July 2, 1957 H. MAYKEMPER 2,797,507

HAND PRESSING STEAM IRON

Filed Aug. 6, 1954 3 Sheets-Sheet 1

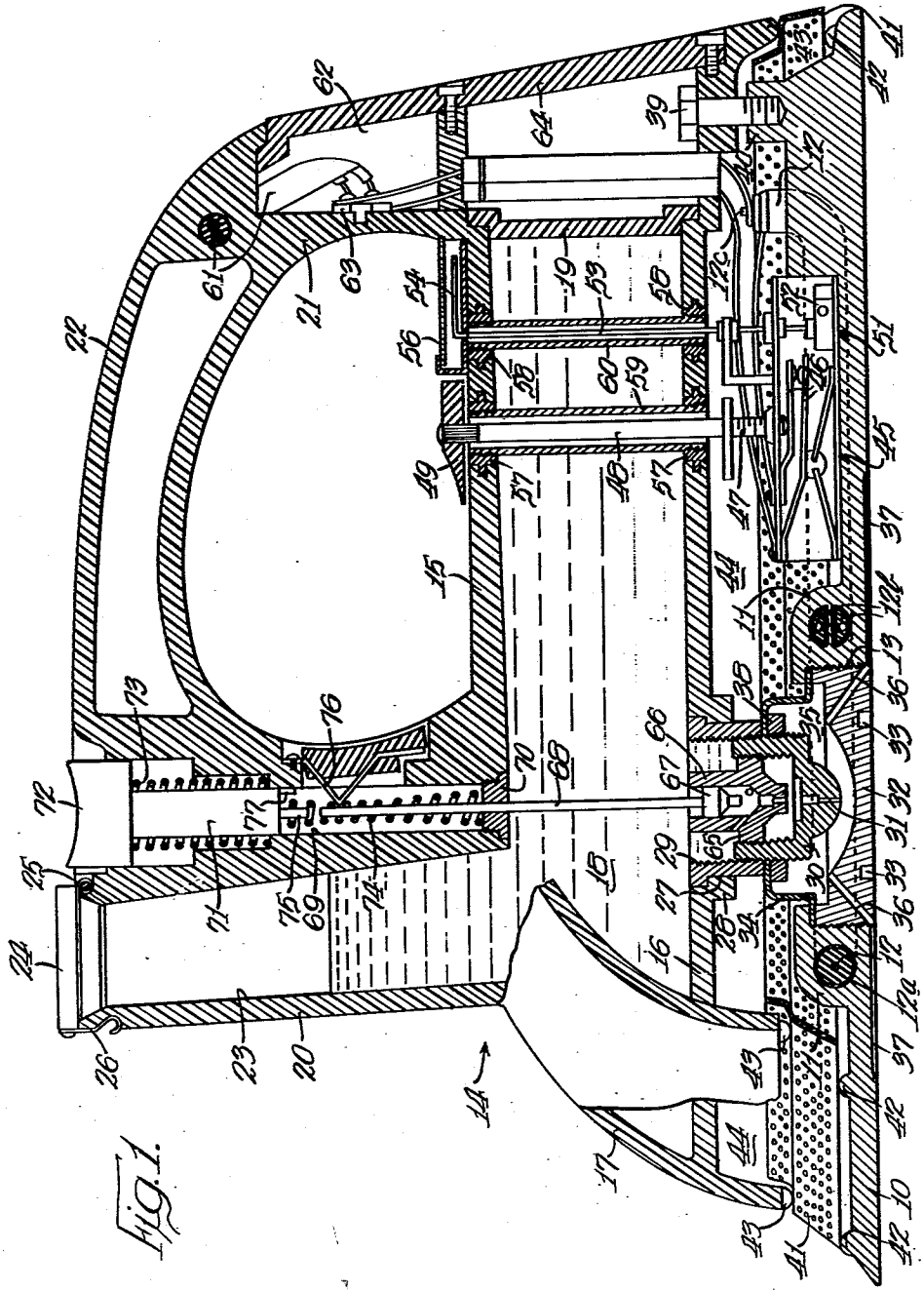


Fig. 1.

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Fig. 2.

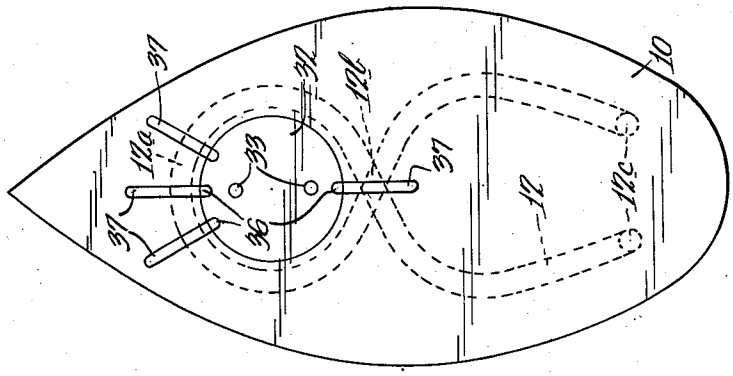
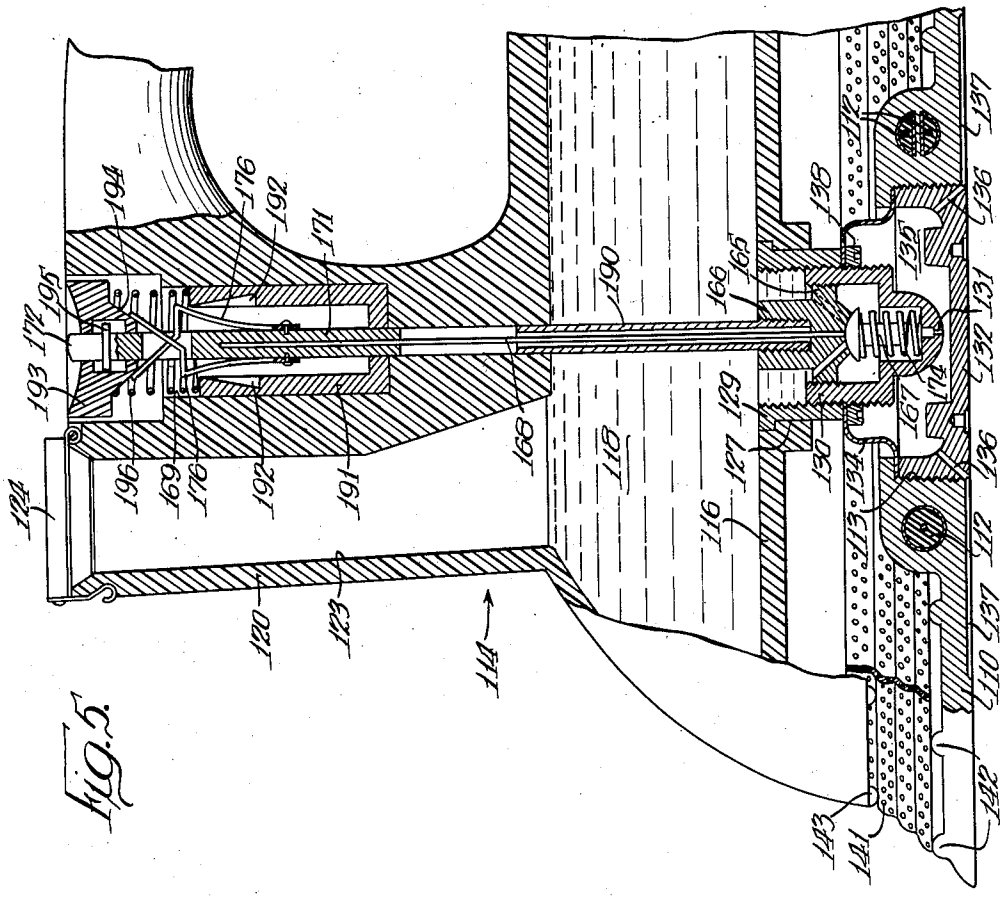


Fig. 5.



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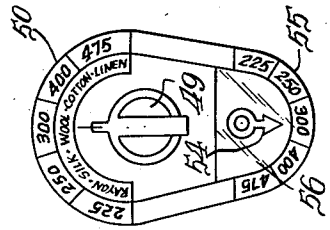


Fig. 3.

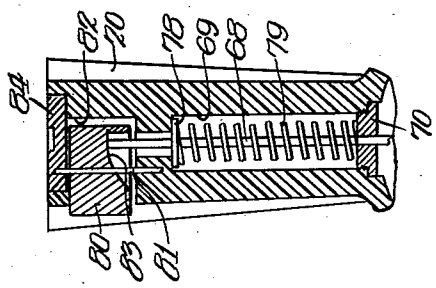


Fig. 4.

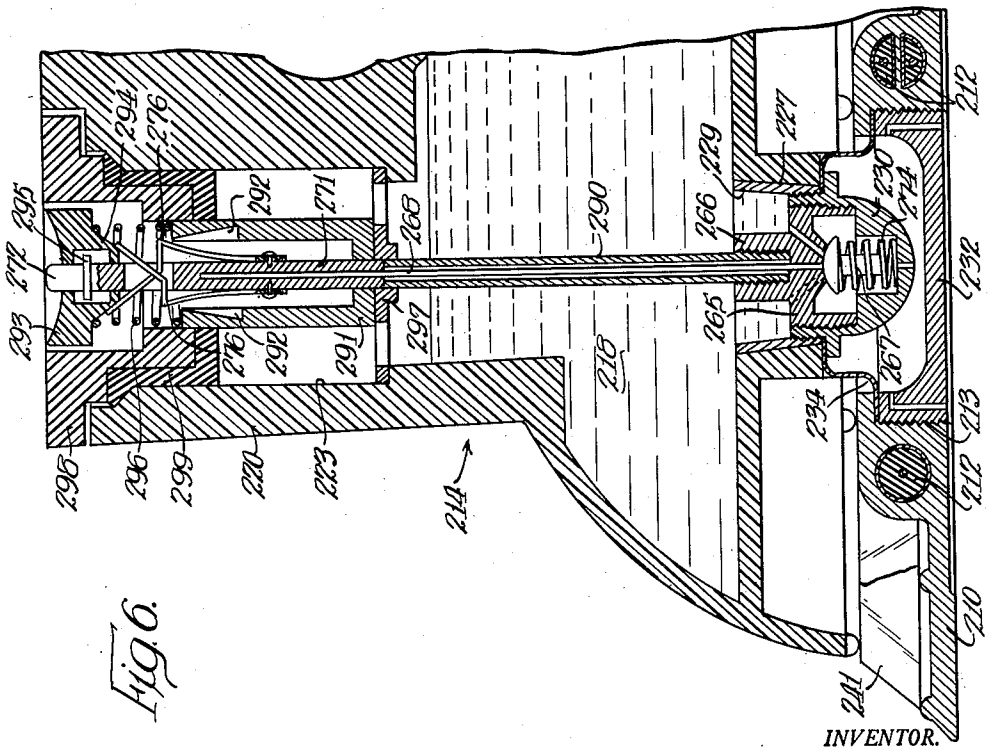


Fig. 6.

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United States Patent Office

2,797,507

Patented July 2, 1957

2,797,507

HAND PRESSING STEAM IRON

Henry Maykemper, Eau Claire, Wis.

Application August 6, 1954, Serial No. 448,171

5 Claims. (Cl. 38—77)

The present invention relates to electric sadirons, and particularly, to improved pressing irons adapted selectively for steam ironing and dry ironing.

In my Patent No. 2,615,265, issued October 28, 1952, I have disclosed a steam iron comprising a sole plate having an electric heating element embedded therein, a housing defining a tank or reservoir for holding water which tank is insulated with respect to the sole plate, and a steam generator unit extending between the sole plate and the tank to the interior of the tank. The steam generator comprises means for transmitting a limited amount of heat from the sole plate to the water in the tank to heat the water and generate steam at a relatively slow but consistent rate, the steam accumulating in the upper portion of the tank. The generator also defines a path for conducting steam from the upper portion of the tank to the lower exterior surface of the sole plate and includes means for superheating, and removing entrained drops of moisture from the steam in its passage from the tank so as to discharge relatively dry steam directly into the material being ironed. For dry ironing, it is only necessary to empty the water from the tank. This iron has met with wide-spread acceptance and has enjoyed great commercial success. However, in an increasingly price-conscious market, it is desirable to decrease the cost and increase the features or advantages of the iron, but this has proved exceedingly difficult. One substantial factor in the cost of the iron is the necessity for forming a water tank that is not only water-tight, but also steam and pressure-tight to accommodate the build-up of a few pounds steam pressure in the tank. The tank is necessarily formed of metal and its fabrication is quite expensive irrespective of the method employed. Further, in a price-conscious market, it is highly desirable to enhance the special selling features of the iron and, if possible, to increase the number of selling points.

It is an object of the present invention to provide improved steam irons of more economical constructions than, and exhibiting advantages and important selling features over, prior proposals in the art.

In respect of the economy of manufacture, it is first an object of the invention to provide improved steam irons eliminating the necessity for a pressure-tight water reservoir. This is accomplished according to the invention by providing means within the iron for flash evaporation of water outside of the water tank so that steam is not accumulated within, and a pressure head is not created in the tank. Further, it is an object of the present invention to afford improved flash evaporation means of a highly efficient yet economical nature.

A further, but primary object of the invention, accommodated or permitted by development and adoption of improved flash vaporization means in accordance with the above object, is the provision of an improved water tank, iron housing and handle construction comprising, preferably, a unitary plastic casting or molding. Since the water tank, according to the invention, need not be capable

of sustaining interior pressure loads and need not be subjected to high heat, adoption of known moldable plastic materials for the tank and housing is completely practical. Such materials are relatively inexpensive, are economically molded in any variety of forms, and are water-tight. Secondly, many plastic materials usable for the purposes of this invention are capable of being colored so that the iron may be supplied with unitary housings and handles in a variety of colors. Also, the iron may suitably be manufactured of a separate housing and handle of different colors to give the housewife a wide selection of gay and cheerful color schemes to brighten, at least in part, an otherwise gloomy task. The harmony of a gleaming, gaily colored iron and freshly laundered and pressed articles will contribute substantially to the housewife's feeling of a job well done and thus to her emotional and psychological welfare. Returning to harsh reality, the all-plastic handle and housing afford the further advantage that the same will not transmit substantial heat from the iron sole plate to the area of the user's hand and will remain relatively cool to the touch, particularly in view of the cooling influence of the water in the tank or reservoir, thus eliminating burned fingers and knuckles and an uncomfortable heating condition at and adjacent the handle. Accordingly, it is to be appreciated that an all-plastic iron handle and housing as provided according to the present invention afford the substantial advantages of greater economy of manufacture, reduced heat transmission and elimination of exposed heated areas that could result in burns on the user's hand, all of which are important features in the retail trade, together with the further selling point or "extra" of affording a cheerfully colored iron.

Concerning the transmission of heat from the sole plate of the iron to the housing, reservoir and handle unit, it is an additional object of the invention efficiently to insulate the sole plate from the housing and tank by establishing a substantial air space between the sole plate and housing, which air space is open to a cooling flow of air. Specifically, it is an object of the invention to provide a spacer between the sole plate and the housing at the peripheries thereof, the spacer having a limited area of contact with both the sole plate and the housing and being formed to accommodate flow of air between the sole plate and the housing.

A further innovation of the present invention is the utilization of perforated sheet metal of low heat conductivity as spacer means, the metal conducting very little heat from the sole plate and being cooled by passage of air through the perforations thereof. Also, the perforated metal accommodates efficient air flow between the upper surface of the sole plate and the lower surface of the water reservoir to prevent transmission of sensible heat to the housing, tank and handle. According to such arrangement, the sole plate is not sapped of heat, whereby heating of the sole plate is efficient and uniform, and the housing and handle remain relatively cool to the touch.

With my prior steam iron, as noted above, it is necessary to empty the water from the tank when it is desired to change from steam ironing to dry ironing, and to refill the tank when it is desired to return to steam ironing. While this is not particularly objectionable, it would be advantageous to accommodate an immediate change-over from one type of ironing to the other, and certainly, such feature would enhance the saleability of the iron. It is an object of the present invention to provide improved means of particularly economical construction accommodating instantaneous change from steam ironing to dry ironing and from dry ironing to steam ironing merely, for example, by finger actuation of a button in the iron handle.

According to the present invention, the objects of affording improved vaporization and changeover control means are accomplished by providing a valved conduit between the water reservoir and an apertured portion of the sole plate and by providing a control rod extending upwardly from the valve in said conduit to the upper surface of the iron handle, at which point means are provided for manually actuating the rod to open and close the valve. When the valve is open, continuous drip feed of water to the upper surface of the sole plate is accommodated, the water upon contact with the heated sole plate being flashed into steam. The sole plate and conduit are so formed as to define a relatively small steam chamber and the sole plate is apertured at points not aligned with the conduit to establish communication between the chamber and the lower exterior surface of the iron. Upon closing the valve, generation of additional steam is prevented and the steam in the chamber is immediately dissipated so that the iron is almost instantaneously conditioned for dry ironing. Upon reopening of the valve, flash evaporation of water commences immediately, rapidly to fill the chamber and re-initiate steam operation almost instantaneously.

In conjunction with the flash evaporating means of the invention, a further object is the provision of an improved sole plate and heating element combination, particularly, an improved arrangement of the heating element, to afford concentrated heating of the flash evaporation means.

The present invention and the above enumerated features thereof are capable of embodiment in a wide variety of structures and I hereinafter describe a number of embodiments that I prefer. In one, the changeover control means is incorporated in the filler opening of the water reservoir or tank, which affords the advantage of less complicated molding of the housing, tank and handle. In other embodiments, the filler opening is unobstructed, and in one of these, the valve operating springs and control rod latch means are completely separated from contact with water to insure long life and efficient service of the control means. In the description of these embodiments, other objects and advantages of the invention will become apparent.

Now, in order to acquaint those skilled in the art with the manner of constructing and using the iron of the present invention, I shall describe, in connection with the accompanying drawings, preferred embodiments of the iron and preferred manners of making and using the same.

In the drawings, wherein like reference numerals refer to like parts:

Figure 1 is a side view, principally in section and partly in elevation, of one embodiment of the steam and dry iron of the invention;

Figure 2 is a bottom view of the iron sole plate showing, in dotted lines, the improved arrangement of the heating element;

Figure 3 is a plan view of the heat control and temperature indicating means incorporated in the iron;

Figure 4 is a fragmentary, transverse, sectional view of the front leg of the iron handle showing a modification of the changeover control operating means;

Figure 5 is a fragmentary view, somewhat similar to Figure 1, of a second embodiment of the iron; and

Figure 6 is a fragmentary view, similar to Figure 5, of a third embodiment of the iron.

Referring now to the drawings, and particularly to Figure 1, I have shown a preferred embodiment of a steam iron formed according to the invention. The iron includes a sole plate **10** of generally thin section having raised or relatively thick boss portions **11** on the upper surface thereof within which an electric heating element **12** is embedded to heat the sole plate. Adjacent the forward end thereof, the sole plate **10** has a stepped bore **13** therethrough and the relatively thick boss portion **11** completely circumscribes the bore. According to the present invention, a greatly improved arrangement of

the heating element is provided, particularly for steam irons, by disposing the element **12** at least substantially to encircle the bore **13**. In particular, the heating element preferably completely encircles the bore **13** within the boss **11** by disposition of the element in generally a figure eight configuration, as is shown in dotted lines in Figure 2, or in any other similar configuration. The heating element **12** conventionally is circular, as indicated at **12***a* in Figure 1, and when arranged according to the invention, I prefer to form the element of generally semicircular cross section at least at the intersecting portions thereof, as is indicated at **12***b*. The predominant purpose and particular benefits of such heating element arrangement will become apparent as the description proceeds. Adjacent the rear of the sole plate, the opposite ends of the heating element are turned upwardly to extend above the sole plate and define terminals **12***c* for connection to an electric power source.

Above the sole plate **10**, there is disposed a housing and handle assembly **14** of improved formation. According to the present invention, this assembly is formed entirely of molded or cast plastic in one or more pieces, and preferably comprises a one-piece plastic molding. The assembly comprises a housing having a top wall **15**, a bottom wall **16** and side walls **17** defining a hollow water reservoir space **18** within the housing. Preferably, such space is closed and retained water-tight by an end closure piece **19**. The handle of the assembly is disposed vertically above the longitudinal axis of the housing and comprises generally vertically front and rear legs **20** and **21**, respectively, and a hand grip portion **22** extending between the legs in spaced relation to the upper surface of the top wall **15** of the housing. The front leg **20** of the handle is formed hollow or with a first bore **23** therein immediately adjacent the front of the handle leading into the reservoir **18** and comprising a filler opening for the reservoir. This filler opening is closed at the upper end thereof by a cap **24** preferably hinged to the handle at **25** and having a spring-type latch **26** cooperable with the forward surface of the front leg **20** of the handle to retain the cap closed. The bottom wall **16** of the reservoir is provided with a stepped bore or hole **27** therethrough aligned axially with the bore **13** in the sole plate **10**. Suitably, the bottom wall of the housing includes a reenforcing boss **28** about the apertured or bored portion thereof. The side walls **17** of the housing preferably extend downwardly beyond the bottom wall **16** thereof and terminate in a free peripheral edge spaced inwardly of but conforming to the peripheral edge of the sole plate **10**.

The stepped bore **27** in the bottom wall **16** of the housing is adapted for the reception and passage therethrough of a flanged conduit or tube **29** which rests by its flange in the step of the bore, i. e. on the inner surface of the wall **16**, and is intimately received in the bore **27** in sealed, water-tight relation to the housing. Suitably, the conduit or tube **29** could be bonded to the housing upon molding or casting of the housing. The cylindrical conduit or tube **29** is internally threaded for the adjustable reception therein of a cylindrical member **30** comprising means for limiting or restricting flow of water. The member **30** comprises a hollow cylindrical or tubular upper portion threaded into the conduit **29** and a lower end wall portion, preferably of hemi-spherical form. The end wall portion is provided with an axial bore **31** therethrough of small diameter which accommodates only such flow of water as to afford intermittent dripping of water from the lower end of the said end wall portion. The stepped bore **13** in the sole plate **10** is adapted for the threaded reception of a plug **32** including a cylindrical wall portion and a depressed or concavely recessed central portion of substantially the same thickness as the major portion of the sole plate. Suitably, the plug **32** is provided with recesses **33** in the lower surface thereof to accommodate a spanner wrench or the like for inserting

and removing the plug. The centrally recessed portion of the plug is imperforate and disposed in axial alignment with the bore 31 in the flow limiting member 30, so that drops of water dripping from the member 30 fall into the concave recess or depression and onto the upper surface of the plug 32. The plug 32, being united to the sole plate, is heated by the sole plate 10 and the heating element 12 so that drops of water falling onto the plug are immediately flashed into steam. A closure member 34, preferably of relatively thin but strong material of low heat conductivity, such as stainless steel, extends between the sole plate 10 and the conduit 29 to extend over the bore 13 and close the same, whereby the bore 13, the flow limiting member 30, the plug 32 and the closure member 34 define a steam chamber 35 wherein flash evaporation of drops of water takes place. The plug 32 is provided with a plurality of passages or bores 36 therethrough establishing communication between the interior of the steam chamber 35 and the lower surface of the sole plate, through which steam is dispersed to render the iron operable for steam ironing. The steam outlet passages 36 are preferably located adjacent the periphery of the plug 32 out of axial alignment with the water conduit means to insure that only relatively dry steam accumulated in the steam chamber 35 is dispersed into the material being ironed.

As thus constructed, the steam generating or flash evaporation means of the invention consist of the plug 32, comprising an exposed portion of the upper surface of the sole plate, the drip feed means or member 30, the closure member 34 and outlet passages 36 in the sole plate or plug. The bore 31 in the drip feed member 30 is of a diameter to insure drop-by-drop feed onto the plug 32 at such rate that one drop is evaporated or flashed into steam before another drop is formed. However, the rate of flow is quite rapid to insure a continuous, large volume flow of steam. To insure optimum performance of the steam generating means, the heating element 12, as previously described, includes a portion at least substantially encircling the plug 32 and the steam chamber 35 to apply heat efficiently to the steam generating means. Also, the sole plate 10 includes the boss 11 circumscribing the steam generating means to concentrate heat in the area of said means, whereby a continuous flow of relatively dry steam is assured. To obtain a wide dispersion of the steam, the outlet passages 36 preferably communicate with recesses 37 provided in the lower surface of the sole plate, as shown in Figures 1 and 2. In use, the volume of water in the water reservoir 18 maintains a sufficient head above the drip feed outlet to insure continuous drip feed of water, to prevent entry of steam into the reservoir and to insure discharge of steam through the passages 36 and 37.

In addition to closing the steam chamber 35, the closure member 34 serves to connect the housing and handle assembly 14 to the sole plate 10. Specifically, the member 34 is in the form generally of an annulus. The outer peripheral margin of the annulus is sealingly confined and clamped between the cylindrical portion of the plug 32 and the step in the bore 13, whereby the same is fixed to the sole plate. At its inner marginal edge, the annulus 34 is clamped between the lower end of the conduit or tube 29 and a nut 38 threaded onto the exterior surface of the flow restricting member 30, whereby the annulus is fixed to the conduit 29, which in turn is fixed to the assembly 14, at least as concerns downward movement of the conduit 29 and upward movement of the assembly 14 with respect to the sole plate, whereby the member 34, being rigid, connects the sole plate and housing assembly adjacent the forward end of the iron. A second point of connection is provided at the rearward end of the iron by means of a screw 39 extending through a bore in the bottom wall 16 of the housing and threaded into a tapped bore provided in a boss 40 of the sole plate. These two means of connection, in addition to physically connecting the sole plate 10 and the assembly 14, serve to clamp a spacer 41 between the housing and sole plate. In the embodiment shown in Figure 1, the spacer 41 comprises a sheet of metal or like material, preferably of low heat conductivity, such as stainless steel, that is perforated with a multitude of closely spaced small holes. The perforated sheet includes a lower edge portion conforming to the periphery of the sole plate 10 and is inclined inwardly and upwardly therefrom to a horizontal ledge portion conforming to the periphery of the lower edge of the side walls 17 of the housing. A further upturned portion of the spacer may be provided on the inner edge of the horizontal ledge to obstruct direct view into the space between the sole plate and the housing assembly. The sole plate 10 along the periphery thereof is provided with spaced, reduced, upwardly extending projections or knobs 42 upon which the spacer 41 rests, whereby the spacer has limited contact with the sole plate and whereby an air space is provided between the sole plate and the lower edge of the spacer sheet. Likewise, the lower edge of the side wall of the housing is provided with spaced, reduced, downwardly extending projections 43 which rest upon the horizontal ledge of the spacer, whereby the housing has limited contact with the spacer and a similar air space is provided. The spacer thus defines an air space 44 between the upper surface of the sole plate and the lower edge and bottom wall 16 of the housing and reservoir, which air space is an optimum insulator for insulating the housing, reservoir and handle assembly from the sole plate. The spacer, both by the perforations therein and the spacing of the same by the projections 42 and 43, accommodates free flow of air into and out of the insulating air space 44 to insure optimum insulating characteristics and cooling of the assembly 14. Being of low heat conductivity, cooled by the passage of air therethrough and thereover, and having limited contact with both the sole plate and housing, the spacer 41 does not transmit or conduit a sensible amount of heat from the sole plate to the housing. The closure member 34 utilized to connect the housing and the sole plate, being of thin section and formed of low heat conductivity material, likewise does not conduct a sensible amount of heat to the housing. Accordingly, the housing and handle assembly 14 and the water in the reservoir 18 remain relatively cool irrespective of heating of the sole plate.

Since the housing, reservoir and handle assembly 14 is insulated from and cooled with respect to the sole plate, fabrication of the entire assembly 14 from known moldable plastics, such as Bakelite, vinyl and fiber glass, is entirely feasible and practical, and leads to the provision of very substantial advantages. The first and primary advantage is the particular economy of molded plastics, especially in the formation of a water-tight receptacle or reservoir. Since the flash evaporation means of the invention eliminates any necessity for a steam and pressure-type reservoir, molded plastics serve optimumly well and afford particular economy over previously essential methods and materials for forming the water tank or reservoir. Secondly, the plastic material itself serves to insulate the user's hand from the heat of the sole plate, and the housing and handle will remain relatively cool to the touch irrespective of heating of the sole plate. The water normally to be stored in the reservoir will assist in this cooling effect to insure optimum comfort of the user by elimination of excessive heating of the iron in the region of the user's hand. Also, by maintaining the handle and housing relatively cool to the touch, and by extending the plastic housing downwardly substantially to the sole plate, the possibility of the user accidentally burning his or her hand is practically, if not fully, eliminated. In addition to the above advantages, the utilization of a molded plastic housing and handle assembly affords the capability of providing irons in a variety of gay and cheerful colors to enhance the appearance of

the iron and improve the psychological attitude of the user of the iron. For example, fiber glass may quite readily be dyed in a variety of colors. If a unitary assembly is employed, solid color or variegated assemblies may be provided, or by utilizing separate handle and housing components, bi-color assemblies may be provided, thus to afford the housewife a wide selection of attractive, enjoyment-provoking iron designs.

To control heating of the sole plate of the iron, a thermostatic switch **45** is included in the electrical circuit of the iron. The switch **45** may suitably be of a known type including bimetallic contact carrying blades **46** and a threaded actuating stem **47** for varying the bias on the blades to vary the temperature at which the contacts will separate and re-engage, thus to afford a variable temperature control for heating of the sole plate according to the requirements of the material being ironed. The switch itself is preferably located in direct engagement with the upper surface of the sole plate so that the contact blades **46** are directly responsive to temperature variations of the sole plate itself. To operate the actuating stem **47**, a control rod **48** extends vertically upward from the stem to the upper surface of the top wall **15** of the housing and terminates in a control knob **49** movable over a suitable graduated and marked scale **50** mounted on the top wall of the housing, as is shown in Figures 1 and 3. To provide a positive indication of the temperature of the sole plate, I prefer to combine a temperature indicator **51** directly with the thermostatic control. The temperature indicator may suitably comprise a spiral bimetal element **52** disposed immediately adjacent the sole plate, a rotatable rod **53** actuated by the element **52** and extending upwardly therefrom to the upper surface of the top wall **15** of the housing, and a needle or pointer **54** carried by the rod **53** and movable over a suitably graduated scale **55** mounted on the wall **15**, the scale **55** and pointer **54** being enclosed within and protected by a transparent cover **56**. According to such arrangement, the temperature control knob **49** is disposed for immediate and convenient actuation by the iron user, and the temperature indicator is readily viewable to assure the user that the proper ironing conditions prevail. To accommodate passage of the rods **48** and **53** through the water reservoir **18**, a pair of collars **57** and **58** are molded in each of the top and bottom **15** and **16** of the housing when the housing is molded. The collars **57** are aligned vertically and are adapted for the threaded reception of the opposite ends of a tube **59** to retain the sealed relation of the reservoir, the tube **59** accommodating passage of the rod **48** therethrough. The collars **58** likewise are aligned vertically for the threaded reception of the opposite ends of a tube **60** adapted for the passage of the rod **53**. One terminal **12***c* of the heating element **12** is connected to one terminal of the switch **45**, and the other heating element terminal **12***c* and the other terminal of the switch **45** are connected to the respective leads of an electric power transmission cord **61**. Connection of the terminals and the conductor cord **61** are accomplished by means of leads extending from the respective terminal upwardly through the bottom wall **16** of the housing, through a chamber **62** at the rear of the housing and handle assembly and to a terminal block **63** mounted on the rear leg **21** of the handle in said chamber **62**. The cord **61** is connected to the terminal block **63** and may suitably extend from the chamber **62** into the rear leg **21** of the handle to be conducted laterally away from the iron. A removable closure plate **64**, suitably formed of plastic, is preferably employed to close the chamber **62** at the rearward side of the assembly **14**.

The iron as thus far described is completely suited for both dry and steam ironing with all of the advantages above enumerated. For steam ironing, the water reservoir has a large capacity, there is no need to reserve room for a steam head, and steam ironing may be carried out at various desired temperatures for a prolonged period of time. To accommodate dry ironing, it would merely be necessary to empty the water from the reservoir. However, according to the present invention, I prefer to eliminate the objectionable nuisance of having to empty or refill the iron each time it is desired to change from one type of ironing to the other. Specifically, I prefer to incorporate in the iron, means for instantaneously changing from one type of ironing to the other merely by a flick of the finger. Referring to Figure 1, the preferred embodiment of such means is shown as including a valve seat member **65** adjustably threaded into the flow restricting member **30**. The valve seat member **65** includes a conical seat surrounding the axial bore or valve port therethrough and an apertured, axial, tubular extension **66** projecting vertically upward from the valve seat. A valve member **67** is vertically slidable in said extension and includes a lower conical surface movable into and out of sealing engagement with the valve seat to close and open, respectively, the apertures in the extension **66**. An operating stem or rod **68** extends vertically upward from the valve into the front leg **20** of the iron handle. Manually operable valve and valve rod actuating means are disposed within the front leg of the handle to accommodate opening and closing of the valve, thus to accommodate and prevent, respectively, the flow of water to the flash evaporation means at the selection of the iron user. When the valve is open, drip feed of water from the reservoir is accommodated in the manner previously described to render the iron operable for steam ironing. When the valve is closed, feed of water to the flash evaporation means is discontinued to stop the generation of steam, whereupon the steam accumulated in the steam chamber is rapidly dispersed to render the iron substantially instantaneously operable for dry ironing. When the valve is re-opened, feed of water commences immediately, steam is rapidly generated to fill the steam chamber and steam is dispersed through the passages **36** almost instantaneously to render the iron again operable for steam ironing.

In the construction of the iron, I prefer to utilize components so constructed as to accommodate adjustment of the drip feed control member **30** with respect to the sole plate plug **32** and to accommodate adjustment of the valve seat **65** with respect to the drip feed member **30** and with respect to the valve member **67**. Specifically, as shown in Figure 1, the drip feed member is adjustably threaded into the conduit or tube **29** and is adapted to be locked in adjusted position with respect to the sole plate plug **32** by means of the nut **38**. Also, the valve seat member **65** is adjustably threaded into the flow restricting member **30** to accommodate vertical adjustment of the valve seat with respect to the valve member to insure optimum operation of the valve and of the steam generating means.

To accommodate actuation of the valve **67** in an extremely convenient manner by the user of the iron, thus to accommodate changeover from one type of ironing to the other upon change from one article ironed to another to be ironed, without loss of time or exertion of any substantial effort, I prefer to dispose the valve actuating means in the front leg of the iron handle for convenient finger operation. One embodiment of a suitable valve operating means is shown in Figure 1, wherein the front leg **20** of the iron handle is provided with a second bore **69** generally parallel to the filler opening **23** and disposed in vertical, axial alignment with the bores **13** and **27** and the components **29**, **30**, **32**, **34**, **65**, **67** and **68**. The valve stem or rod **68** is slidably received in the lower portion of the bore **69** and a packing or sealing member **70** is fixedly secured in the lower end of the bore about the rod to seal the bore and rod against entry of water. Above the upper free end of the rod **68**, a plunger or operating member **71** is slidably received in the bore **69**, the same terminating at the upper end thereof in a push button **72** exposed to the upper side of the handle for convenient depression by a finger of the user of the iron.

The plunger 71 is normally retained in its upward position, as shown, by a first spring 73 confined between the push button 72 and a shoulder of the stepped bore 69. A second spring 74 is also positioned between the lower end of the plunger 71 and the sealing member 70, the spring 74, at least at the central portion thereof, closely encircling and firmly grasping the rod 68 effectively to unite the spring and rod. The plunger 71 at the lower end thereof includes a reduced axial extension 75 aligned with the rod 68, the extension normally being spaced from the upper end of the rod as shown. A detent or latch member 76, in the form of a leaf spring bent to present a V-shaped knee extending into the bore 69 toward the rod 68, is mounted by means of a pin in a narrow slit in the rearward portion or surface of the front leg of the handle, the slit communicating with the bore 69 and accommodating entry of the latch member 76 into the bore. The knee of the latch 76 normally engages the windings of the spring 74 as is shown. When the iron is conditioned for steam ironing as shown in Figure 1 and it is desired to change over to dry ironing, all the iron user need do is depress the push button 72 with one finger. As the button 72 is depressed, the plunger 71 descends to force the lower spring 74 downwardly, whereupon the valve stem 68 and the valve 67 are moved downwardly to the closed position of the valve. During such movement, the latch 76 ratchets over the windings of the spring 74 until the valve is closed, at which time the upper end of the rod 68 is located adjacent the knee of the latch 76 so that the latch may engage the upper end of the rod 68, in the space between the upper end of the rod 68 and the lower end of the extension 75, to retain the valve in its closed position. Upon release of the push button 72, the spring 73 moves the plunger 71 upwardly without interfering with the latched condition of the rod 68. To open the valve, it is only necessary for the iron user again to depress and release the push button 72. Upon the down stroke of the push button, the spring 74, being held down by the latch 76, is not compressed to a substantial extent and the user is able to push the plunger down sufficiently to bring the extension 75 of the plunger substantially into engagement with the upper end of the valve rod 68. At approximately this time, a lip 77 provided on the peripheral edge of the plunger 71 engages the latch 76 to move the latch generally radially outward of the rod 68 to release the rod and spring 74 from the latched condition thereof, whereupon the upper end of the rod 68 engages the lower end of the extension 75 to prevent re-entry of the knee of the latch into the space normally provided between the rod and the extension. Then, upon release of the push button 72, the springs 73 and 74 move the plunger 71 and the rod 68 and valve 67 upwardly to open position. In such upward movement, the latch 76 ratchets over the windings of the spring 74 and enters between two of the windings in the upper open position of the assembly to retain the valve in open position. Thus, the present invention affords means whereby the user of the iron, simply by a flick of the finger to depress a push button, is able to effect substantially instantaneous changeover from dry ironing to steam ironing and from steam ironing to dry ironing.

A modified form of valve actuating means is shown in Figure 4. In the modification, the valve stem or rod 68 extends nearly to the top of the handle and is provided with a radial flange 78 limited in upward movement by an inwardly extending flange in the bore 69. Only a single spring 79 is provided and the same is confined between the flange 78 and the sealing member 70 positively to bias the valve to open position. An actuating member, in the form of a rotatable knob mounted for rotation about an eccentric axis 81, is disposed within an eccentric recess 82 in the upper end of the front leg 20 of the handle. The recess 82 opens to one side of the handle and the knob 80, which is cylindrical, extends to the exterior of the side wall of the handle for convenient manipulation by one finger of the user's hand. In the lower surface thereof, the cylindrical knob is recessed, principally in the form of a cylindrical bore having its axis inclined to the axis 81, to define an inclined cam surface 83 within the knob. The upper end of the valve stem or rod 68 extends into the recess in the knob and bears against the lower surface of the knob, whereby, upon rotation of the knob, the rod is alternatively forced downwardly to close the valve and released upwardly under the urge of the spring 79 to open the valve, 180° knob rotation being required to move from one valve position to the other. The upper end of the bore 69 may suitably be closed by a plug 84 pressed into the upper end portion thereof. Preferably the knob 80 includes a complete cylindrical wall to present a readily engaged and continuous finger-engaging side wall portion.

In either form above described, the valve rod actuating means, including all of the necessary springs, latches and like moving parts, are housed within a bore that is not open to entry of water, whereby the components operate in free air and are not subjected to the corrosive effects of water. Accordingly, long life and efficient service of the valve operating means is assured according to the present invention.

From the foregoing, it will be appreciated that the present invention, in the embodiment and modification described, affords a substantially improved steam and dry iron including, among others, the advantages of improved economy in the elimination of a pressure-type water tank or reservoir, improved steam generating means of the flash evaporation type, and all-plastic housing, reservoir and handle assembly which itself presents the advantages of substantial economy, heat insulation and attractive designing, improved insulation of the housing from the sole plate including the provision of novel spacer means between the housing and sole plate, improved and economical connection of the housing assembly to the sole plate, an improved arrangement of the heating element to insure optimum flash vaporization, and improved, economical and efficient means accommodating instantaneous changeover from dry ironing to steam ironing and from steam ironing to dry ironing.

A second embodiment of the invention is shown in Figure 5 wherein the principal difference over the embodiment previously described resides in the particular flow controlling valve and valve actuating means. Due to the similarity of the majority of the components, the same tens and digit numerals as employed in Figures 1 to 3 are employed in the 100 series in Figure 5 to indicate like or similar parts. The Figure 5 embodiment of the invention, like that of Figure 1, includes a sole plate 110 having a heating element 112 embedded therein and encircling, within a boss 111, a stepped bore 113 in the sole plate. Around the peripheral edge thereof, the sole plate is provided with projections of knobs 142 upon which a spacer 141 rests. The spacer 141 is generally of the same structure and serves the same purpose as the spacer 41 in the Figure 1 embodiment, except that the spacer 141 is corrugated to strengthen the same and afford greater surface area for cooling. A housing, water reservoir and handle assembly 114, of molded or cast plastic, is rested, by means of projections 143 on the lower edge of the side walls thereof, on the spacer 141, whereby the assembly 114 is fully insulated from the sole plate as will be appreciated from the foregoing description. The assembly 114 includes a handle having a front leg 120 within which a filler opening 123 is provided leading to a water reservoir 118 in the interior of the housing, the opening 123 being closed by a removable cap 124. A second bore or passage 169, of stepped formation, is formed in the front leg of the handle in axial alignment with the bore 113 in the sole plate, and the bottom wall 116 of the water reservoir 118 is provided

with an opening or bore **127** aligned axially with the bores **113** and **169**.

A conduit or tube **129** is intimately and sealingly received within the bore **127** in the reservoir wall **116** and depends downwardly therefrom toward the sole plate. A flow restricting member **130** is adjustably threaded into the tube **129**, the said member including a flow restricting orifice or bore **131** in the end wall thereof. A plug **132** having an imperforate central portion is threaded into the bore **113** in the sole plate to receive on the imperforate center thereof drops of water dripping in controlled amount through the orifice **131**. The plug **132** also serves to clamp the outer periphery of a closure member **134** to the sole plate **110** and the closure member extends to the conduit **129** to define a steam chamber **135** in the sole plate between the plug **132** and the closure member. In use, the conduit **129** and the restricted drip feed orifice **131** in the member **130** establish communication between the reservoir **118** and the steam chamber **135** so that water is fed drop by drop onto the upper surface of the plug **132**. The plug **132** is subjected to the concentrated heat of the heating element **112** so that drops of water contacting the plug are immediately flashed to steam to accumulate in the chamber **135**. Adjacent the periphery thereof, the plug **132** is provided with passages or bores **136** communicating with recesses **137** in the sole plate to disperse the steam thus generated into the material being ironed. The closure member **134** is clamped to the tube **129** by means of a nut **138** threaded onto the member **130** and serving as well to lock the member **130** in adjusted position in the tube **129**. Further, as thus assembled, the closure member **134** and the associated components serve to connect the assembly **114** to the sole plate **110** adjacent the forward end of the iron.

To control the feed of water to the steam generating means, a valve assembly is provided in the conduit means **129** and **130**. Specifically, a valve seat member **165** is adjustably threaded into the member **130**, the member **165** having inclined bores or ports therein establishing communication between the reservoir and a downwardly facing valve seat formed in said member. A valve member **167**, having a face complemental to the valve seat, is disposed between the valve seat and the end wall of the member **130** for vertical movement toward and away from said seat. A valve spring **174** is confined between the head of the valve and the end wall of the member **130** normally to bias the valve into engagement with its seat to prevent flow of water to the steam chamber **135** and thus to render the iron operable for dry ironing. Upon opening of the valve, drip feed of water in the manner above described is accommodated to render the iron operable for steam ironing.

The valve seat member **165** includes an axial, upwardly extending, tubular portion **166** threadingly receiving the lower end of a tube **190** which is intimately fitted at its upper end into the bore **169** in the front leg of the iron handle. A valve operating rod **168**, rested on the top of the valve **167**, extends upwardly through the tube **190** and the bore **169** and at its upper end is fixed to a valve rod actuating plunger **171**. The plunger **171** carries a pair of diametrically opposed spring latch members **176** which each comprise an upwardly and outwardly extending latch portion, a substantially horizontal portion extending generally diametrically through a bore in the plunger and an upwardly and outwardly inclined end portion extending to the opposite side of the plunger and in the opposite outward direction from the first or latch portion of the respective member. A hollow cylindrical member **191** is fitted into the bore **169** adjacent the latch members **176** and the member **191** is provided at diametrically opposed points with latch recesses **192**, each aligned with one of the latch members **176** and presenting an upwardly and inwardly inclined latching surface to be engaged by the latch portion of the respective member **176**. In Figure 5, the valve, valve rod and latch means are shown in the closed or dry ironing position of the valve. To accommodate steam ironing, the valve is opened by depressing the plunger **171** to force the rod **168** downwardly against the urge of the spring **174**. As the plunger moves downwardly, the latch portions of the member **176**, by moving radially inwardly, cam over the upper edges of the member **191** and then are biased outwardly to engage in the respective recesses **192**. When the plunger is released, the latch portions of the members **176** engage the inclined surfaces of the recesses **192** to maintain the plunger **171**, valve rod **168** and valve **167** in the down, or open, or steam-ironing position of the valve. To release the latches to accommodate closing of the valve **167** by means of the spring **174**, a release push button **193** is slidably mounted on the plunger **171**. The button **193** includes a frusto-conical lower cam portion **194** adapted to engage between and bias the upper end portions of the latch members **176** apart, thus to move the latch portions thereof toward one another, radially inwardly of the plunger, to release the latch portions from the recesses **192**. Upon such release, the spring **174** is freed to bias the valve **167**, valve rod **168** and plunger **171** upwardly, as the iron user releases the push button **193**, to close the valve **167**. The push button **193** may suitably be carried by the plunger by means of a pin **195** working in a slot in the button, and a spring **196** is provided normally to retain the push button in its upper position generally flush with the iron handle. The plunger **171** includes a projecting portion **172** normally extending through and above the push button for independent actuation of the plunger.

In use, to change from dry ironing to steam ironing, the iron user would depress the plunger **171** by means of the portion **172** thereof to move the plunger downwardly to open the valve and latch the valve, valve rod and plunger in open position for steam ironing. As the plunger is initially depressed, the push button, due to the spring **196**, remains stationary and the upper ends of the latch members are released from the frusto-conical portion **194** to accommodate full expansion and effective latching of the latch portions of the latch members. Even though the push button **193** may be subsequently depressed to a slight extent, the released condition of the latches will prevail as long as the iron user depresses the plunger **171** to dispose the upper end **172** thereof substantially flush with the upper surface of the push button. Upon release of the plunger and push button, the plunger is latched in the down position and the push button is returned by the spring **196** to its normal position. Thus, the iron user, by noting that the upper end **172** of the plunger is depressed within the push button, is provided with a visual indication that the iron is set for steam ironing. To change from steam ironing to dry ironing, the iron user need depress only the push button **193** to release the latches, whereupon the upper end of the plunger pops upwardly above the push button. Then, by releasing the push button, the entire assembly is returned to the valve closed or dry ironing position shown in Figure 5.

A further embodiment of the invention is shown in Figure 6, wherein the principal difference over the Figure 5 embodiment resides in the disposition of the changeover control means within the water reservoir filler opening, thus to eliminate a second bore in the front leg of the iron handle and to accommodate a reduction in size of the leg. Due to the substantial identity of the two embodiments, tens and digits reference numerals employed in the 100 series in Figure 5 are employed in the 200 series in Figure 6 to indicate like or similar parts. In the Figure 6 embodiment, the sole plate **210**, heating element **212**, housing and handle assembly **214** and spacer **241** are constructed and assembled substantially in the same manner as previously described in respect to the other embodiments, except that the spacer **241** is neither perforated nor corrugated, although either or both features may be employed if desired. The front leg **220** of the handle differs from the embodiments of Figures 1 and 5 in that

only the filler opening 223 for the reservoir 218 is provided in the leg. The bores 213 and 227 in the sole plate and reservoir, respectively, are aligned with the filler opening 223, as are the conduit 229, flow restricting means 230, plug 232, and closure member 234 of the steam generating means, and as also are the valve seat member 265, valve member 267 and spring 274 of the control valve assembly.

The valve seat member 265 includes an axial tubular stem 266 threadingly receiving a tube 290 which extends up through the reservoir 218 and is guided at its upper end in a perforated washer 297 or the like positioned in the filler opening 223. A valve operating rod 268, rested on the upper surface of the valve, extends upward through the tube 290 at its upper end is fixed to a plunger 271 disposed above the tube 290. The plunger 271 carries two latch members 276 of the character described in reference to Figure 5, which members are adapted to engage in latching recesses 292 provided in the inner wall of a cylindrical extension 291. The extension 291 encloses the lower end of the plunger 271 and is preferably connected, by means of a radial pin or the like (not shown), to a removable cap member 298 provided for the filler opening. Alternatively, the extension 291 may be formed as an integral depending extension of the cap member 298. When the cap member is disposed in the filler opening, the same is sealed by means of a gasket 299, and the lower end of the extension 291 engages the central portion of the washer 297 to close the filler opening. A push button 293 is slidably mounted on the plunger 271 and includes a frusto-conical portion 294 operable upon actuation of the push button, in the manner described in reference to Figure 5, to release the latches 276 from the latched positions thereof. The push button 293 may suitably be slidably but permanently associated with the plunger 271 by means of a pin and slot arrangement 295. Also, the push button is normally biased to a position flush with the closure cap 298 by means of a spring 296. The plunger 271 includes an upper extension 272 projecting about the surface of the push button in the dry ironing position and depressed within the push button in the steam ironing position.

In use of the resultant assembly, filling of the reservoir is accommodated upon removal of the assembly of the cap 298, extension 291, plunger 271, push button 293, spring 296, latches 276 and rod 268 from the mouth of the filler opening. When the reservoir 218 is filled, the said assembly is re-inserted, whereafter operation and control of the iron for dry and steam ironing are effected in the same manner as described with respect to Figure 5.

From the foregoing, it will be appreciated that the present invention affords substantial advantages over prior proposals in the art in the numerous novel features and constructions described hereinbefore, including the particular advantages of the improved flash vaporization means, the all-plastic body and handle assembly, the spacer means, the changeover control means and the improved heating element arrangement provided according to the invention.

While I have described what I regard to be preferred embodiments of my invention, it will be appreciated that various changes, rearrangements, and modifications may be made therein without departing from the scope of the invention, as defined by the appended claims.

I claim:

1. An electric iron comprising a sole plate having a recess in the upper surface thereof, steam generating means of the flash evaporation type located in said recess in said sole plate, said sole plate including a relatively thick boss encircling said recess and said steam generating means, a heating element embedded in said sole plate and including a portion embedded in said boss and encircling said recess and steam generating means, a molded plastic housing and handle assembly disposed above and connected to said sole plate, a spacer between and extending about the peripheries of said sole plate and said housing, said spacer having limited contact with at least said sole plate, the housing portion of said assembly including integral bottom, top and side walls all of molded plastic defining a water reservoir spaced above said sole plate, the handle portion of said assembly including a water filler opening communicating with said reservoir, said spacer defining an insulating air space between the upper surface of said sole plate and the lower edge and bottom wall of said housing and reservoir and accommodating flow of air into and out of said insulating air space to insulate said assembly from said sole plate, said assembly insulating the user's hand from the sole plate and the water in said reservoir cooling said assembly, whereby said assembly remains relatively cool to the touch irrespective of heating of the sole plate, a conduit establishing communication between said water reservoir and said recess and terminating adjacent the base of said steam generating means, flow restricting means in said conduit limiting flow of water from said reservoir to said steam generating means to a drip feed, a valve in said conduit to open and close said conduit to fluid flow, and valve operating control means extending from said valve to the exterior of the iron, said control means being operable to actuate said valve to open and close said conduit, said valve closing said conduit to prevent drip feed of water to said steam generating means thus to render the iron operable for dry ironing, said valve opening said conduit to accommodate drip feed of water to said steam generating means, the drops of water being flashed to steam in said steam generating means, said steam generating means including passages leading from the ironing surface of said sole plate to said recess and entering said recess at a level above the outlet end of said conduit, whereby steam only is dispersed through said passages to render the iron operable for steam ironing.

2. An electric iron comprising a sole plate having a bore therethrough and a relatively thick boss circumscribing said bore, a relatively thin plug threaded into said bore and having passages therethrough adjacent the periphery thereof, the lower surface of said plug being continuous with the lower surface of said sole plate, an electric heating element embedded in said sole plate and including a portion embedded in said boss and encircling said bore, a molded plastic housing and handle assembly disposed above said sole plate, the housing portion of said assembly including bottom, top and side walls all of molded plastic defining a water reservoir, said bottom wall having a bore therethrough axially aligned with the bore in said sole plate, a conduit engaging in and extending downwardly through said bore toward said plug, a generally annular closure member extending between said sole plate and said conduit, said closure member being confined between said plug and said sole plate at the outer periphery thereof and being secured to said conduit at the inner periphery thereof to define with said bore in said sole plate and said plug a steam chamber, said plug, said closure member and said conduit connecting said assembly to said sole plate, a spacer clamped between and extending around the peripheries of said sole plate and said housing, said spacer defining an insulating air space between the upper surface of said sole plate and the lower edge and bottom wall of said housing and reservoir to insulate said housing and reservoir from said sole plate, said assembly insulating the user's hand from the heat of said sole plate and the water in said reservoir cooling said assembly whereby said assembly remains relatively cool to the touch irrespective of heating of said sole plate, said handle including a generally vertical front leg having a bore therethrough communicating with said reservoir and comprising a filler opening for said reservoir, a valve seat in said conduit between said reservoir and said plug, flow

limiting means associated with said conduit axially thereof to limit flow from said reservoir to drip feed onto the central portion of said plug, a valve movable into and out of engagement with said valve seat to open and close said conduit, a valve operating rod extending vertically upward from said valve into the said front leg of said handle, valve operating control means located in said front leg of said handle and exposed to the exterior of said handle for finger actuation by the iron user, said control means being operatively associated with said rod to open and close said valve, said valve opening said conduit to accommodate drip feed flow of water into said steam chamber and onto the central portion of said plug, said plug being subjected to the concentrated heat of said sole plate and said heating element whereby drops of water contacting said plug are flashed into steam to accumulate in said steam chamber, steam in said chamber being dispersed through said passages in said plug to render the iron operable for steam ironing, said valve closing said conduit to prevent drip feed of water onto said plug thus to prevent steaming and render the iron operable for dry ironing.

3. An electric iron as set forth in claim 2, wherein the said front leg of said handle is provided with a second bore aligned axially with said bores in said bottom wall of said reservoir and in said sole plate, said valve operating rod extending into and said valve operating control means being positioned within said second bore, said filler opening bore being unobstructed.

4. An electric iron as set forth in claim 3, wherein said valve is biased in one direction by spring means, said spring means being disposed within said second bore in the front leg of said handle and being sealed from the water in said reservoir and said filler opening.

5. An electric iron as set forth in claim 2, wherein said filler opening bore in the front leg of said handle is aligned axially with said bores in said bottom wall of said reservoir and in said sole plate, said valve rod extending into and said valve operating control means being positioned within said filler opening bore.

References Cited in the file of this patent

UNITED STATES PATENTS

2,207,669	Huffman	July 9, 1940
2,276,726	Huffman	Mar. 17, 1942
2,313,382	Kistner	Mar. 9, 1943
2,337,078	Morton	Dec. 21, 1943
2,437,571	Waage	Mar. 9, 1948
2,499,185	Finlayson	Feb. 28, 1950
2,506,941	Scott	May 9, 1950