This invention relates to electric spray irons, and more particularly to means for discharging a spray of water onto the material to be ironed, replacing the older method of hand-sprinkling. In general, such irons include a spray nozzle located preferably at an elevated position in the forward portion of the iron, arranged to deliver atomized water over a considerable area of the work surface, the water being drawn from a water container within the body of the iron.

It has been proposed to use steam, generated in the iron, as a propulsion means for the water, either through the force of steam pressure on the surface of the water in the container or by utilizing the velocity of the steam to draw water from the container by eductor action. Such irons are complex and costly, requiring among other things a pressure-tight container and pressure-regulating and relief means.

Other proposals call for the use of compressed air for this purpose, the pressure being developed either by a hand-operated piston pump or by a rubber bulb. These irons are in general impractical because of the considerable amount of pumping required before enough pressure is generated to provide an adequate spray.

It has also been suggested that a piston pump be located within the water reservoir, actuated either by a motor or by hand, with a suction and a discharge port in the pump housing, the discharge port being connected by tubing to a spray nozzle. These arrangements all lack to some degree the requirements of simplicity, economy, or convenience.

It is an object of this invention to provide a simple and inexpensive spray iron that avoids the difficulties encountered in the teachings of the prior art.

It is a further object of the invention to provide a spray iron having a manually operable piston pump located outside the water reservoir, whereby the full volume of the reservoir is useable for a water supply.

It is another object of the invention to provide a spray iron having a manually operable piston pump, wherein the spray nozzle is so mounted in relation to the pump that the full pump pressure may be employed to atomize the water, without conduit means that can create back-pressure.

It is a further object of the invention to provide a spray iron having a piston pump in which the pump is readily accessible and easy to assemble.

It is another object of the invention to provide a spray iron having a manually operable pump which may be actuated by the thumb of the user while his hand is in normal ironing position.

Further objects and advantages will become apparent in the following description taken in connection with the appended drawings in which:

FIGURE 1 is a side elevational view of a spray iron embodying the invention;

FIGURE 2 is a front elevational view of the iron of FIGURE 1;

FIGURE 3 is a plan view of the front portion of the iron of FIGURE 1;

FIGURE 4 is a sectional view taken along line 4--4 of FIGURE 3;

FIGURE 5 is a view taken along line 5--5 of FIGURE 4, showing some of the structure broken away;

FIGURE 6 is a sectional view taken along line 6--6 of FIGURE 4;

FIGURE 7 is an enlarged sectional view of the pump;

FIGURE 8 is a sectional view taken along the line 8--8 of FIGURE 7;

FIGURE 9 is a sectional view taken along line 9--9 of FIGURE 7;

FIGURE 10 is an axial sectional view of the nozzle tip of FIGURE 7 taken normal to that section along line 10--10; and

FIGURE 11 is an enlarged sectional view of an alternate embodiment of the pump.

Referring to FIGURES 1 to 4, numeral 10 generally represents a solenoid having a U-shaped heating element 11 embedded therein with its bight adjacent the toe of the solenoid and its legs extending rearwardly adjacent the side edges of the solenoid. In the upper surface of solenoid 10 is formed a steam generating chamber 12 which is closed by a cover 13. A plurality of steam emission apertures, only one of which 15 is shown in part, communicate with steam generating chamber 12 and extend through the ironing surface of solenoid 10 in a manner known to the art.

As best seen in FIG. 4, mounted above the solenoid and spaced therefrom is a hollow sheet metal reservoir 16 which is partly enclosed by a sheet metal housing or shell 17 extending above the solenoid from its periphery. A handle, generally designated 18, preferably moulded of phenolic resin, surmounts shell 17, and these parts are securely to the solenoid in any suitable manner. The front leg 19 of handle 18 is hollow as shown and is adapted to house the upper part of thermostatic control switch mechanism, generally designated 20, and other parts that will be described hereinafter.

The thermostatic control mechanism 20 is fully described in a copending application of C. R. Turner, Serial No. 307,481, filed Sept. 9, 1963, assigned to the assignee of the present application. The present invention is not concerned with the details of the thermostatic control mechanism and it is sufficient to note that it comprises a switch 23, adjustable through a cam and lever system by means of a knob 24 extending from the front of handle 18, and a thermomotive member 25 which actuates switch 23 in response to the temperature of that portion of the solenoid on which the control mechanism is mounted.

Above knob 24 is a removable funnel member 26 preferably of phenolic resin which completes the enclosure provided by the leg 19 and is secured to handle 18 by screws or other appropriate means. An apron 27 on funnel member 26 has its semicircular peripheral edge terminated by skirt 28 which carries an indica strip 29 indicating the preferred positioning of knob 24 providing proper thermal conditions for selected fabrics and ironing conditions. Apron 27 is horizontally disposed in ironing position with a downward slope toward the fill opening of funnel 26. Water-fill tube 30 is secured to the forward end of the top of reservoir 16 and communicates with the interior of the reservoir. Tube 30 is connected at its other end to funnel 26 by a tubular coupling 31, preferably constructed of silicone rubber, which is generally Y-shaped to provide another branch 32, the purpose of which will be described hereinafter. When the iron is supported with the solenoid in a substantially vertical position, the reservoir may be filled with water through funnel 26, tubular coupling member 31 and fill tube 30.

As best seen in FIGURE 5, water flows downwardly from water reservoir 16 into steam generating chamber...
12 through an annular valve body 33 secured to the reservoir 16 is a control of flow. The valve body is advantageously secured to the bottom of reservoir 16 and removably fits an opening in steam chamber cover 13. A tapered tubular member 34, which is secured to valve body 33 and extends upward through the top of reservoir 16 houses a valve stem 35. Valve stem 35 is arranged for axial movement to move an integral shoulder which rests from or against a seat in valve body 33 to open or close communication between the reservoir and the steam generating chamber. The valve is held normally open under the bias of spring 36—this may be easily closed by the manual operation of actuator 37 to move cam 38 (see in FIGURE 4) against valve actuator 39. Valve actuator 39 is a heavy strip of resilient material affixed at one end to the handle 18, contacting the valve stem at its other end, and moved by cam 38 acting upon the strip at an intermediate point.

The present invention is concerned primarily with the integral pump and nozzle structure 41 which, as seen in FIGURES 1, 2 and 3, is affixed to the handle 18 at the forward or toe end of the iron and may be constructed in large part of the same resilient materials as handle 18. The arrangement is such that the nozzle is near the highest point on the iron when in ironing position so that spray issuing from the nozzle can be a maximum area for the spray pattern of the nozzle. The nozzle is directed downwardly both by virtue of the general orientation of the pump and nozzle structure 41 on handle 18 and by virtue of the further downward direction of the nozzle axis with respect to the overall axis of the pump structure. As can best be seen in FIGURES 1 and 7, the pump consists of two pieces, a body 42 and an end cap 43 which together enclose the pump cylinder or bore 44 in which is located a piston 45. The piston is moved within the cylinder 44 by a manual actuator, a thumb operated plunger 46, the thumb piece 47 of which is shaped for convenient use by the thumb and is so located that the thumb of the operator's hand which grasps the handle 18 may be used to actuate the pump to initiate spraying in the course of ironing. The thumb piece 47 conveniently is not only shaped to provide a convenient contour against which the thumb may press more effectively but its contact surface is ribbed transversely to the direction of pressure to minimize slippage of the thumb. As can be best seen in FIGURES 7 and 8, the part of the handle mounting the pump and nozzle 41 is grooved to provide a channel 18a with a generally flat bottom slanting gently downwardly in the direction toward the toe of the iron in the ironing position. The channel provides a thumb piece guide and a mount for the housing 42 which, as seen in FIGURE 8, has a pair of narrow shoulders 43a which rest on the handle each side of the channel 18a. The pump housing 42 has an extension 48 which projects through an opening or slot in the bottom of channel 18a and is provided with a pair of longitudinal grooves 48a which lie just below the inside wall of the hollow handle 18. A corrugated U-shaped clip 49 inserted in grooves 48a in the position of FIGURE 8 overlaps the inside wall of the handle and holds the pump housing in place.

As seen in FIGURE 7, water is supplied to cylinder 42 from the reservoir by a water intake conduit 51 which is mechanically connected to extension 48. Through extension 48 and housing 42 a bore 52 extends the water supply line into the main cylinder 42. A check valve provided by ball 54 and seat 55 is so oriented that water may flow past the seat and ball into the cylinder 44 but may not flow in the other direction. Increase in pressure within the cylinder 44 will cause the ball 54 to seat against seat 55 and prevent any reverse flow to the reservoir through conduit 51. FIGURES 4 and 5 water intake conduit 51 extends from the pump housing 42 into the reservoir 16. After passing through a sealing grommet 56, the tubing 51 as seen in FIGURE 5 terminates near the bottom of the reservoir 16 and is preferably surrounded by a tube 57, the lower end of which is perforated or terminated before the bottom of the reservoir and surrounded by screening means 58. For example, as shown, a suitable screening means may be provided by a helical spring 59 slid over the end of tube 57 and compressed between the bottom of the reservoir and a shoulder provided by an annular band on the tube 57.

Thumb pressure on actuator 47 causes the piston 45 to increase the pressure on the water within the cylinder to cause the nozzle 60 to produce a spray. End cap 43 is joined to the housing 42 by suitable interlocking portions on the two pieces which permit a snug fit. The end cap in addition to closing one end of the cylinder 44 provides a loose bearing for piston rod 46 as it moves back and forth within the cylinder 44. The piston rod 46 everywhere has considerable clearance within cylinder 44.

The piston rod 46 is provided with a bore at the piston end which is designed to receive loosely a tubular projection 62 of resilient piston body 61. Within the tubular extension 62 is a pin 63 which preferably has a spherical end against which piston rod 46 pushes to move piston 61 within cylinder 44. The spherical end of pin 63 accommodates a maximum area for the spray pattern of the nozzle 64. After passing through a sealing grommet 65 and housing 42 and groove 18a in which thumb piece 47 rides, the piston 61 has forwardly and rearwardly projecting sealing members 64 and 65 tapered to a feather edge at their free ends snugly accommodated within the cylinder. Within the tapered sealing members 64 and 65 is mounted a wedge-shaped silicon rubber spreader 66. A generally cylindrical rigid member 68 also fits within the spreader 66. Member 68 has a radially outwardly projecting flange 69a which provides on its opposite sides shoulders one of which presses against the end of the silicon rubber spreader 66 and the other of which retains one end of a helical spring 70. The other end of the spreader 66 is retained by the end wall of housing 42. Spring 69 urges the piston into the position shown in FIGURE 7 and opposes pressure of the thumb on actuator 47.

The cylinder 44 is extended to the nozzle by a bore 71 through an integral extension 72 of the pump housing 42. Bore 71 in turn terminates in small circular ducts 73, two of which are shown in this embodiment, as can best be seen in FIGURES 9 and 10. The ducts 73 terminate in ports beneath an elastic band 74 which is retained in a circumferential groove in a reduced diameter portion of extension 72. This elastic band acts as a check valve to permit the flow of water outwardly through ducts 73 but to resist a flow of air inwardly as the piston is retracted. The extension 72 is covered by an end cap 75 of cup-like form. The end cap is internally threaded adjacent its lip to permit connection to the threaded periphery of extension 72 and a resilient gasket 76 is provided between cap 75 and housing 42 and seals against extension 72 to prevent leakage of water from cap 75. Extension 72 also preferably extends into contact with the bottom of cap 75. As a consequence, the only path of escape for water released through the ducts 73 into the cap 75 is a pair of ducts 77 and through the axial nozzle duct 77. Offsetting ducts 78 from alignment with one another as best seen in FIGURE 9 due to provision of an enlarged vestibule 77a causes the water to swirl as it leaves the nozzle duct 77 and develop a conical spray.

From the above description it will be clear that, in operation, when piston 45 is moved in the opposite direction by pressure on actuator 47 check valve 54 and 55 closes and the water in the cylinder 44 and bore 71 and 73 is forced past elastic band 74 into cap 75 and out nozzle duct 77 leaving the nozzle in a fine spray. Any leakage past piston 61 flows back...
to reservoir 16 through a duct extension 79 from end cap 43, branch 32 of coupling member 31 and tube 30. Nozzle location is such that after actuator 64 is released and spraying is discontinued thereby, any drops of water that may drain from nozzle 60 will be caught by apron 77 and, because of its downward slope, will flow back through funnel 26 into reservoir 16 via coupling member 31 and tube 30, the same route followed by water in filling.

FIGURE 11 illustrates a simplified alternate embodiment of the pump. To this extent that components are common to the previously described embodiment, the same reference numerals with the addition of primes thereto have been applied to parts corresponding to those in FIGURE 7. In this arrangement, manual actuator 47' is secured to a piston rod 46'. Piston 45', however, is modified in detail and constitutes an enlarged portion at the end of rod 46' having annular circumferential recesses 81 and 82 having bottom and side walls. Recess 82 is arranged to receive an O-ring 83 which is of such proportions that it is deformed between the bottom of recess 83 and the walls of cylinder 44'. Recess 81 is arranged to receive a lubricating ring 84, preferably constructed of sponge rubber and impregnated with a lubricant such as silicone grease, which makes sliding contact within cylinder 44'. The forward end 85 of piston 45' is of reduced diameter and serves as a guide for spring 69' which surrounds it.

To remove the pump from the iron it is necessary merely to take off coupling member 26 and withdraw U clip 49, after which the pump and nozzle structure 41 may be lifted off. All of the internal parts of the pump are accessible when body 42 and cap 43 are snapped apart. To reinstall the pump, piston 51 which is preferably fixed to the pump is passed through the aperture in the bottom of groove 18a and is pushed down through grommet 56 into reservoir 16. When the pump is seated in recess 18a, conduit 79 enters branch 32 of coupling member 31 and extension 48 projects through the aperture, to be secured by U clip 49. Funnel member 26 is then placed in position, making sure that the end of the funnel enters coupling member 31 and screws are tightened in place.

The location and construction of the pump provide a number of important advantages. In contrast to spray irons of the prior art in which a pump is integral with the water reservoir, this invention provides maximum use of the reservoir for a water supply, thus minimizing the need for refilling. Full pump pressure is available at the nozzle because of its direct connection to the pump body, thus providing optimum atomization. The movement of these parts at a point of maximum elevation results in a desirably large spray pattern, and the location is most convenient to the user since the actuator is adjacent his thumb whereby it may be pushed forward while the hand is in normal ironing position. In addition, the unique relationship between the nozzle location and the specially shaped spur on the funnel portion 26 precludes the possibility of unatomized water dropping on the material to be ironed.

Although only two embodiments have been described, other embodiments and modifications will be apparent to persons skilled in the art, and it is therefore to be understood that the invention is not to be limited in interpretation except by the scope of the following claims.

I claim:
1. In a spray iron, the combination comprising a soleplate, a water reservoir positioned above said soleplate, a handle fixed relative to the soleplate, and spray means mounted on the forward end of said handle, said spray means comprising a spray nozzle and a pump having a piston actuated by thumb pressure along an axis generally aligned with the spray means and having a water inlet duct communicating with said reservoir and a discharge duct extending between said pump and said spray nozzle, said pump and spray nozzle being substantially on a common axis.
2. In a spray iron, the combination comprising a soleplate, a water reservoir positioned above said soleplate, a handle fixed relative to the soleplate, and spray means mounted on the forward end of said handle, said spray means comprising a spray nozzle and a pump having a piston actuated by thumb pressure along an axis generally aligned with the spray means and having a water inlet duct communicating with said reservoir and a discharge duct extending between said pump and said spray nozzle being substantially on a common axis.
3. A spray iron in accordance with claim 1, wherein said piston is provided with a water inlet duct communicating with said reservoir and a discharge duct extending between said pump and said spray nozzle being substantially on a common axis.

4. In a spray iron, the combination comprising a soleplate, a water reservoir positioned above said soleplate, a handle fixed relative to the soleplate, and spray means mounted on the forward end of said handle, said pump and spray nozzle being substantially on a common axis.

5. A spray iron in accordance with claim 2, wherein said piston is provided with a water inlet duct communicating with said reservoir and a discharge duct extending between said pump and said spray nozzle being substantially on a common axis.
7. The apron will drain into the funnel, a spray nozzle on the handle above the apron, and means for drawing water from said reservoir and delivering it through said spray nozzle onto the material to be ironed that, after spraying, residual droplets of water from said spray nozzle will fall onto said apron and be returned to said reservoir through said funnel.

10. In a spray iron, the combination comprising a soleplate, a water reservoir positioned above said soleplate, a handle including a hollow front leg fixed relative to the soleplate, means for filling said reservoir with water including a fill tube communicating with the interior of the reservoir and with an orifice in the front face of said handle, manually operable spray means surrounding the forward end of said handle including a piston pump having a piston in a cylinder and having a spray nozzle secured to the forward end of said pump, a water intake conduit extending from a low point in said reservoir in ironing position communicating with the interior of said pump, and means connected to the cylinder of said pump for returning to said reservoir water that may leak past the piston of said pump.

11. A spray iron in accordance with claim 10, wherein the means for returning water from the cylinder to the reservoir is a second conduit which extends downward from the rear of said pump and communicates with the interior of said reservoir.

12. A spray iron in accordance with claim 11, wherein said second conduit intersects the fill tube and is connected into said reservoir through said fill tube.

13. A spray iron in accordance with claim 11, wherein a portion of said second conduit is formed integral with a portion of said pump.

14. In a spray iron, the combination comprising a soleplate, a water reservoir positioned above said soleplate, a handle including a hollow front leg fixed relative to the soleplate, first and second apertures in the top of said reservoir, means for filling said reservoir with water comprising a tube extending from said first aperture and communicating with an orifice in the front face of said handle, spray means surrounding the forward end of said handle including a manually operable piston pump and a spray nozzle secured to the forward end of the pump, and a water intake conduit extending from a low point in said reservoir in ironing position and through said second aperture to the interior of said pump.

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