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Solomon

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[54] **STEAM GENERATING AND CONTROL SYSTEM**

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[52] **U.S. Cl.** **38/77.6**

[51] **Int. Cl.** **D06f 75/06**

[58] **Field of Search** 38/77.6

[56] **References Cited**

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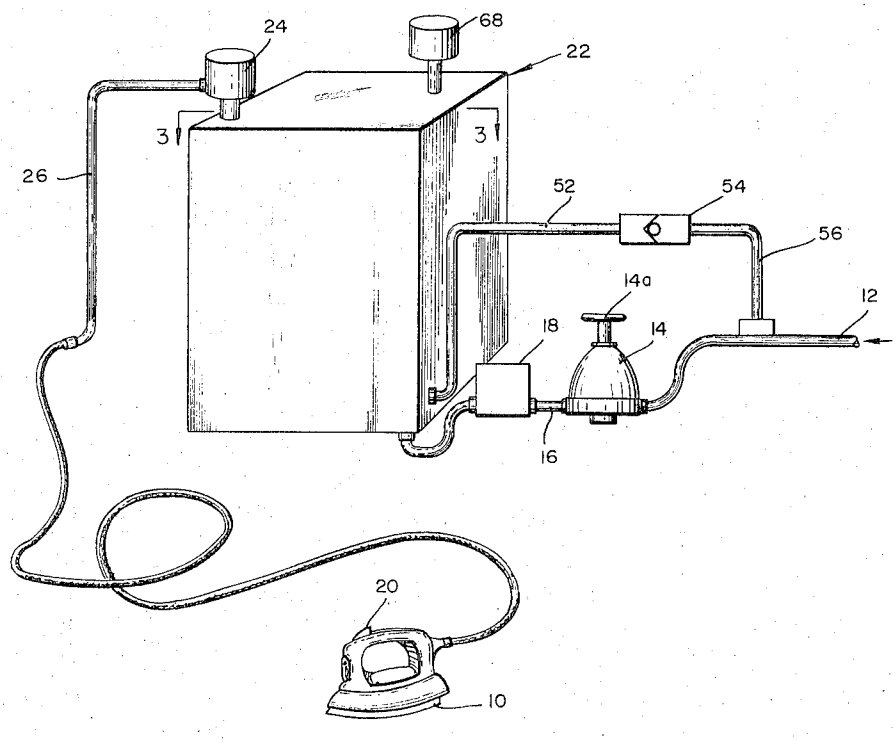
Primary Examiner—Patrick D. Lawson

Attorney, Agent, or Firm—Morris Kirschstein

[57] **ABSTRACT**

A steam generating and control system for supplying steam to a steam iron in accordance with the steam requirements of the iron. The system includes a water supply pipe through which water is supplied serially to a pressure regulator and a first solenoid valve. The first solenoid valve leads to a steam generating chamber and a second solenoid valve controls the communication between the steam generating chamber and the steam iron. A microswitch is operatively associated with the iron and upon being actuated opens each of the solenoid valves to allow water to be directed to the steam generating chamber and the steam formed therein to be transferred to the iron.

17 Claims, 8 Drawing Figures



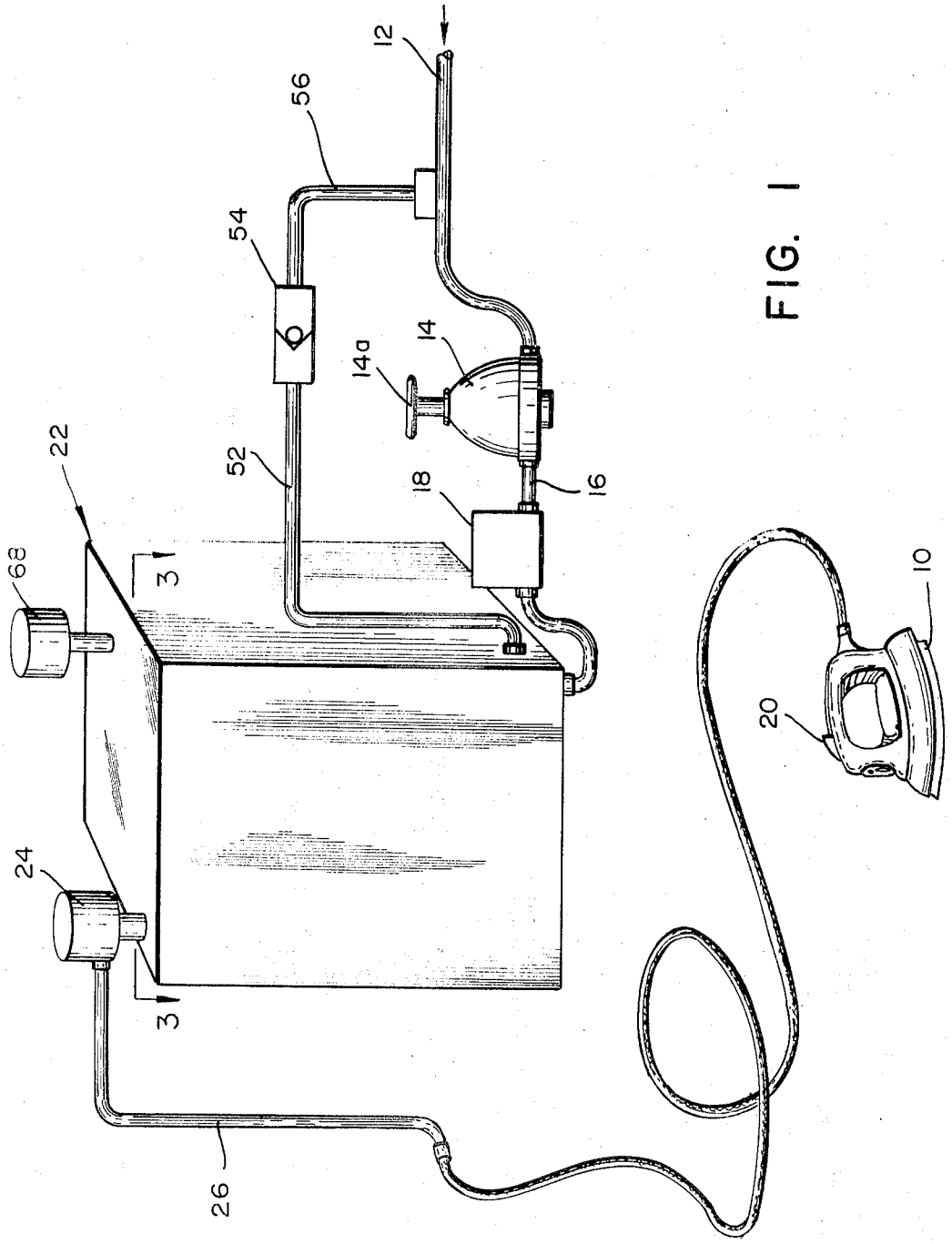
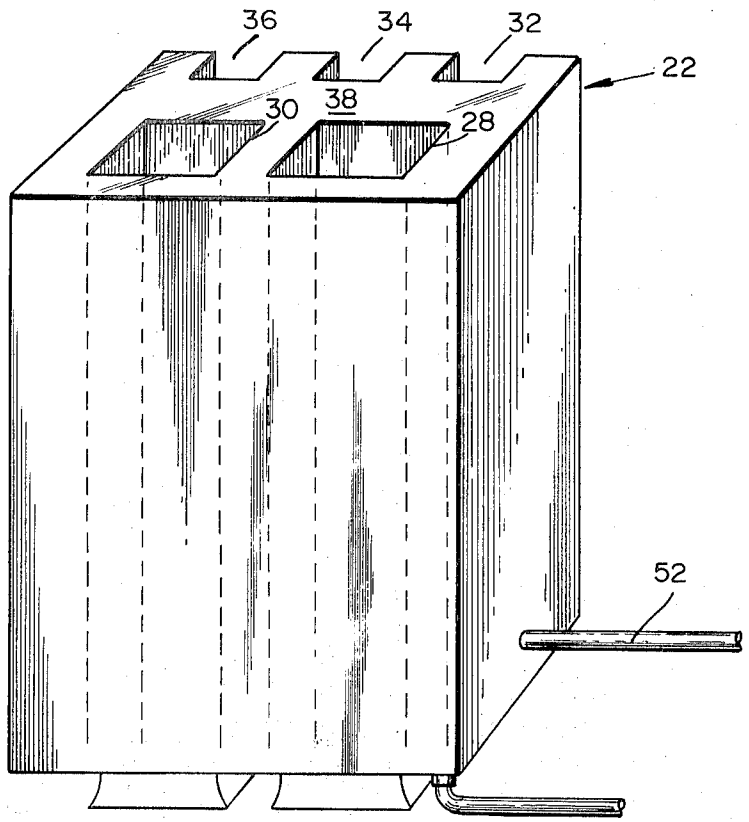


FIG. 1

FIG. 2



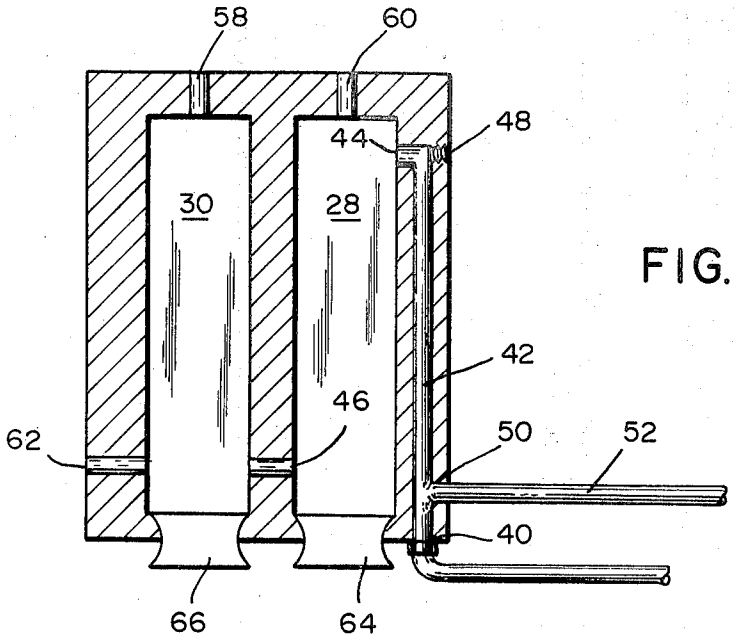


FIG. 3

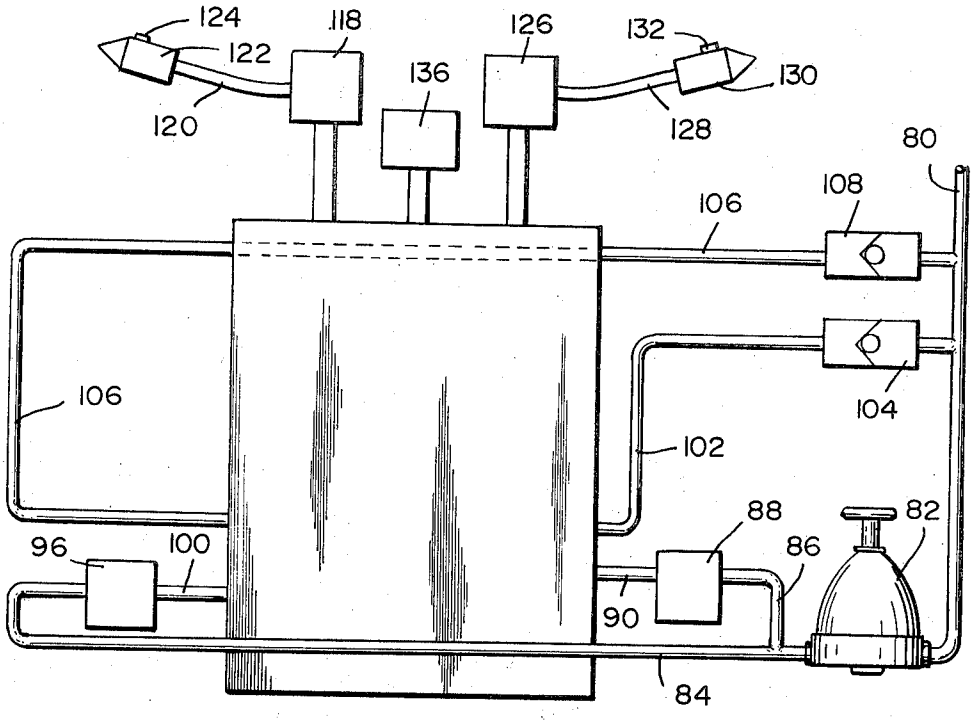

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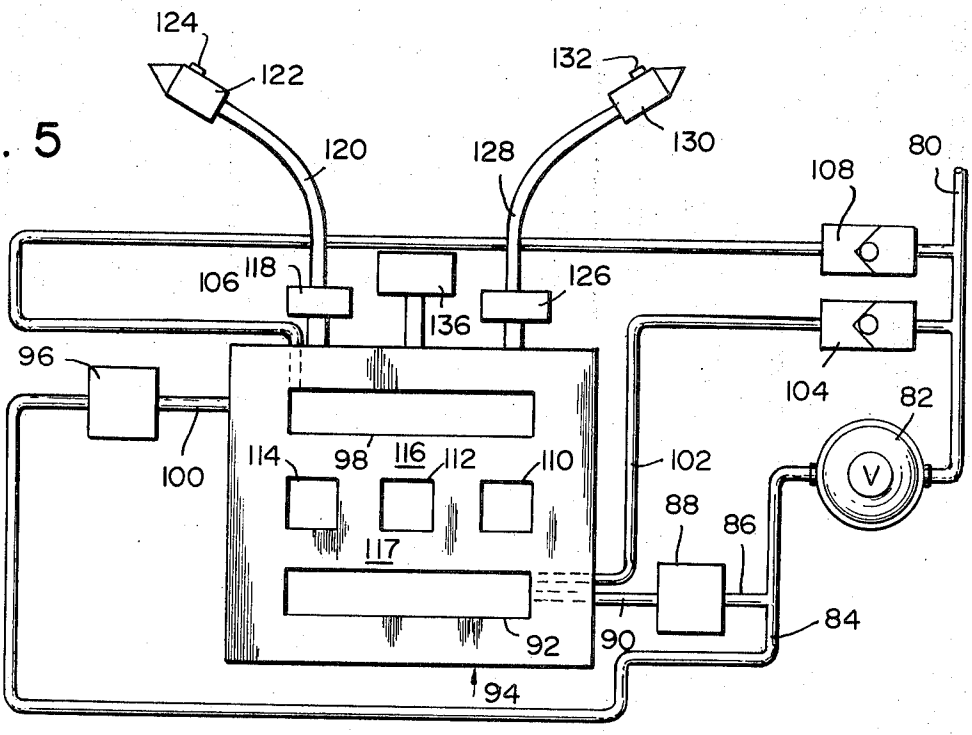
FIG. 4

FIG. 5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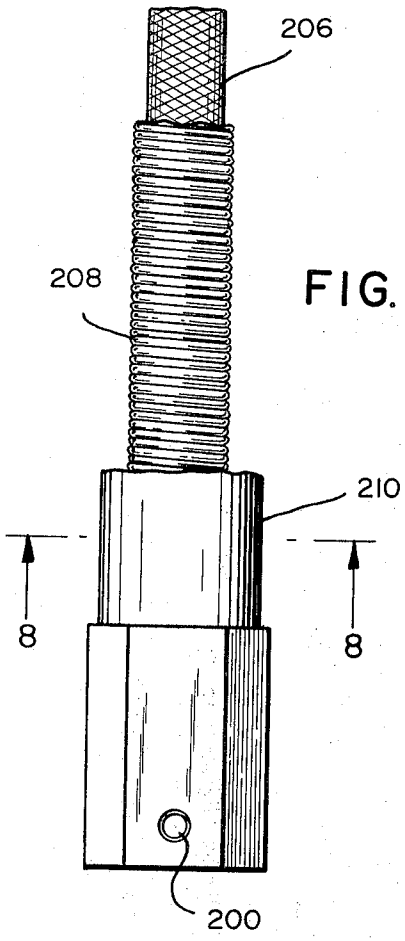

FIG. 6

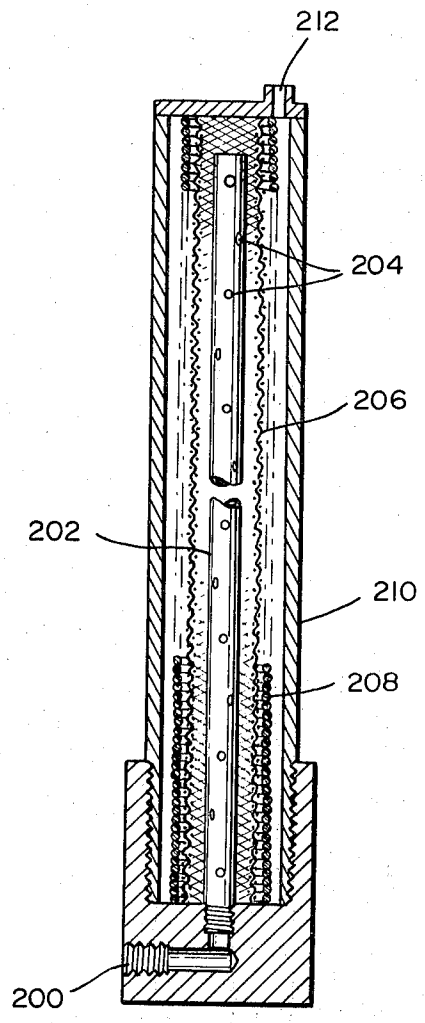

FIG. 7

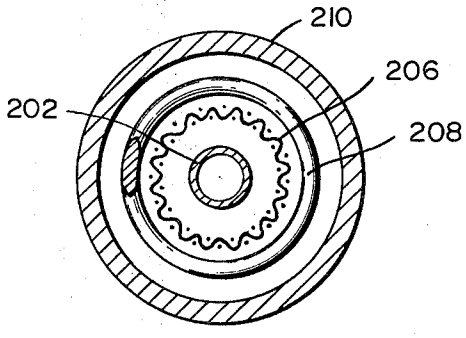

FIG. 8

STEAM GENERATING AND CONTROL SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a steam generating and control system for a commercial steam iron.

2. Description of the Prior Art

Commercial steam irons are used in cleaning establishments for presssing clothing as well as for other purposes. In order to efficiently utilize the steam iron it is necessary that steam be delivered to the iron from the steam source with a minimum of losses and as rapidly as possible in accordance with the steam requirements of the iron. Additionally, it is desirable that the steam which is delivered to the iron be as dry as possible, this being something that was difficult to achieve with prior art steam generating systems for steam irons. This was particularly so after extended periods of use of the iron.

Many of the prior art steam generating systems for commercial steam irons required the use of a large steam boiler. These boilers were expensive, both in their initial cost and maintenance, as well as requiring a large volume within which to be operated. Additionally, a large number of prior art steam generating systems that were used to generate steam for a commercial steam iron required pumps in order to provide sufficient pressure to the generated steam so that it could be conducted to the steam iron as needed. The use of pumps was undesirable due to the cost of buying and maintaining them. Further, the power requirements of the pumps was often high enough to significantly add to the cost of generating steam for the steam iron.

It is apparent that the most optimum situation is provided by a steam generating system which does not require the use of a boiler or pumps and that can provide dry steam to the iron as required. It is further apparent that any steam generating system which is to be used in supplying steam to a commercial steam iron must be safe in operation and not allow any large pressure build up the steam. Naturally the steam generating system should be as economical as possible.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an improved steam generating and control system for supplying steam to a steam consuming device such as a steam iron.

Another object of the present invention is to provide an improved steam generating and control system for supplying steam to a commercial steam iron that does not require the use of a large steam boiler and/or pumps.

A further object of the present invention is to devise an improved steam generating and control system for supplying steam to a steam iron that can provide steam to the iron as rapidly as required by the iron.

Another object of the present invention is to provide an improved steam generating and control system for supplying steam to a commercial steam iron wherein the system delivers dry steam to the iron even after extensive use of the iron.

A yet further object of the present invention is to provide a steam generating and control system for supplying steam to a commercial steam iron that minimizes steam losses with the power requirements of the system being minimal for the steam generated.

Still another object of the present invention is to provide a steam generator and control system for supplying steam to a commercial steam iron wherein safety means are built into the system to prevent unsafe steam pressure build ups.

A still further object of the present invention is to provide apparatus for generating steam wherein the apparatus includes means for regulating the pressure of the steam generated.

A further object of the present invention is to provide aparatus capable of achieving each of the foregoing objects wherein the apparatus may be operated efficiently and safely for long periods of time with a minimum of maintenance.

Briefly, in one aspect of the present invention, the foregoing and other objects are achieved by connecting a water supply pipe to a pressure regulator. The pressure regulator is set to allow water under a predetermined pressure which is later converted to steam to flow to a first solenoid valve that leads to a steam generator. The first solenoid valve is opened and closed by a microswitch that is operated by the operator of the steam iron. A second solenoid valve controls the communication of the steam produced by the steam generator to the steam iron and is operated by the same microswitch which controls the first solenoid valve.

A pressure release means is connected to the steam generator and upon a certain pressure level being reached in the generator bleeds both the steam in the generator and the water directed thereto from the first solenoid valve through a check valve to the water supply pipe for recycling. This prevents the internal pressure within the steam generator from exceeding a predetermined safe level. The water pressure regulator by only directing water via the first solenoid valve to the generator that is below a pre-determined pressure also assists in maintaining the pressure of the steam formed in the generator below a safe value.

A thermostat is in operative relation with the steam generator and acts as an override on the solenoid valves to automatically shut the valves if the heating elements of the generator have not reached a sufficient temperature to generate steam. When this occurs the heating elements rise in temperature as a result of the power they receive to the level necessary for converting water to steam without any water being directed to the generator to retard this process by receiving heat that is required for raising the temperature of the heating elements. Additionally, by shutting the second solenoid valve the transfer of steam to the steam iron having a high moisture content which results from the lower temperature of the heating elements is prevented.

In normal operation, water is directed through the water supply pipe to the pressure regulator and, if the pressure is below the pre-determined level, to the first solenoid valve. Operation of the microswitch by the steam iron operator results in the first and second solenoid valves being opened so that water is directed to the steam generator and converted to steam along with the steam previously in the generator transferred to the iron for the ironing operation. The water directed to the steam generator that is converted to steam undergoes a great increase in pressure which provides the energy necessary to direct the steam via the second solenoid valve to the steam iron without the need for

pumps. The pressure release means assures that pressure in the steam generator will not rise above the predetermined safe level.

Other objects of the invention in part will be obvious and in part will be pointed out hereinafter.

The invention accordingly constitutes the features of constructions, combinations of elements and arrangements of parts which will be exemplified in the steam generating and control system hereinafter described, and of which the scope of application will be indicated in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a schematic illustration of an embodiment of the present invention;

FIG. 2 is a perspective view of the steam generator that is utilized in the present invention;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 1 showing the steam generating chambers of the steam generator utilized in the present invention;

FIG. 4 is a front view of an alternate embodiment of the present invention;

FIG. 5 is a flow diagram of the alternate embodiment of the present invention;

FIG. 6 is a front plan partially broken view of a portion of a steam generating means according to the present invention;

FIG. 7 is a vertical sectional view of the steam generating means shown in FIG. 6; and

FIG. 8 is a sectional view taken substantially along the line of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 of the drawings, a steam generator and control system for generating steam for a commercial steam iron **10,** or other steam device, is shown and includes a water supply pipe **12** which can be connected to any convenient source of water. Water supply pipe **12** communicates with a water pressure regulator **14** which may be of conventional design. Regulator **14** may be adjusted by rotation of wheel **14a** to regulate the pressure of water that can be passed therethrough and which is later converted to steam. A conduit **16** connects water pressure regulator **14** with a first solenoid actuated valve **18.** Solenoid valve **18** is controlled by a microswitch **20** on iron **10** with there being suitable wiring leading from microswitch **20** to the solenoid valve.

A steam generator **22** receives the flow of water that passes through solenoid valve **18** and will be more specifically described hereinafter in the specification. A second solenoid valve **24** that is operated by microswitch **20** communicates the output of steam generator **22** to conduit **26** which in turn leads to steam iron **10.**

Steam generator **22** includes generating chambers **28** and **30** (FIGS. **2** and **3**) which are separated from slots **32, 34** and **36** by a wall **38.** Electrically operated heating elements are normally located in slots **32, 34** and **36** and upon power being directed thereto generate heat that is transferred by conduction through wall **38** to steam generating chambers **28** and **30.** The heat generated converts the water, which is directed to the steam generating chambers to steam. Port **40** communicates the flow through solenoid **18** to sleeve **42** and via port **44** to steam generating chamber **28.** A slot **46** communicates chambers **28** and **30.**

A plug **48** via port **44** is in communication with steam generator chamber **28** and may be rapidly removed to bleed the chamber as desired. A port **50** communicates sleeve **42** with conduit **52,** the conduit leading to a check valve **54,** conduit **56** and to water supply pipe **12** (FIG. **1**). Check valve **54** is set to open on a predetermined pressure in chambers **28** or **30** being above predetermined safe level. When this occurs the steam in the steam generating chambers and the water that is vented through outlet port **40** is directed through pipe **12** to be recycled.

A port **58** communicates steam generator chamber **30** with conduit **26,** solenoid valve **24** and iron **10.** Plugs **60** and **48** are provided for chambers **28** and **30,** respectively, while the bottom of these chambers are defined by plugs **64** and **66.**

In operating the steam generator water is directed by port **40** and sleeve **42** to chambers **28** and **30** which are heated due to electrical energy being supplied to the heating elements in slots **32, 34** and **36.** As a result, the water in the steam generating chambers is converted to steam with a great increase in pressure which provides the energy for conducting the steam through port **58,** solenoid valve **24** and conduit **26** to iron **10.**

A thermostat **68** is in operative relation with the heating elements in slots **32, 34** and **36** and shuts solenoid valves **18** and **24** when the heating elements are not at a sufficiently high temperature to convert water to steam. Thus there are never instances where steam generator **22** will direct water or wet steam to conduit **26** and steam iron **10** as would occur when the temperature of the heating elements in the generator is not sufficiently high to completely convert the water to steam. Also, by having thermostat **68** shut solenoid valve **18** when the temperature of the heating elements are below a temperature sufficient to convert water to steam the admission of water to the steam generating chambers is prevented. This precludes the water from absorbing heat from the heating elements that would otherwise raise the temperature of the heating elements.

In normal operation of the overall system, water is connected to water supply pipe **12** with pressure regulator **14** being adjusted to allow water under a certain specified pressure to be passed to conduit **16.** By regulating the pressure of water being passed to conduit **16** and ultimately to steam generator **22** a safety factor is built into the system against the unsafe build up of pressure in the generator. The operator actuates microswitch **20** when he wishes to use steam iron **10** and upon actuation of the microswitch solenoid valves **18** and **24** are opened. As a result of solenoid valve **18** being opened, water is transferred via port **40,** sleeve **42** and port **44** to steam chamber **28** and through slot **46** to steam chamber **30.** The water in the chambers is converted to steam due to the heat from the heating elements which greatly increases the pressure within the chambers and provides the energy for the steam being transferred to the iron without the need for pumps. The steam is transferred to iron **10** through port **58,** open solenoid valve **24** and conduit **26.**

If the pressure in the steam generating chambers is above a desired safe level the water directed past solenoid **18** and the steam in the steam generating chambers passes via port **50,** conduit **52** and check valve **54**

to water pipe 12 for recycling. This insures that the pressure of the steam chambers does not continue to rise above the pre-determined safe level. The pressure at which the steam in the chambers and the water directed thereto is recycled is determined by appropriately selecting check valve 54.

In FIGS. 4 and 5 of the drawings an embodiment of the invention is shown wherein steam may be supplied to a plurality of irons in accordance with the steam requirements of each iron. As can be seen in FIGS. 4 and 5 a water supply pipe 80 is connected to a pressure regulator 82 and by conduits 84 and 86 to solenoid valve 88. Solenoid valve 88 is connected by a conduit 90 to a steam generating chamber 92 of steam generator 94.

A solenoid valve 96 is connected to conduit 84 and communicates with steam chamber 98 via a conduit 100. A check valve 104 leads from chamber 92 via a conduit 102 and bleeds the chamber to conduit 80 when opened. Check valve 104 is selected to open at the desired maximum pressure limit within chamber 92. In a similar fashion a conduit 106 communicates steam chamber 98 and a check valve 108 with the check valve leading to conduit 80. Check valve 108 controls the maximum pressure within steam chamber 98 in the same way check valve 104 controls the maximum pressure in steam chamber 92.

Slots 110, 112 and 114 are located between steam chambers 92 and 98 and normally electrical heating elements are located therein. When electrical energy is supplied to the heating elements heat is transferred to each of the steam chambers by conduction through walls 116 and 117, respectively.

A solenoid valve 118 communicates with steam chamber 98 and via conduit 120 to a steam iron 122. A switch 124 is located on steam iron 122 and simultaneously controls the opening and closing of solenoid valves 96 and 118. In like fashion solenoid valve 126 communicates with steam chamber 92 and via conduit 128 with steam chamber 130. A switch 132 is located on steam iron 130 and simultaneously controls the opening and closing of solenoid valves 88 and 126. A thermostat 136 senses the temperature of the heating elements in slots 110, 112 and 114 and shuts all the solenoid valves upon the temperature of the heating elements being insufficient to convert the water in the generating chambers to steam. Thus, thermostat 136 functions in a similar manner as thermostat 68 described in connection with the embodiments shown in FIGS. 1–4.

In a normal operation water is directed by supply pipe 80 and regulator 82 to solenoid valves 88 and 96. If the operator of iron 122 desires to use the iron he actuates microswitch 124 which opens solenoid valves 96 and 118. As a result, water is directed through conduit 100 to steam generating chamber 98 and steam from the chamber is directed via solenoid valve 118 and conduit 120 to the steam iron. No pumps are necessary in transferring the steam from the steam generating chamber to the iron due to the increase of pressure in the chamber as water is converted to steam therein. In a like fashion, the operator of iron 130 by actuating switch 132 controls the supply of steam to the iron.

Check valves 104 and 108 function in an analogous manner to check valve 54 to control the pressure in each of the steam generating chambers below a maximum safety level.

While the embodiments shown in FIGS. 4 and 5 discloses the use of two irons it is obvious that as many irons as desired could be used with there being a separate steam generating chamber for each iron and a pair of solenoid valves for controlling communication to and from each chamber.

In FIGS. 6, 7 and 8 of the drawings a steam generating means according to the present invention is shown and consists of an inlet 200 which is in communication with a vertical pipe 202 having a plurality of holes 204 extending along its length. Located about pipe 202 is a wire screen 206 and located thereabout are a plurality of electric heating coils 208. An annular wall 210 surrounds coils 208 and a passageway 212 is located at the uppermost portion thereof.

The steam generating means in FIGS. 6, 7 and 8 operates as follows. Water is directed via passageway 200 to pipe 202 and through openings 204 against screen 206. Electrical energy is supplied to electric heating coils 208 and as a result thereof the water which impinges on screen 206 is immediately flashed into steam and via passageway 212 directed to a point of use.

It is to be appreciated that the embodiment of the invention shown in FIGS. 6, 7 and 8 can be used in lieu of the steam generating means hereinbefore described with excellent results. It is wished particularly to emphasize that in the embodiment of the invention shown in FIGS. 6, 7 and 8 water is immediately flashed into steam which is directed via passageway 212 to a point of use.

It is readily apparent from the foregoing description that a steam generating and control system is provided which is capable of achieving all the objects of the present invention as well as others.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments above set forth, it is to be understood that all matter herein described or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described the invention there is claimed as new and desired to be secured by Letters Patent:

1. A steam generator and control system for supplying steam to a device in accordance with the steam consumption of the device comprising:
   a. a steam consuming device;
   b. a steam generator having an inlet for receiving water which is converted to steam and an outlet for directing the steam formed therein to the device;
   c. inlet regulating means for regulating the flow of water to said steam generator inlet;
   d. outlet regulating means for regulating the flow of steam from the steam generator outlet to the device, and
   e. control means for simultaneously operating both said inlet regulating means and said outlet regulating means whereby water is converted to steam in said generator and directed to the device upon actuation of said control means.

2. A steam generator and control system according to claim 1 wherein said inlet regulating means is a first value regulating the flow of water to said steam generator, said outlet regulating means being a second valve for regulating the flow of steam from said steam generator outlet to the device, and said control means simultaneously opening and closing said first and second valves.

3. A steam generator and control system according to claim 1 wherein said steam generator is normally provided with heating elements and means for closing said first and second valves upon the temperature of the heating elements for said generator being below a pre-determined temperature.

4. A steam generator and control system according to claim 1 wherein means are provided for regulating the pressure of the water supplied to said steam generator.

5. A steam generator and control system according to claim 1 wherein said steam generator includes at least one steam generating chamber which receives water from said inlet regulating means and means for bleeding steam in said chamber and the water directed thereto from said inlet regulating means upon the pressure in the chamber being above a pre-determined level.

6. A steam generator and control system according to claim 5 wherein said bleeding means includes a check valve in communication with said steam generator chamber which is set to operate at the pre-determined pressure, and means for recycling the flow through said check valve to the said steam generator inlet regulating means.

7. A steam generator and control system according to claim 2 wherein said first and second valves are solenoid valves, said control means being a switch that opens and shuts said valves simultaneously.

8. A steam generator and control system according to claim 7 wherein said device is a steam iron and said switch is operatively associated with said steam iron.

9. A steam generator and control system according to claim 5 wherein said inlet regulating means and said outlet regulating means are respectively first and second solenoid valves, said control means being a switch that opens and shuts said valves simultaneously.

10. A steam generator and control system according to claim 9 wherein said device is a steam iron and said switch is operatively associated with said steam iron.

11. A steam generator and control system according to claim 10 wherein said steam generator is normally provided with heating elements and means for shutting said first and second valves upon the temperature of the heating elements being below a pre-determined temperature.

12. A steam generator and control system according to claim 1 including a plurality of devices wherein said steam generator has a plurality of steam generating chambers with each chamber connected to a different device, an inlet regulating means for each chamber for regulating water which is directed to the chamber, an outlet regulating means for each steam chamber for controlling the flow of steam from each chamber to the different devices, said control means including a control for each chamber for simultaneously operating said inlet regulating means and said outlet regulating means for said chamber independently of the regulating means for other chambers.

13. A steam generator and control system according to claim 12 wherein said inlet regulating means and said outlet regulating means for each chamber are a pair of valves, said control for each chamber opening and closing said pair of valves for each chamber simultaneously.

14. A steam generator and control system according to claim 13 where said steam generator normally includes heating elements and means for shutting all of said valves upon the heating elements being below a pre-determined temperature.

15. A steam generator and control system according to claim 14 further including means in communication with each of said steam generating chambers for bleeding said chambers individually upon the pressure in the individual chambers being above a pre-determined level.

16. A steam generating and control system according to claim 15 wherein said plurality of devices are a plurality of steam irons, said valves of said different outlet regulating means each connected to a different steam iron.

17. A steam generator and control system according to claim 16 wherein said valves are all solenoid valves and said control for each chamber includes switches operatively associated with each iron.

* * * * *