Dec. 21, 1943. K. L. WOODMAN 2,337,077

STEAM IRON

Filed April 11, 1941 2 Sheets-Sheet 1

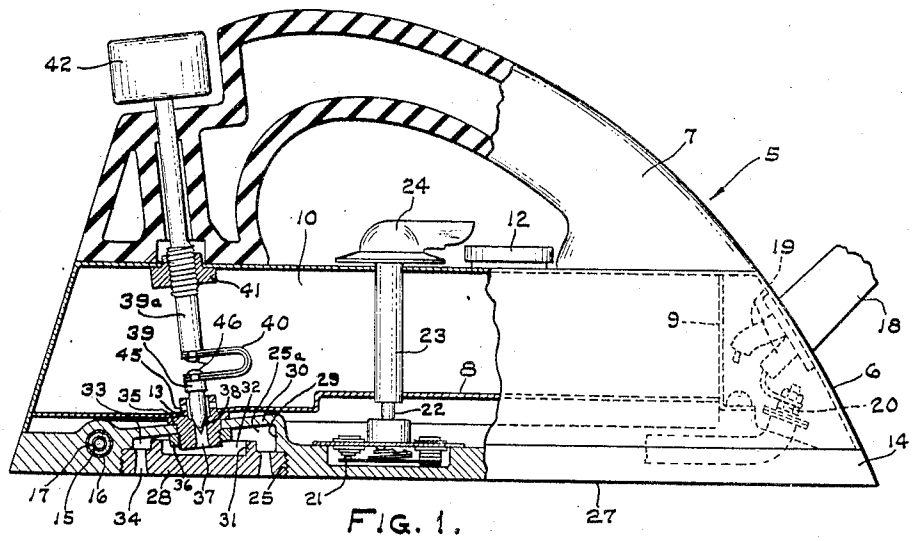
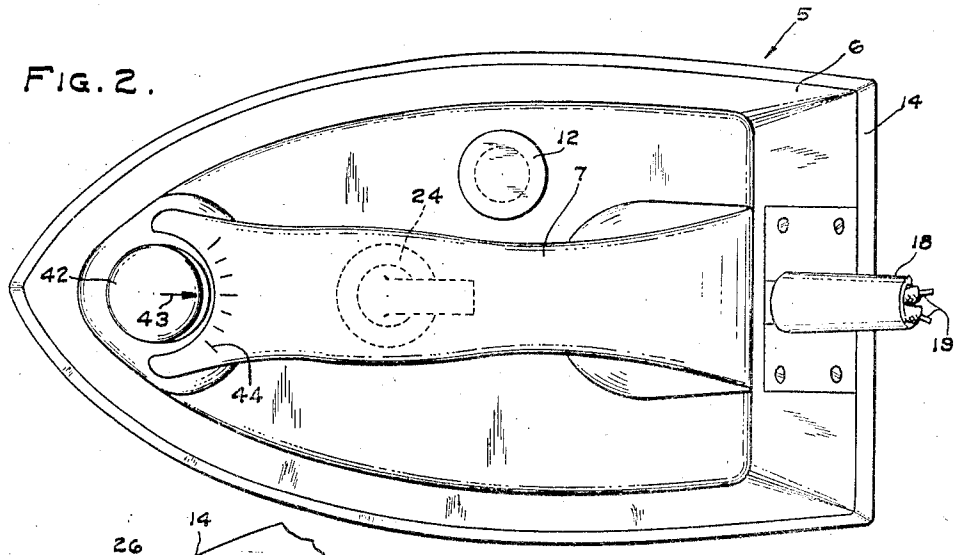


FIG. 1.

FIG. 2.



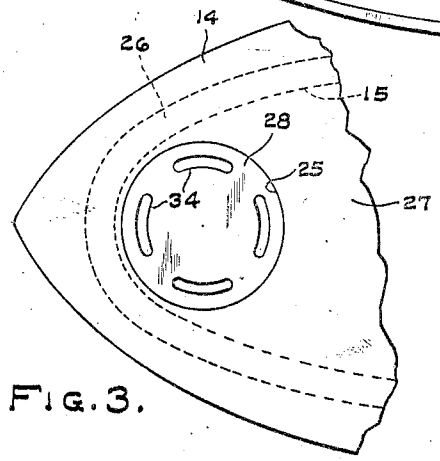


FIG. 3.

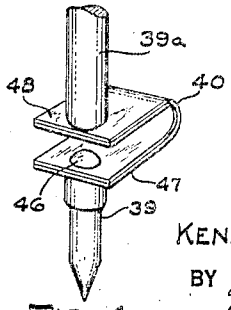


FIG. 4.

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STEAM IRON

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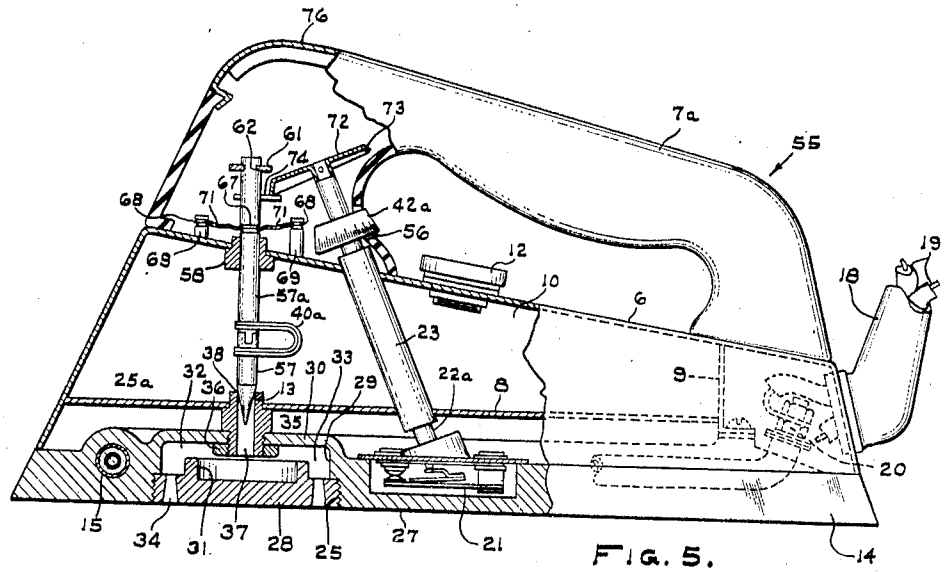


FIG. 5.

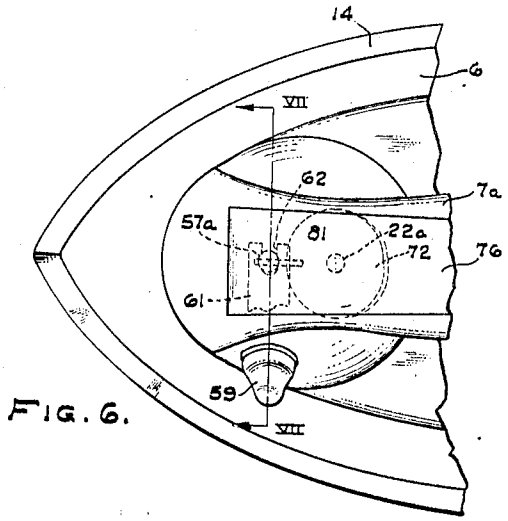


FIG. 6.

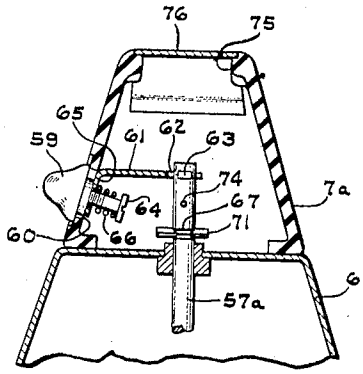


FIG. 7.

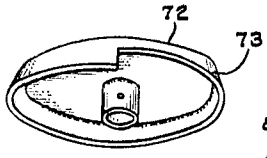


FIG. 10.

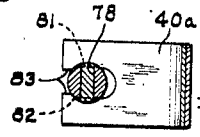


FIG. 9.

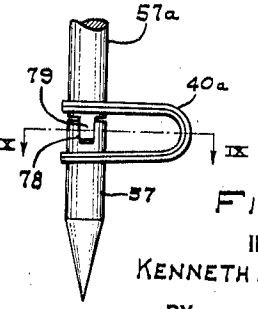


FIG. 8.

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2,337,077

UNITED STATES PATENT OFFICE

2,337,077

STEAM IRON

Kenneth L. Woodman, Mansfield, Ohio, assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application April 11, 1941, Serial No. 388,061

10 Claims. (Cl. 38—77)

This invention relates to steam irons and particularly to that class of steam irons which includes a steam generator and a valve-controlled liquid supply forming a part thereof and has for an object to provide an improved steam iron of the character set forth.

Steam irons of the character mentioned have been provided with adjustable water valves for regulating the rate of water flow to the steam generator in accordance with the demand for steam. The valves of these irons were usually adjustable to provide a certain rate of water flow for one type of fabric being pressed and a different rate of flow for another type of fabric. Thus, for each setting of the water valve a certain and fixed rate of flow of water was desired in order to provide the correct amount of steam for the material being ironed.

However, it has been found that for any given setting of the water valve of a steam iron the rate of water flow therethrough tends to increase with continued operation of the iron and allow too much water to flow into the steam generator. This increase in the rate of water flow is apparently due to a change in surface tension of the water stored in the iron as its temperature is raised and to a change in the size of the valve opening because of differential expansion of the metal parts which support the valve as their temperature is raised. With continued operation of a steam iron, enough heat may be transmitted from the heated parts of the iron to the water stored in the iron and to the metal parts which support the water valve to appreciably raise the temperature of the water and these metal parts.

It is an object of this invention to provide a steam iron construction in which a substantially uniform rate of steam flow to the article being pressed or steamed is maintained for each adjustment of the steam-controlling means.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a side elevation, partly in section, of an electrically-heated steam iron made in accordance with the present invention;

Fig. 2 is a top plan view of the iron shown in Fig. 1;

Fig. 3 is a fragmentary bottom plan view of the iron shown in Fig. 1;

Fig. 4 is a perspective view of a portion of the valve stem shown apart from the iron;

Fig. 5 is a view, similar to Fig. 1, of a modified form of the invention;

Fig. 6 is a fragmentary top view of the steam iron illustrated in Fig. 5;

Fig. 7 is a fragmentary sectional view taken substantially on the line VII—VII of Fig. 6;

Fig. 8 is a side view of a portion of the valve stem shown in Fig. 5, and showing the relation of the parts when the temperature of the bi-metal element has been raised above normal;

Fig. 9 is a sectional view taken substantially on the line IX—IX of Fig. 8; and

Fig. 10 is a perspective view of an adjustable stop member visible in Fig. 5.

Referring to the drawings, there has been illustrated, in Figs. 1 to 4, inclusive, an electrically-heated steam iron indicated generally by the reference character 5. The iron 5 comprises a body including a cover or shell 6 having a handle 7 secured to the top thereof in any suitable manner. The interior of the cover 6 is provided with partitions such as 8 and 9 which, together with the side and top walls of the cover, define a water-storage chamber or reservoir 10. For convenience in assembling and servicing the iron, the partition 8 may be removable if desired.

The reservoir 10 is filled with water through an opening in the top of the cover 6, which opening is normally closed by a removable plug 12. This plug preferably has a vent therethrough to allow air to enter the reservoir as water is removed through an outlet opening 13 provided in the bottom of the reservoir adjacent the front thereof.

A metallic soleplate or base 14 is detachably secured in any suitable manner to the bottom of the cover 6, preferably in spaced relation to the partition 8 so that the reservoir 10 is thermally isolated from the soleplate. This soleplate may be of conventional outline, as illustrated in Fig. 2, and is provided with a U-shaped heating element 15 secured thereto or imbedded therein as illustrated particularly in Fig. 1. This heating element may be of well-known construction and comprises an outer metallic tube 16 having a coiled resistance element 17 supported in spaced concentric relation thereto by means of suitable heat-conducting, electrical insulating material.

Power for heating the iron is supplied to the element 15 by means of a cord 18 adapted to be connected to an electrical outlet (not shown). This cord comprises conductors 19 connected to the ends 20 (only one of which is visible in Fig. 1) of the resistance element 17 in series with a manually-adjustable thermostat 21.

The thermostat 21 may be of conventional design and is adjusted by means of a rotatable rod or shaft 22 extending through a sleeve 23 brazed or soldered in fluid-tight relation in the upper and lower walls of the reservoir 10. A knob or handle 24 is secured to the upper end of the shaft 22 and is provided with a suitable scale to be read with an index fixed to the cover 6, to indicate the temperature of the soleplate ironing surface.

The soleplate 14 is provided with a recess or hole 25 located within the loop or bight 26 (Fig. 3) of the heating element 15. This recess opens on the ironing surface 27 of the soleplate 14, and is normally closed at its lower end by means of a metallic plug or member 28 which is externally threaded to removably engage mating threads formed on the lower portion of the side wall of the recess. It will be noted that the upper surface of this plug, together with the lateral wall 29 and the upper wall 30 of the recess, defines a chamber 25*a*.

The chamber 25*a* is divided into two communicating compartments by an annular rib or baffle 31, preferably formed integral with the plug. The circular space or well within this baffle provides a steam-generating compartment 32 while the annular space between the baffle and the lateral wall 29 defines a steam-distributing compartment 33.

A plurality of steam ports 34 extending inwardly from the outer surface of the plug communicate with the steam-distributing compartment 33 and serve to discharge steam on the material being ironed. These ports also serve as tool-receiving openings whereby a suitable tool may be inserted therein for removing the plug from the iron.

The outlet 13 of the water reservoir 10 is preferably located directly above the steam-generating compartment 32 and receives a bushing 35 which may be brazed, soldered or otherwise suitably secured to the partition 8 to provide a fluid-tight joint. The lower end of this bushing which extends through an aperture in the upper wall 30 of the soleplate is threaded and receives a nut 36 to provide a fluid-tight joint between the bushing and the wall 30. This bushing is provided with a water passage 37 having a valve seat 38 formed therein.

The valve seat 38 is engageable by the lower tapered end of a valve stem 39 for closing the passage 37. The valve stem 39 has an extension 39*a* connected thereto by means of a U-shaped bimetal element 40 secured to the opposed ends of the stem and its extension. This bimetal element will be referred to in detail hereinafter. The valve stem extension 39*a* has threaded engagement with an internally-threaded bushing 41 suitably secured in fluid-tight manner in the upper wall of the reservoir 10.

The upper end of the valve stem extension projects through the front support of the handle 7 and carries a knob 42. By turning the knob 42 in one direction or the other, the valve stem may be raised or lowered relative to the valve seat 38 to regulate the rate at which water is fed from the reservoir 10 into the steam-generating compartment 32. If desired, the knob 42 may be provided with an index arrow 43 (Fig. 2) which cooperates with a scale 44 on the handle 7 to indicate the size of the valve opening for any given setting of the knob. It will be noted that the bushing 35 may be provided with openings 45 which permit the water to enter the passage 37 when the valve is open.

To use the iron for the purpose of steaming clothes or supplying moisture in the form of steam to an article being pressed, the operator fills the reservoir 10 with water and adjusts the thermostat 21 to maintain the iron at the proper temperature for the particular material being ironed. When the iron has reached the correct heat, the valve-controlling knob 42 is turned to set the index 43 at a predetermined point of the scale 44 to allow water to be fed to the steam-generating chamber 32 at a rate which will provide the correct amount of steam for the particular material being ironed. The water falls on the surface of the plug 28 within the baffle 31 where it is instantly flashed into steam. The steam thus generated will pass over the baffle 31 and into the steam-distributing compartment 33 and then through the steam outlet ports 34 to the material being pressed or steamed.

The baffle 31 normally prevents the steam from carrying particles of water out through the ports 34 although, as an added precaution, non-corrosive metallic wool or the like, such as asbestos, aluminum or glass wool, may be provided in the steam chamber 25*a* as disclosed in my copending application, Serial No. 382,679, filed March 11, 1941. It will be understood that the plug 28, due to its metal-to-metal contact with the soleplate 14 which carries the heating element, will be heated sufficiently to convert the water into steam. Further, by locating the plug closely adjacent the loop or bight 26 of the heating element, proper heating of the plug is insured.

The water valve is initially adjusted by means of the knob 42 to supply water to the steam-generating chamber 32 at a rate which will provide the proper amount of steam to the article being pressed or steamed and, therefore, it is desirable that the water flow be uniform. However, continued operation of the iron may cause a change in the rate of water flow through the valve even though the setting of the knob 42 remains the same. This change may be due to differential expansion of the iron causing the valve opening to vary and may also result from a change in viscosity and surface tension of the water stored in the reservoir 10 as the temperature of the water increases. Although the reservoir 10 is thermally isolated from the heated soleplate 14 by the air space between the soleplate and the lower partition 8, enough heat may be transferred to the water in the reservoir during prolonged use of the iron to appreciably increase its temperature.

To maintain a uniform rate of water flow through the water valve for any given setting of the knob 42 thereof, regardless of the temperature changes of the body of the iron or of the water stored in the reservoir 10, the valve stem is provided with a compensating device such as the bimetal element 40 which is responsive to temperature changes. As shown particularly in Figs. 1 and 4, the valve stem is made in two parts, 39 and 39*a*, which parts are connected by the U-shaped bimetal element 40. This bimetal element is secured to the opposed ends of the divided valve stem as by headed projections 46 on these ends. If desired, the shanks of these projections may be non-circular and extend through non-circular holes in the bimetal element so that the bimetal element will transmit rotation of the

upper part 39a of the valve stem to the lower part 39.

It will be appreciated that as the temperature of the water stored in the reservoir 10 increases, which, as pointed out above, tends to increase the flow of water through a fixed valve opening, the legs 47 and 48 of the bimetal element 40 will spread apart slightly. This spreading of the legs 47 and 48 will move the lower part 39 of the valve stem toward the valve seat 38 to reduce the size of the valve opening and compensate for the change in the surface tension of the water to maintain the flow of water at a uniform rate.

Differential expansion due to heating of the metal parts of the iron may cause the size of the valve opening to increase from its initial adjustment. The bimetal element 40 will be heated by the metal parts of the iron, such as the cover 6 and partition 8, due to its metal-to-metal contact with the upper part 39a of the valve stem which engages the bushing 41. The legs 47 and 48 will be spread apart under the influence of this heat and lower the part 39 of the valve stem to compensate for the differential expansion of the iron, which tends to increase the size of the valve opening. It will be appreciated that the lower part 39 of the valve stem is spaced from the bushing 35 when the valve is open so that the heat of this bushing, which is clamped to the heated soleplate, will not directly affect the bimetal element 40.

In Figs. 5 to 10, inclusive, there has been illustrated a modified form of the invention. The modified steam iron, generally indicated at 55, is similar to the previously-described iron 5, and the same reference characters have been used to designate elements of the iron 55 which are identical with elements of the iron 5. The elements of the iron 55 which are similar or equivalent to the elements of the iron 5 have been identified by the same reference characters, but with the addition of the letter *a*.

Thus, the iron 55, like the iron 5, comprises a body including a cover or shell 6, a handle 7a and a soleplate 14. The soleplate 14 and steam-generating unit formed therein, including the plug 28, are identical with the structure of the iron 5 except that the upper wall 30 of the soleplate is substantially horizontal, as shown in Fig. 5.

As shown particularly in Fig. 5, the rotatable rod 22a which adjusts the thermostat 21 is inclined and projects into the hollow front support of the handle 7a and carries a knob or handle 42a. This knob projects through a window 56 formed in the handle and is provided with a scale which cooperates with a reference index (not shown) provided on the handle adjacent the window 56 to indicate the temperature of the soleplate for any given setting of the knob.

The valve seat 38 provided in the bottom wall 8 of the reservoir above the steam generator is engageable by the lower tapered end of a valve stem, for closing the water passage 37. The valve stem is made in two parts and includes an extension 57a connected to the lower tapered part 57 by means of a U-shaped bimetal element 40a. The valve stem extension 57a is slidable in a bearing or bushing 58, secured, as by brazing or soldering, in fluid-tight manner in the upper wall of the cover 6. The upper end of the valve stem extension 57a projects into the front hollow support of the handle 7a, preferably in longitudinal alignment with the thermostat adjusting rod 22a. The valve stem 57—57a is raised or lowered to open or close the water passage 37 by means of a knob or button 59 (Figs. 6 and 7) slidably mounted in a slot 60 provided in the front handle support. This knob is positioned to be conveniently engaged by the operator's thumb or fingers.

The longitudinal movement of the knob 59 along the slot 60 is transmitted to the valve stem extension 57a by means of a bracket 61 (Fig. 7) carried by the knob and which is provided with an elongated opening or open-ended slot 62 to receive the reduced flattened portion 63 on the upper end of the valve stem. This bracket 61 is resiliently secured to the knob 59, by means of a headed screw 64 threaded into the bottom of the knob and which extends loosely through an aperture provided in an angular portion 65 of the bracket 61. A coil spring 66 surrounding the screw 64 abuts the head of this screw and engages the angular portion 65 to resiliently maintain the bracket in engagement with the bottom of the knob.

It will be understood that the water-controlling valve may be opened or closed by raising or lowering the knob 59. Since it is usually necessary to open and close the valve a number of times during an ironing period to start and stop the generation of steam, it is desirable to positively maintain the water valve in either its closed or predetermined open position. Therefore, there has been provided a snap-acting means in the form of a toggle or off-center spring mechanism which will bias the valve stem and hold the valve in either closed or a predetermined open position.

In the specific embodiment illustrated in the drawings, the valve stem extension 57a is provided with a spring-receiving groove 67 (Figs. 5 and 7), while corresponding grooves 68 are provided on spaced posts 69 secured to the upper wall of the body 6. Flat springs 71 each have one end seated in a groove 68 of posts 69 and the other end seated in the groove 67 formed on the valve stem extension 57a. These springs are of such length that they remain under a compressive stress in either the open or closed position of the valve stem. The groove 67 provided on the valve stem is so related to the grooves 68 of the posts 69 that when the valve is closed, it will be disposed below the grooves 68 and consequently the springs 71 will bias the valve to resiliently hold it in closed position. Similarly, when the valve is moved to open position, the groove 67 will be positioned above the grooves 68 so that the springs 71 will snap up from the position shown in Fig. 5 to bias the valve in open position.

It is desirable to regulate the rate of steam generation in accordance with the temperature of the ironing surface of the soleplate 14. This may be done by controlling the rate at which water is fed to the steam-generating chamber of the iron in accordance with the setting of the thermostat 21 which controls the temperature of the soleplate 14 and its ironing surface 27. To accomplish this, the thermostat adjusting rod 22a is provided with an adjustable stop which may take the form of a flanged disc 72 fixed to the upper end of the thermostat rod. The depending flange 73 of this disc is of graduated height as most clearly shown in Fig. 10, and is of such diameter that it projects into the path of a pin or stop 74 carried by the valve stem extension 57a.

It will be understood that the stop or disc **72** turns with the thermostat-adjusting rod **22***a* so that when this rod is rotated, by means of the knob **42***a*, to set the thermostat for maintaining the ironing surface **27** of the soleplate at a given temperature, a related portion of the flange **73** will lie in the path of the stop **74**. The portion of the flange **73** in the path of the stop **74** will automatically limit the upward movement of the valve stem **57—57***a*, and consequently determine the rate at which water is fed into the steam-generating chamber **32** for the particular thermostat setting. By graduating the height or suitably shaping the edge of the flange **73**, a particular rate at which water will be fed to the steam generator may be provided for each setting of the thermostat. For example, the edge of the flange may be designed so that when the iron is adjusted to maintain a high soleplate temperature, a greater quantity of water will be fed to the steam generator than when the soleplate is maintained at a lower temperature. In addition, the flange may be designed so that the portion thereof in the path of the stop **74**, when the thermostat is moved to its "off" position to open the heating circuit, will cause the stop **74** to be forced down to close the water valve.

To facilitate assembly of the iron and adjustment of the mechanism within the hollow front support of the handle **7***a*, the handle may be provided with an opening **75** which may be closed by a cover plate **76** removably secured to the handle.

The specific arrangement and construction of the thermostat and water valve control for the iron **55** described above is disclosed and claimed in my copending application, Serial No. 382,305, filed March 8, 1941.

In using the iron **55** for the purpose of steaming clothes or supplying moisture in the form of steam to an article being pressed, the operator fills the reservoir **10** with water and adjusts the thermostat **21** to maintain the ironing surface of the soleplate **14** at the proper temperature for the particular material being ironed. Adjustment of the thermostat also positions the adjustable stop **72** to provide a rate of water flow to the steam generator corresponding to the temperature at which the ironing surface of the soleplate **14** is maintained. The rate of water flow determines the rate at which steam will be supplied to the material being ironed.

When the iron has reached the correct heat, the controlling button **59** may be raised to open the valve and allow water to be fed from the reservoir **10** into the steam-generating chamber **32**. Steam is generated within the chamber **32** and distributed to the material being ironed in the manner described in detail in connection with the iron **5**.

In doing ordinary domestic ironing it is usually necessary to terminate flow of steam for certain periods, as when it is desired to use the iron as a "dry" iron. With the steam iron **55**, this is readily accomplished by closing the water valve, by means of the button **59**, and when steam is again required, it is only necessary for the operator to raise the button to the "open" position, the adjustment of the proper rate of flow of water having already been determined automatically by the setting of the thermostat. In other words, it is not necessary for the operator to manually adjust the water-regulating valve each time the valve is opened.

In order to compensate for the tendency of the water flow to vary as the temperature of the body of the iron **55** and the temperature of the water stored in the reservoir **10** increases, the two parts **57** and **57***a* of the valve stem are connected together by a U-shaped bimetal element **40***a*. As shown particularly in Figs. 8 and 9, the lower part **57** of the valve stem is provided with a transverse slot **78** which receives a depending tongue **79** formed on the lower end of the valve stem extension **57***a*. The U-shaped bimetal element **40***a* is provided with open-ended slots **81** which receive reduced flattened portions **82** of the valve stem parts.

By reference to Fig. 9, it will be noted that the open-ended slots **81** in the bimetal element **40***a* may be undercut to provide projections **83** which latch the bimetal element to the valve stem. The bimetal element **40***a* will function in the same manner as the bimetal element **40** previously described to maintain a uniform flow of water to the steam generator.

The flattened reduced portions **82** in the valve stem are preferably spaced from the adjacent ends of their respective valve stem parts, so that the opposed surfaces of these parts will substantially abut when the bimetal element is cold. With this construction the valve may close tightly without distorting or bending the bimetal element.

It will be understood that the valve stem construction and bimetal element **40***a* illustrated in Figs. 8 and 9 may be used in place of the valve stem and bimetal element **40** shown in Fig. 1. The interlocking arrangement provided by the tongue and groove connection of the valve stem **57—57***a* is particularly desirable with a rotatable valve stem like that shown in Fig. 1, since the rotative force is transmitted directly from the extension to the valve stem proper instead of through the bimetal element.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. A steam iron comprising a body, a liquid-storage chamber carried by said body, a steam generator carried by said body, said chamber having an outlet for discharging liquid into said steam generator, a valve for controlling the flow of liquid through said outlet, said valve including a valve member, means for setting said valve member to provide a given rate of flow of water through said outlet, and means responsive to the temperature of the interior of said chamber for maintaining said given rate of flow.

2. A steam iron comprising a body having a soleplate, means for heating said soleplate, a steam-generating chamber carried by said soleplate, a liquid-storage chamber carried by said body in spaced relation to said soleplate, said storage chamber having an outlet communicating with said steam-generating chamber, a valve for regulating the flow of liquid through said outlet, an operating member for adjusting said valve, said member having a temperature-responsive portion disposed in heat exchange relation to the interior of said storage chamber and adapted to adjust said valve in accordance with the temperature of the contents of said storage chamber.

3. A steam iron comprising a body having a

liquid-storage chamber and a steam generator, means including a valve having an operating member for conveying liquid from said chamber to said generator, said member having an interrupted portion disposed within said chamber, and a curved bimetal element bridging said interrupted portion and adapted to adjust the valve in accordance with temperature changes in said chamber.

4. A steam iron comprising a body having a liquid-storage chamber, a steam generator carried by said body, means including a valve for controlling the flow of liquid from said chamber to said generator, means for opening said valve to provide a given rate of flow of liquid to said steam generator, and means responsive to the temperature of the interior of said chamber for varying said valve opening to maintain said given rate of flow of liquid.

5. A steam iron comprising a body having a liquid-storage chamber provided with an outlet, a steam generator carried by said body and arranged to receive liquid discharged through said outlet, a valve having an operating member for controlling the flow of liquid from said chamber through said outlet to said steam generator, said member being made in two parts, and a U-shaped bimetal element, the arms of said element being secured to the respective parts of said member and connecting said parts together, said bimetal element being located in heat exchange relation to the interior of said chamber.

6. A steam iron comprising a body having a steam generator, means including a valve for supplying liquid to said steam generator, said valve being adjustable to provide a given rate of flow of liquid to said steam generator, and temperature-responsive means in heat exchange relation to said body, said last-mentioned means being adapted to adjust said valve to vary the opening therethrough in accordance with the temperature changes of said body in such a manner as to maintain said given rate of flow of liquid to said steam generator.

7. A steam iron comprising a steam generator, means including a valve for supplying liquid to said steam generator, a valve-operating member for adjusting said valve to provide a given rate of liquid flow to said steam generator, and means, responsive to temperature changes in said iron, engaging said member to compensate for temperature changes in said iron which tend to affect said rate of liquid flow in such a manner as to maintain said rate of liquid flow substantially uniform.

8. A steam iron comprising a body having a liquor-storage chamber and a steam-generating chamber, a soleplate carried by said body, means for heating said soleplate, said storage chamber having an outlet communicating with said steam generator, a valve including an operating member for opening and closing said outlet, means engaging said operating member to resiliently maintain said valve in open or closed position, means for regulating said heating means to maintain said soleplate at any one of a plurality of desired temperatures, means controlled by the adjustment of said temperature-regulating means for limiting the movement of said operating member in accordance with the maintained temperature of said soleplate, said operating member having an interrupted portion disposed within said liquid-storage chamber and a curved temperature-responsive element bridging said interrupted portion and adapted to adjust said valve in accordance with the temperature changes in said liquid-storage chamber.

9. A steam iron comprising a body having an ironing surface, means for heating said surface, means for regulating the temperature of said surface, a steam generator carried by said body, means including a valve for supplying liquid to said generator, snap-action means for maintaining said valve in open or closed position, means controlled by said temperature-regulating means for determining the maximum opening of said valve and thereby provide a predetermined rate of flow of liquid to said generator, and temperature-responsive means for automatically adjusting said valve to vary the opening therethrough in accordance with temperature changes effecting said rate of flow of said iron to substantially maintain said predetermined rate of flow.

10. A steam iron comprising a body having a steam generator, means including an adjustable valve for supplying liquid at substantially a predetermined rate of flow to said steam generator for conversion into steam, and means responsive to change in a temperature existing within the iron, which change tends to vary said rate of flow, said last-mentioned means automatically adjusting said valve in response to said temperature change in the direction to compensate for the tendency of the temperature change to vary the rate of flow and thereby to maintain said predetermined rate of flow to said steam generator.

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