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Toft et al.

[11] **3,919,793**

[45] **Nov. 18, 1975**

[54] **EXTRA CAPACITY STEAM IRON**

[75] Inventors: **Kaj Toft**, Upland; **Wendell C. Walker**, Alta Loma, both of Calif.

[73] Assignee: **General Electric Company**, Bridgeport, Conn.

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[21] Appl. No.: **531,357**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 424,568, Dec. 13, 1973.

[52] **U.S. Cl.** **38/77.83;** 38/77.83

[51] **Int. Cl.**[2] **D06F 75/06**

[58] **Field of Search** 38/77.83, 77.5, 77.8, 77.81, 38/77.82

[56] **References Cited**

UNITED STATES PATENTS

3,041,757	7/1962	Swenson et al.	38/77.83
3,183,611	5/1965	Swenson	38/77.83
3,599,357	8/1971	Gronwick	38/77.5
3,703,043	11/1972	Ogata	38/77.83
3,711,972	1/1973	Risacher	38/77.83
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3,820,259	6/1974	Flowers	38/77.5
3,828,452	8/1974	Eaton et al.	38/77.83

Primary Examiner—Patrick D. Lawson

Attorney, Agent, or Firm—George R. Powers; John F. Cullen; Leonard J. Platt

[57] **ABSTRACT**

An electric steam iron having first and second steam generating means for converting water into steam for selective dispersal through primary and secondary ports in the soleplate of the iron. The first steam generating means communicates only with the primary ports through a primary plenum means, and the second steam generating means communicates only with the secondary ports through a secondary plenum means. Water supply means are provided for selectively supplying water to said first and second steam generating means such that water supplied to the first steam generating means is discharged as steam only through the primary ports and water supplied to the second steam generating means is discharged as steam only through the secondary ports.

15 Claims, 3 Drawing Figures

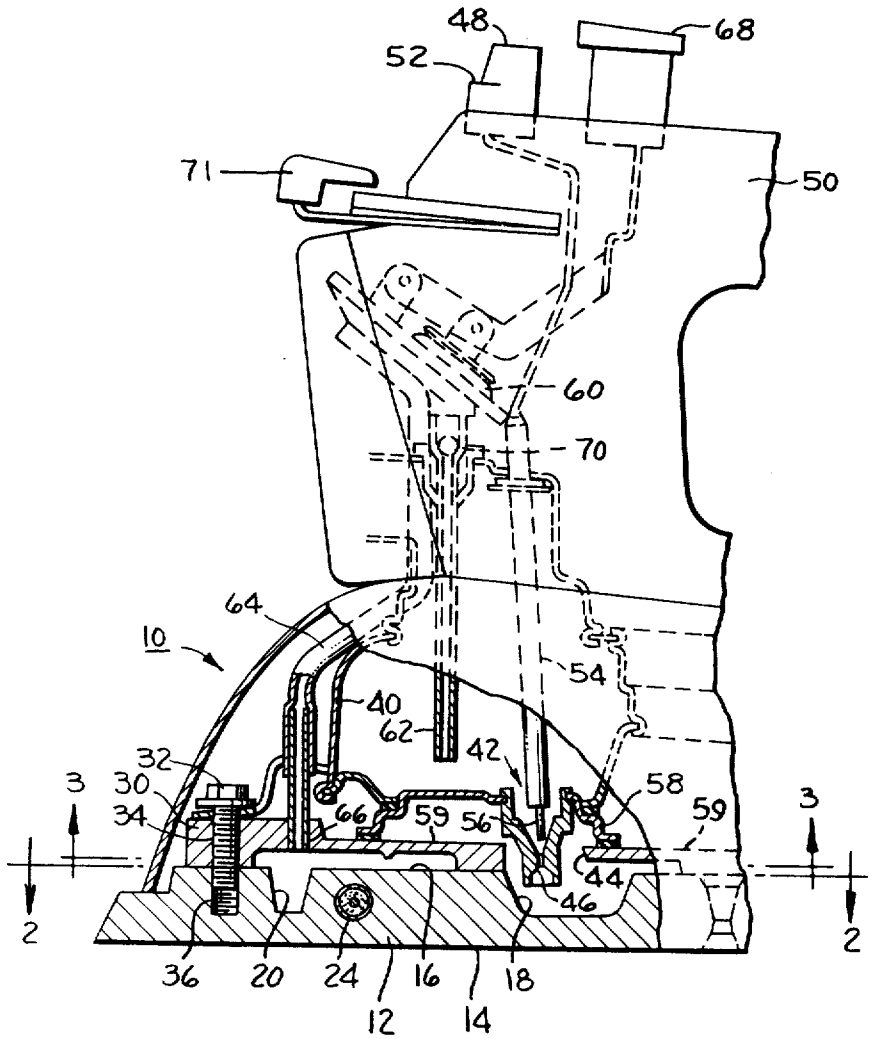


Fig. 1.

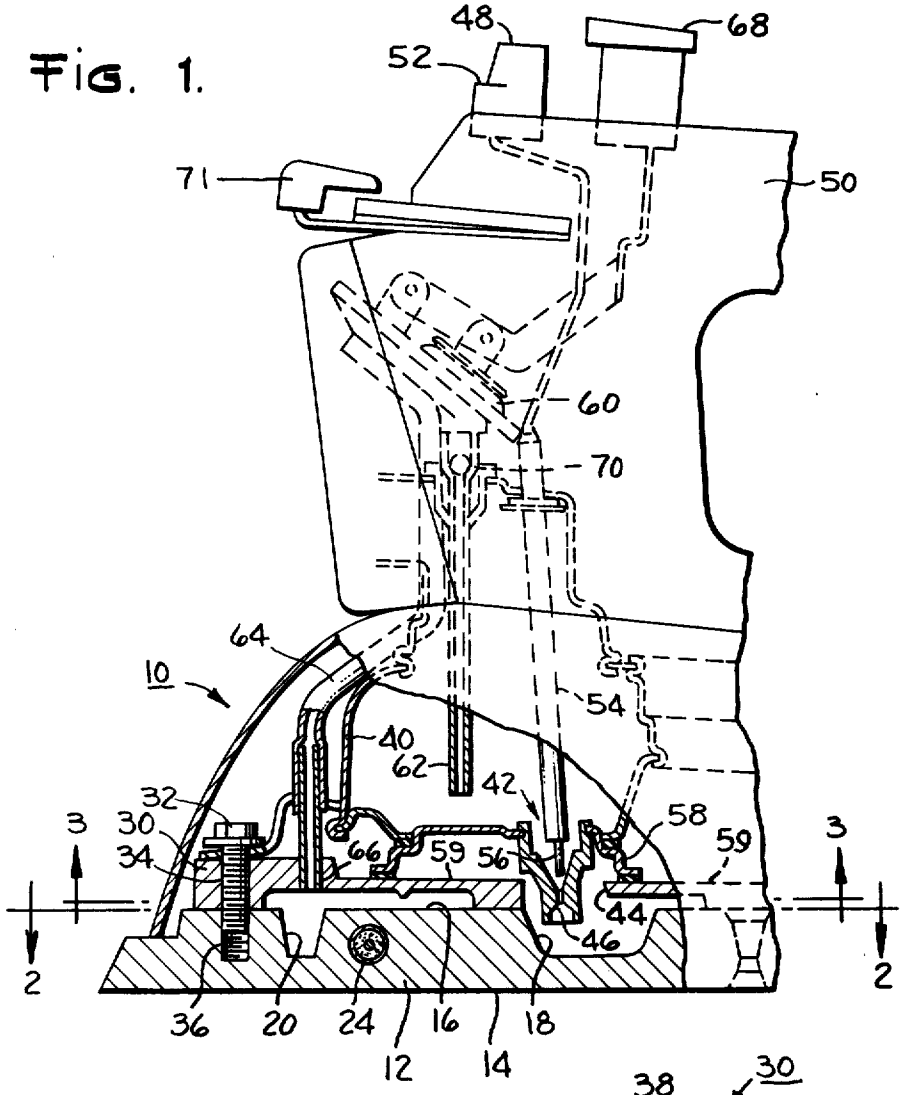

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Fig. 3.

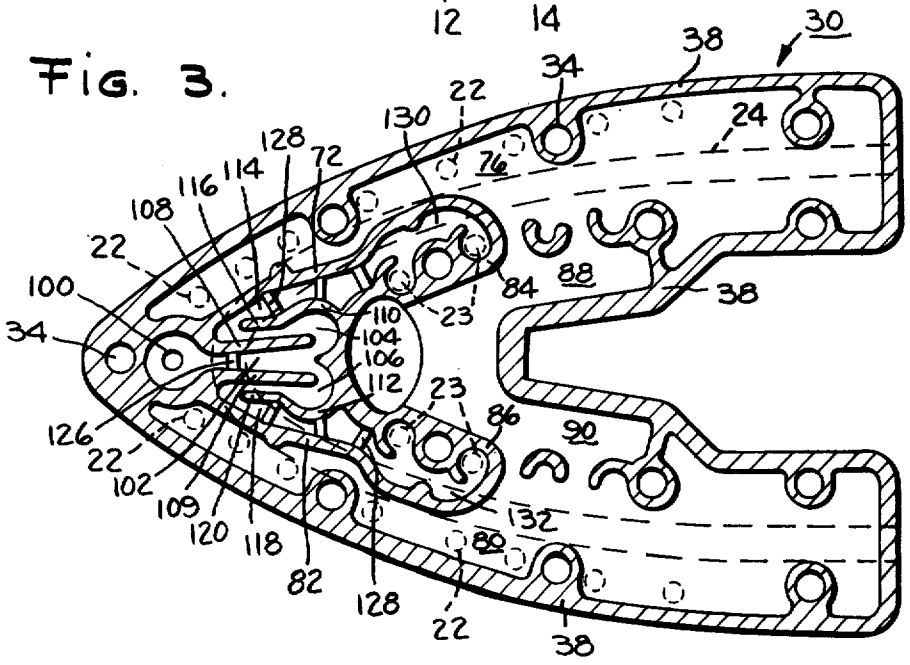
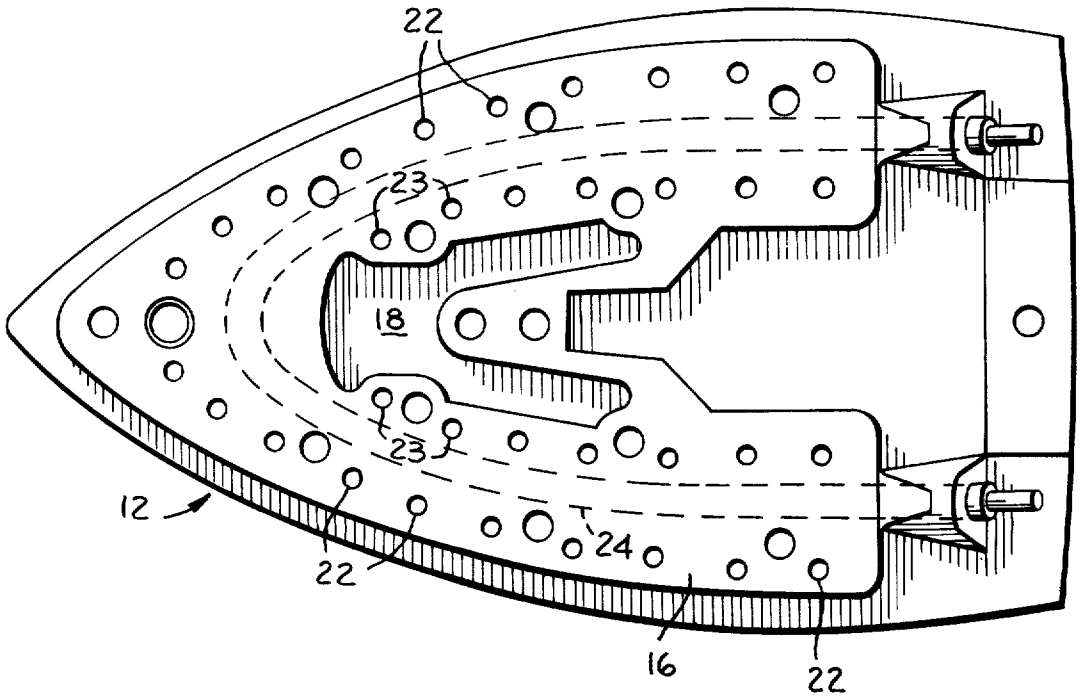

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FIG. 2.



EXTRA CAPACITY STEAM IRON

This application is a continuation-in-part of copending patent application Ser. No. 424,568 for "Steam Iron," filed Dec. 13, 1973, by Kaj Toft and Wendell C. Walker and assigned to the assignee of this application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electric steam irons and, more particularly, to steam irons capable of producing a relatively heavy steam flow of short duration.

2. Description of the Prior Art

Under certain ironing conditions, it may be desirable to supplement the uniform steam flow of a conventional steam iron with a short burst of relatively heavy steam flow. The extra steam generated in the iron and dispelled in a short period of time through the ports in the soleplate of the iron has much greater velocity and hence penetrating power than the normal steam flow of the iron. As a result, irons having extra steam capabilities are particularly useful in ironing thick or multiple thickness fabrics or garments in which stubborn wrinkles may be located beyond the penetrating range of normal steam flow.

Steam irons having extra steam capability have been proposed and built in the past, U.S. Pat. Nos. 3,599,357 to Gronwick; 3,711,972 to Risacher; and 3,828,452 to Eaton et al being illustrative of various extra steam constructions. To produce a surge of extra steam in steam irons, a relatively large quantity of water is quickly introduced into a hot soleplate cavity or boiler, from which it is directed through appropriate distribution passages to the soleplate ports.

It is desirable that the extra steam be discharged with velocity as high as possible in order to provide deep penetration into the fabric being ironed.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide an improved iron construction for producing high velocity extra steam.

Another object of this invention is to provide an extra capacity steam iron having improved steam generation means for producing high velocity extra steam while assuring rapid and essentially total conversion to steam of a relatively large quantity of water rapidly injected into the steam generation means.

Briefly stated, in carrying out the invention in one form, an electric iron having a soleplate with a heating element for heating the soleplate is provided with cover means which cooperates with the soleplate to define primary plenum means, secondary plenum means independent of the primary plenum means, first steam generating means communicating with the primary plenum means, and second steam generating means communicating with the secondary plenum means. The soleplate has a plurality of primary ports therethrough communicating only with the primary plenum means and at least one secondary port therethrough communicating only with the secondary plenum means. Supply means are provided for selectively supplying water to the first steam generating means and for selectively supplying water to the second steam generating means. During iron operation, water supplied to the first steam generating means is converted to steam and is discharged from the iron only through the primary ports, and water

supplied to the second steam generating means is converted to steam and is discharged from the iron only through the secondary ports. By a further aspect of the invention, there are a substantially greater number of the primary ports than secondary ports, and the supply means is adapted to selectively supply water to the first steam generating means at a substantially continuous metered rate and to selectively supply water to the second steam generating means for brief intervals of time at a momentary rate substantially greater than the metered rate to the first steam generating means. In this manner, steam discharged through the smaller number of secondary ports has much greater velocity and penetrating power than steam discharged through the greater number of primary ports.

By still further aspects of the invention, the second steam generating means comprises a soleplate boiler chamber and a circuitous passage means connecting the soleplate boiler chamber and the secondary plenum means. To provide rapid and essentially total conversion of the relatively large quantity of water rapidly injected into the soleplate boiler chamber, the circuitous passage means crosses the heating element. The first steam generating means also includes a soleplate boiler chamber and the boiler chambers of the first and second steam generating means are located on opposite sides of the heating element. The heating element is preferably U-shaped, and the soleplate boiler chamber of the second steam generating means is located forward of the U-shaped heating element in the front portion of the soleplate.

BRIEF DESCRIPTION OF THE DRAWINGS

While the novel features of the invention are set forth with particularity in the appended claims, the invention, both as to organization and content, will be better understood and appreciated, along with other objects and features thereof, from the following detailed description taken in conjunction with the drawings, in which:

FIG. **1** is an elevation view of the front portion of an electric steam iron incorporating the present invention, the lower portion of the iron being shown in cross-section and the upper portion of the iron illustrating internal iron components by broken lines;

FIG. **2** is a view of the upper surface of the soleplate of the iron taken along viewing line **2—2** of FIG. **1**; and

FIG. **3** is a view of the coverplate of the iron taken along viewing line **3—3** of FIG. **1**, the location of the heating element and the ports in the soleplate relative to the coverplate being illustrated by broken lines.

DETAILED DESCRIPTION

As shown by FIGS. **1** and **2**, an iron indicated generally by the numeral **10** includes a flat soleplate **12** having a smooth flat lower ironing surface **14** and a substantially flat upper deck **16**. The soleplate **12** has a pair of cavities **18** and **20** therein opening upwardly to the upper deck **16**. The purpose of the cavities **18** and **20** will become obvious as this description proceeds. A plurality of primary ports **22** and a smaller plurality of secondary ports **23** are provided in the soleplate **12** extending from the upper deck **16** to the ironing surface **14**. In accordance with conventional practice, soleplate **12** may be made from a suitable material such as cast aluminum with an electrical loop or U-shaped heating element **24** cast in position. This heating element preferably is of the sheath type and, with an electrical resis-

tance element, extends through an outer tubular protective sheath with the heating element separated from the outer sheath by an insulating compound resistant to heat such as granulated and compressed magnesium oxide. As illustrated by broken lines in FIG. 2, the heating element generally extends in a U-shaped loop beginning at the rear of the iron and along one side to the front generally pointed portion of the soleplate and then rearwardly along the other side such that the open end of the U faces the rear of the soleplate. Thus, substantially uniform heat distribution is provided in the soleplate 12 when the iron is plugged in and activated.

Referring now to FIGS. 1 and 3, a coverplate 30, which may also be made of a suitable material such as die cast aluminum, is mounted on the upper deck 16 and is secured to the soleplate 12 by suitable fastening means such as the illustrated machine screw 32 passing through openings 34 in the coverplate 30 and into threaded bores 36 in the soleplate 12. Unlike the substantially flat soleplate 12, the coverplate 30 is provided as best illustrated by FIGS. 3 and 4 with a large number of depending walls which cooperate with the essentially flat deck 16 of the soleplate 12 (and the cavities 18 and 20 therein) for forming a number of chambers, passages, and plenums therein. More particularly, the coverplate 30 includes a peripheral wall 38 which extends around the entire boundary of the coverplate 30 and seats against the flat deck 16 of the soleplate 12 to prevent leakage therebetween. If the seal provided by the mating wall 38 and the soleplate 12 is insufficient in practice, an appropriate sealant may be applied to the peripheral joint between the soleplate and the coverplate to further prevent leakage.

Still referring to FIGS. 1 and 3, the iron 10 further includes a water tank 40 mounted above and substantially coextensive with the coverplate 30. A metering valve generally indicated by the numeral 42 is provided in the bottom of the water tank 40 directly above the cavity 18, the lower portion of the valve 42 extending downwardly from the water tank 40 through an aligned opening 44 in the coverplate 30. The water valve 42 has a relatively small orifice 46 therein through which water may drip from the water tank 40 into the cavity 18 at a metered rate selected for substantially continuous conversion of water into steam. If desired, the iron may be used in a dry mode by depressing button 48 on the iron handle 50 until locking surface 52 thereon engages a mating surface (not shown) on the handle 50 to hold the button 48 in its depressed position. When the button 48 is depressed, stem 54 attached thereto is moved downwardly until its reduced diameter lower end portion 56 moves into the metering orifice 46 to seal the orifice, thus preventing the entry of additional water into the cavity 18. To prevent escape of steam from the cavity 18 upwardly around the water tank 40, walls 58 surround the water valve 42 and are sealed with respect to both the tank 40 and the upper surface 59 of the coverplate 30.

A diaphragm pump 60 is located above the water tank 40 in the front portion of the handle 50 with a water inlet tube 62 depending therefrom into the tank 40. A water outlet tube 64 connects the diaphragm pump 60 with the cavity 20 in the front portion of the soleplate 12, the lower end of the tube 64 being tightly received in an opening 66 in the coverplate 30. The diaphragm pump 60 is operated by a pushbutton 68 on the iron handle 50. When the button 68 is depressed, a measured quantity of water from the tank 40 is drawn up the tube 62 past a ball check valve 70 and then ejected through the outlet tube 64 into the cavity 20 in the soleplate 12. In this manner, water is injected into the cavity 20 for only brief intervals of time at a momentary rate greater than the rate at which water can be metered through the orifice 46 of the valve 42. In accordance with the unique arrangement of chambers and passages provided by the soleplate 12 and the coverplate 30, the amount of water supplied by the pump 60 may be maximized without substantial risk of incomplete vaporization and water spotting. The diaphragm pump 60 will not be further described since various pump arrangements may be used to supply water to the cavity 20. As an example, the diaphragm pump structure disclosed by U.S. Pat. No. 3,183,611 to Alfred G. Swenson may be used in connection with the present invention.

The iron 10 also includes a temperature selector 71 which through appropriate control apparatus (not illustrated) controls the energization of the heating element 24 when the iron is connected to a source of electric power to maintain the temperature of the soleplate 12 at a selected temperature.

Referring now to FIGS. 1 through 3, the soleplate 12 and the peripheral wall 38 and interior walls including walls 72 and 82 of the coverplate 30 cooperate to form primary plenum means including a plenum 76 along the upper edge of the iron as illustrated by FIG. 3 and a plenum 80 along the lower edge of the iron as illustrated by FIG. 3. The plenum 76 communicates with the primary ports 22 in the lower portion of the soleplate 12 as illustrated by FIG. 2 such that steam supplied to plenum 76 will in turn be delivered to the primary ports 22 and ejected through the primary ports 22. Similarly, the plenum 80 communicates with the primary ports 22 in the upper portion of the soleplate 12 as illustrated by FIG. 2. The primary plenum means is thus symmetrically disposed with respect to the longitudinal centerline of the soleplate 12. Walls 38, 84 and 86 of the coverplate 30 cooperate with the deck 16, the cavity 18 and the walls 58 between the coverplate 30 and the tank 40 to form a first steam generating means in which water metered through the orifice 46 is flashed into steam in the cavity 18 and then delivered through the passages 88 and 90 to the plenums 76 and 80, respectively of the primary plenum means. This first steam generating means is essentially a conventional steam generator of the flash boiler type, the cavity 18 being conventionally referred to as the "boiler" of the iron. Since water is essentially continuously metered into the cavity or soleplate boiler chamber 18 at a relatively slow rate at which the heating element 24 and the heat it transmits to the soleplate 12 can readily convert the water to steam, the passages 88 and 90 and boiler itself can be of relatively simple construction. Since there are a large number of primary ports 22 and water is continuously metered into the soleplate boiler chamber 18 at a relatively slow rate, the steam generated in the first steam generating means is discharged through the primary ports 22 in the relatively gentle manner desired for normal ironing applications.

In accordance with the present invention, a secondary plenum means is provided, the secondary plenum means including a pair of plenums 130 and 132 symmetrically disposed with respect to the longitudinal centerline of the soleplate 12. As illustrated by FIG. 3, the plenum 130 is located inboard of the primary plenum 76 and is formed between the soleplate and the

coverplate by depending coverplate walls **72** and **84**. The plenum **130** communicates with the secondary ports **23** in the lower portion of the soleplate **12** as illustrated by FIG. **2** such that steam supplied to the plenum **130** is ejected through the relatively small number, in this case, two, of secondary ports **23**. Similarly, the secondary plenum **132** is formed inboard of the primary plenum **80** by coverplate walls **82** and **86**. The plenum **132** communicates with the secondary ports **23** in the upper portion of the soleplate **12** as illustrated by FIG. **2** such that steam supplied to the plenum **132** is ejected through the relatively small number of secondary ports.

As best illustrated by FIGS. **1** and **3**, a second or extra steam generating means includes a soleplate boiler chamber **100** formed by the soleplate **12** including the cavity **20** and the coverplate **30**. The soleplate boiler **100** of the second steam generating means is located forward of the U-shaped heating element **24** and the soleplate boiler **18** in the front or nose portion of the iron, and a passage **102** extends rearwardly from the relatively large chamber **100** across the heating element **24** to a pair of expansion chambers **104** and **106**, the passage **102** and the expansion chambers **104** and **106** also being formed by the upper deck **16** of the soleplate **12** and walls depending from the coverplate **30**. More particularly, the passage **102** is a converging-diverging passage partially defined by walls **108** and **109**, and the expansion chambers **104** and **106** are partially defined by curved walls **110** and **112**, respectively. A passage **114** connects the expansion chamber **104** and the plenum **130**, the passage **114** being defined by coverplate walls **108**, **116**, and **72** in cooperation with soleplate deck **16**. A similar passage **118** symmetrically disposed with respect to the passage **114** and the longitudinal connects the expansion chamber **106** and the plenum **132**, the passage **118** being defined by coverplate walls **109**, **120** and **82** in cooperation with the soleplate deck **16**. The upstream ends of the passages **114** and **118** are substantially parallel with the downstream end of the passage **102** such that steam and water passing through the chambers **104** and **106** is turned through approximately 180°. It will thus be seen that the passages **102**, **114** and **118** and the expansion chambers **104** and **106** comprise circuitous passage means interconnecting the soleplate boiler **100** and the plenums **130** and **132** of the secondary plenum means.

A rib **126** is provided across the throat portion of the converging-diverging passage or nozzle **102** to further restrict its flow area and to deflect water and steam passing therethrough downwardly against hot deck **16** of the soleplate **12**. A plurality of similar ribs **128** are provided in each of the passages **114** and **118** to provide flow restrictions and to further deflect water and steam flowing therethrough downwardly against the hot deck **16** of the soleplate **12**.

When it is desired to provide extra steam (whether or not the orifice **46** is open and supplying water to the first steam generating means), the button **68** on the handle **50** is pumped once, and a measured amount of water is drawn up the inlet tube **62** and is discharged from the diaphragm pump **60** through the outlet tube **64** into the cavity **20** and the expansion chamber **100**. Since the chamber **100** is adjacent the heating element **24** and is relatively large, the water injected into the chamber **100** absorbs heat from the soleplate **12**, partially vaporizes and expands within the chamber **100** until the pressure builds up to a level sufficient to force the partially vaporized water out of the expansion chamber **100** and through the circuitous passage means comprising the nozzle **102**, the expansion chambers **104** and **106**, and the passages **114** and **118** to the symmetrically disposed secondary plenums **130** and **132**.

Since there are a relatively small number of secondary ports **23** and water is injected into the soleplate boiler chamber **100** for only brief intervals of time at a momentary rate greater than the rate at which water is metered into the first steam generating means, the steam generated in the second steam generating means is discharged through the secondary ports **23** at much higher velocity than that discharged from the primary ports **22**. The extra steam discharged through the secondary ports **23** is thus particularly adapted for use in fabrics requiring deep penetrating steam for deep down wrinkles and the like.

As illustrated by FIG. **3**, the soleplate boilers **18** and **100** of the first and second steam generating means are preferably positioned on opposite sides of the heating element **18** in order to promote rapid and efficient use of the heat transferred to the soleplate **12** in the generation of normal and extra steam. To further enhance heat transfer to the relatively large quantity of water injected into the boiler chamber **100**, the circuitous passage means leading from the chamber **100** to the secondary plenums **130** and **132** preferably crosses or extends over the heating element **118** at one or more points to assure rapid heat transfer from the heating element to the vaporizing water. In the illustrated embodiment of the invention as illustrated by FIG. **3**, the second steam generating means and the secondary plenums **130** and **132** are located inboard of the primary plenums **76** and **80**, a portion of the inner walls **72** and **82** of the primary plenums **76** and **80** forming an outer wall of the plenums **130** and **132**.

From the foregoing, it will be seen that this invention provides an improved iron construction for providing high velocity extra steam while simultaneously assuring rapid and essentially total conversion to steam of a relatively large quantity of water rapidly injected into the steam generating means. This is accomplished by utilizing totally independent steam generating means for the extra steam and discharging the extra steam through a limited number of soleplate ports used only for the delivery of extra steam.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form, details, and application may be made therein without departing from the spirt and scope of the invention. For example, while two secondary ports **23** have been shown in communication with each secondary plenum, it will occur to those skilled in the art, more or less ports could be used depending upon the discharge velocity desired. Also, although the various chambers and passages as illustrated are symmetrically disposed with respect to the longitudinal centerline of the soleplate, it will be obvious that a symmetrical arrangement is not required for the practice of the present invention in its broader aspects. Accordingly, it is intended that all such modifications and changes be included within the scope of the appended claims.

What is claimed as new and is desired to secure by letters patent of the United States is:

1. An extra capacity steam iron comprising:

a soleplate;

a heating element for heating said soleplate;

cover means on said soleplate;

said soleplate and said cover means defining therebetween primary plenum means, secondary plenum means independent of said primary plenum means, first steam generating means communicating with said primary plenum means, and second steam generating means independent of said first steam generating means communicating with said secondary plenum means;

and supply means for selectively supplying water to said first steam generating means and for selectively supplying water to said second steam generating means,

said soleplate having a plurality of primary ports therethrough communicating only with said primary plenum means such that water supplied to said first steam generating means is converted to steam and discharged from the iron through said primary ports, and said soleplate having at least one secondary port therethrough communicating only with said secondary plenum means such that water supplied to said second steam generating means is converted to steam and discharged from the iron through said secondary port.

2. An extra capacity steam iron as defined by claim **1** in which said second steam generating means comprises a soleplate boiler chamber and a circuitous passage means connecting said soleplate boiler chamber and said secondary plenum means.

3. An extra capacity steam iron as defined by claim **2** in which said secondary plenum means comprises a pair of plenums disposed symmetrically with respect to the longitudinal centerline of said soleplate and at least one secondary port communicates with each of said plenums, said circuitous passage means being disposed symmetrically about the longitudinal centerline of said soleplate.

4. An extra capacity steam iron as defined by claim **2** in which said first steam generating means includes a soleplate boiler chamber, said soleplate boiler chamber of said second steam generating means being located forward of said soleplate boiler chamber of said first steam generating means in the nose portion of said soleplate.

5. An extra capacity steam iron as defined by claim **2** in which said circuitous passage means crosses said heating element.

6. An extra capacity steam iron as defined by claim **2** in which said first steam generating means includes a soleplate boiler chamber, said soleplate boiler chambers of said first and second steam generating means being located on opposite sides of said heating element.

7. An extra capacity steam iron as defined by claim **6** in which said heating element is imbedded within said soleplate and in which said heating element is generally U-shaped with the open end of the U facing the rear of the soleplate, said soleplate boiler chamber of said second steam generating means being located forward of said heating element in the nose portion of said soleplate.

8. An extra capacity steam iron as defined by claim **7** in which said circuitous passage means crosses said heating element.

9. An extra capacity steam iron as defined by claim **2** in which said second steam generating means is located within said primary plenum means.

10. An extra capacity steam iron as defined by claim **2** in which said soleplate has a substantially greater number of primary ports communicating with said primary plenum means than secondary ports communicating with said secondary plenum means and in which said supply means is adopted to selectively supply water to said first steam generating means at a substantially continuous metered rate and to selectively supply water to said second steam generating means for brief intervals of time at a momentary rate substantially greater than the metered rate to said first steam generating means such that steam discharged through said secondary ports has much greater velocity and penetrating power than steam discharged through said primary ports.

11. An extra capacity steam iron as defined by claim **10** in which said first steam generating means includes a soleplate boiler chamber for receiving water from said supply means, said soleplate boiler chambers of said first and second steam generating means being located on opposite sides of said heating element.

12. An extra capacity steam iron as defined by claim **11** in which said heating element is generally U-shaped with the open end of the U facing the rear of the soleplate, said soleplate boiler chamber of said second steam generating means being located forward of said heating element in the nose portion of said soleplate.

13. An extra capacity steam iron as defined by claim **12** in which said circuitous passage means crosses said heating element.

14. An extra capacity steam iron as defined by claim **13** in which said primary plenum means is disposed symmetrically with respect to the longitudinal centerline of said soleplate and in which said second steam generating means is located within said primary plenum means.

15. An extra capacity steam iron as defined by claim **14** in which said secondary plenum means comprises a pair of plenums disposed symmetrically with respect to the longitudinal centerline of said soleplate and at least one secondary port communicates with each of said plenums, said circuitous passage means being disposed symmetrically about the longitudinal centerline of said soleplate.

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