of hot products of combustion and steam, comprising a housing enclosing a body of water and a mixing chamber thereabove, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, a passage for conducting hot combustion gases in heat exchange relation to the body of water and into the mixing chamber, means for partially confining a portion of the body of water closely adjacent the hot gases so that this water will be partially boiled, an open receptacle positioned within the mixing chamber for holding an auxiliary body of water, the passage opening into the mixing chamber beneath the receptacle so that the gases will pass through the water overflowing from the receptacle, and a conduit leading upwardly from the confined space to the receptacle through which water is forced upwardly from the confined space.

3. A generator for a mixed fluid heating medium consisting of hot products of combustion and steam, comprising a housing enclosing a body of water and a mixing chamber thereabove, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, a passage for conducting hot combustion gases in heat exchange relation to the body of water and into the mixing chamber, means for partially confining a portion of the body of water closely adjacent the hot gases so that this water will be partially boiled, an open receptacle positioned within the mixing chamber for holding an auxiliary body of water, the passage opening into the mixing chamber beneath the receptacle so that the gases will pass through

the water overflowing from the receptacle, a conduit leading upwardly from the confined space to the receptacle through which water is forced upwardly from the confined space, and other conduits leading from the confined space into the mixing chamber through which fountains of water are forced upwardly.

4. A generator for a mixed fluid heating medium consisting of hot products of combustion and steam, comprising a housing enclosing a body of water and a mixing chamber thereabove, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, a passage for conducting hot combustion gases in heat exchange relation to the body of water and into the mixing chamber, means for partially confining a portion of the body of water closely adjacent the hot gases so that this water will be partially boiled, an open receptacle positioned within the mixing chamber for holding an auxiliary body of water, the passage opening into the mixing chamber beneath the receptacle so that the gases will pass through the water overflowing from the receptacle, and a conduit leading upwardly from the confined space to the receptacle through which water is forced upwardly from the confined space, the bottom of said receptacle being below the normal level of the body of water so that some water will remain in the receptacle.

5. A generator for a mixed fluid heating medium consisting of hot products of combustion and steam, comprising a housing enclosing a body of water and a mixing chamber thereabove, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, a passage leading substantially centrally through the body of water for conducting hot combustion gases into the mixing chamber, means for partially confining an annular portion of the body of water closely adjacent the hot gases so that this water will be partially boiled, and a conduit projecting from the confined space through which a fountain of water is forced upwardly into the mixing chamber.

6. A generator for a mixed fluid heating medium consisting of products of combustion and steam, comprising a housing enclosing a combustion chamber, means for introducing hot combustion gases into this chamber, a second housing enclosing the first housing so as to hold a body of water around the first chamber and also enclose a mixing chamber above the combustion chamber, the upper surface of the body of water forming part of the lower wall of the mixing chamber, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, a conduit for conducting the hot gases from the combustion chamber into the mixing chamber, means for partially confining a portion of the body of water closely adjacent the hot gases so that this water will be partially boiled, and a conduit projecting upwardly from this confined space through which a fountain of water is forced upwardly into the mixing chamber.

7. A generator for a mixed fluid heating medium consisting of products of combustion and steam, comprising a housing enclosing a combustion chamber, means for introducing hot combustion gases into this chamber, a second housing enclosing the first housing so as to hold a body of water around the first chamber and also enclose a mixing chamber above the combustion chamber, the upper surface of the body of water

forming part of the lower wall of the mixing chamber, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, a conduit for conducting the hot gases from the combustion chamber into the mixing chamber, means for partially confining a portion of the body of water closely adjacent the hot gases so that this water will be partially boiled, an open receptacle positioned within the mixing chamber for supporting an auxiliary body of water adapted to overflow through the hot gases into the main body of water, and a conduit leading upwardly from the confined space into the receptacle through which water is forced upwardly.

8. A generator for a mixed fluid heating medium consisting of products of combustion and steam, comprising a housing enclosing a combustion chamber, means for introducing hot combustion gases into this chamber, a second housing enclosing the first housing so as to hold a body of water around the first chamber and also enclose a mixing chamber above the combustion chamber, the upper surface of the body of water forming part of the lower wall of the mixing chamber, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, a conduit for conducting the hot gases from the combustion chamber into the mixing chamber, means for partially confining a portion of the body of water closely adjacent the hot gases so that this water will be partially boiled, an open receptacle positioned within the mixing chamber for supporting an auxiliary body of water adapted to overflow through the hot gases into the main body of water, and conduits leading upwardly from the confined space into the receptacle and into the mixing chamber, water from the confined space being forced upwardly to replenish the auxiliary body of water and to spray into the mixing chamber above the receptacle.

9. A generator for a mixed fluid heating medium consisting of products of combustion and steam, comprising a housing enclosing a combustion chamber, means for introducing hot combustion gases into this chamber, a second housing enclosing the first housing so as to hold a body of water around the first chamber and also enclose a mixing chamber above the combustion chamber, the upper surface of the body of water forming part of the lower wall of the mixing chamber, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, a conduit for conducting the hot gases from the combustion chamber into the mixing chamber, means for partially confining a portion of the body of water closely adjacent the hot gases so that this water will be partially boiled, an open receptacle positioned within the mixing chamber for supporting an auxiliary body of water adapted to overflow through the hot gases into the main body of water, and a conduit leading upwardly from the confined space into the receptacle through which water is forced upwardly, the bottom of said receptacle being below the normal level of the main body of water so that a reserve body of water will remain in the receptacle.

10. A generator for a mixed fluid heating medium consisting of hot products of combustion and steam, comprising a housing enclosing a combustion chamber, means for introducing hot combustion gases into this chamber, a second housing enclosing the first chamber so as to hold a

body of water around the first chamber and enclose a mixing chamber above the combustion chamber, the upper surface of the body of water forming the lower wall of the mixing chamber, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, an open receptacle supported within the mixing chamber above the body of water for supporting an auxiliary body of water, a conduit leading centrally from the combustion chamber into the mixing chamber through which the hot gases flow upwardly beneath the receptacle and thence outwardly around the receptacle through the water overflowing therefrom, means for partially confining an annular portion of the main body of water around the central conduit adjacent the hot gases so that this water will be partially boiled, and a conduit leading from this confined space to the receptacle through which water is forced up into the receptacle.

11. A generator for a mixed fluid heating medium consisting of hot products of combustion and steam, comprising a housing enclosing a combustion chamber, means for introducing hot combustion gases into this chamber, a second housing enclosing the first chamber so as to hold a body of water around the first chamber and enclose a mixing chamber above the combustion chamber, the upper surface of the body of water forming the lower wall of the mixing chamber, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, an open receptacle supported within the mixing chamber above the body of water for supporting an auxiliary body of water, a conduit leading centrally from the combustion chamber into the mixing chamber through which the hot gases flow upwardly beneath the receptacle and thence outwardly around the receptacle through the water overflowing therefrom, means for partially confining an annular portion of the main body of water around the central conduit adjacent the hot gases so that this water will be partially boiled, a conduit leading from this confined space to the receptacle through which water is forced up into the receptacle, and a conduit leading upwardly from the confined space into the mixing chamber through which a fountain of water is sprayed upwardly.

12. A generator for a mixed fluid heating medium consisting of hot products of combustion and steam, comprising a housing enclosing a combustion chamber, means for introducing hot combustion gases into this chamber, a second housing enclosing the first chamber so as to hold a body of water around the first chamber and enclose a mixing chamber above the combustion chamber, the upper surface of the body of water forming the lower wall of the mixing chamber, means for replenishing the body of water, an outlet for the mixed heating medium leading from the mixing chamber, an open receptacle supported within the mixing chamber above the body of water for supporting an auxiliary body of water, a conduit leading centrally from the combustion chamber into the mixing chamber through which the hot gases flow upwardly beneath the receptacle and thence outwardly around the receptacle through the water overflowing therefrom, means for partially confining an annular portion of the main body of water around the central conduit adjacent the hot gases so that this water will be partially boiled, and a conduit leading from this confined space to the receptacle through which

water is forced up into the receptacle, the bottom of said receptacle being below the normal level of the body of water so that some water will remain in the receptacle.

- 5 13. A generator for a mixed fluid heating medium consisting of hot products of combustion and steam, comprising a housing enclosing a body of water and a mixing chamber thereabove, an open receptacle positioned within the mixing
10 chamber for holding an auxiliary body of water which overflows into the main body, means comprising a passage opening into the mixing chamber beneath the receptacle for conducting hot combustion gases in heat exchange relation to
15 the bodies of water and through the water overflowing from the auxiliary body, the receptacle having a shallow annular edge portion with a downturned rim, there being a second downwardly extending drip flange on the lower wall of the
20 annular edge portion and spaced inwardly from the rim.

14. A generator for a mixed fluid heating me-

dium consisting of hot products of combustion and steam, comprising a housing enclosing a body of water and a mixing chamber thereabove, an open receptacle positioned within the mixing chamber for holding an auxiliary body of water 5 which overflows into the main body, means comprising a passage opening into the mixing chamber beneath the receptacle for conducting hot combustion gases in heat exchange relation to the bodies of water and through the water over- 10 flowing from the auxiliary body, means actuated by heat from the combustion gases for feeding water upwardly from the main body of water into the auxiliary body, the receptacle having a shallow annular edge portion with a downturned rim, 15 there being a second downwardly extending drip flange on the lower wall of the annular edge portion and spaced inwardly from the rim.

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CERTIFICATE OF CORRECTION.

Patent No. 2,169,683.

August 15, 1939.

CLAYTON A. DUNHAM, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 32, for "abut" read about; page 5, second column, line 43, claim 5, for the article "the" read this; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of October, A. D. 1939.

(Seal)

Henry Van Arsedale,
Acting Commissioner of Patents.

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