

Ironing machine comprising an iron and a stand.

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The invention relates to an ironing machine comprising an iron and a stand, the iron comprising a steam generator and the stand comprising a water reservoir, the water reservoir being connected to the steam generator by means of a duct, the ironing machine further comprising a pump driven by an electrical current for pumping water from the reservoir to the iron, and flow rate adjustment means having settings corresponding to at least two different flow rates of water to the steam generator.

Such an ironing machine is known from EP-A-0 557 901. The known ironing machine consists of an iron and a stand comprising a water reservoir and an electrical pump. The pump serves to pump water from the reservoir via a duct to a steam chamber in the iron. The flow rate of water into the steam chamber is adjustable by means of a valve. A disadvantage of the known ironing machine is that the pump is heavily loaded when a small flow rate is selected by the user. This requires a special pump or results in a reduced life time of the pump. Another disadvantage of the known ironing machine is the rather large range of flow rate fluctuation at each setting, due to component tolerances. This could result in insufficient steam or water spitting out when the flow rate exceed the steaming capacity of the iron.

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It is an object of the invention to provide a ironing machine with which the amount water supplied to the steam generator can conveniently be adjusted. To achieve this object the ironing machine according to the invention is characterized in that the flow rate adjustment means comprise an electrical drive circuit for controlling the electrical current supplied to the pump dependent on the setting. Due to this measure the electrical current supplied to the pump is adjustable resulting in a desired flow rate of water to the steam generator. The pump is only loaded as far as required to obtain a desired flow rate resulting a longer lifetime of the pump. Additionally, the pump may be chosen from a larger

collection enabling optimisation of the specifications and the total costs of the ironing machine. A valve in the iron is not required so that there is more freedom in the mechanical design of the ironing machine.

5 An embodiment of the ironing machine according to the invention is characterized in that the flow rate adjustment means comprise a manually adjustable selector for selecting a setting. Due to these measures the user can chose the amount of steam generated by the steam generator.

- 10 An embodiment of the ironing machine according to the invention is characterized in that the selector is located at the iron. Due to this measure the user can operate the selector with the hand which holds the iron.

15 An embodiment of the ironing machine according to the invention is characterized in that the electrical current is pulsating or alternating with a frequency, which depends on the setting. The variation of the frequency of the electrical current dependent on the setting results in a proper operation of the pump for low and high flow rates. The pump may, for example, be an electromagnetically driven piston pump or membrane pump.

20 An embodiment of the ironing machine according to the invention is characterized in that the iron comprises a spray nozzle, the spray nozzle being connected to the duct via a valve. By opening the valve spray operation is obtained without the user having to operate a manual pump. Due to these measures the spray function is very convenient to operate and a continuous spray operation is obtained.

25 An embodiment of the ironing machine according to the invention is characterized in that the valve is loaded with resilient means. With this measure the valve will be closed when the pressure in the duct is below a certain value. By setting the electrical current to, for example, its maximum value, the pressure in the duct will increase and the valve will automatically open resulting in a spray of water out of the nozzle. Hence, the spray function can be activated with a electrical switch connected to the drive circuit.

30 An embodiment of the ironing machine according to the invention is characterized in that the iron comprises a further valve located between the duct and the steam generator, the iron further comprising actuating means for closing said further valve and setting a certain electrical current for the pump. By activating the actuating means the spray function will be started and the flow of water into the steam generator is interrupted so that the production of steam is not increased by activating the spray function.

An embodiment of the ironing machine according to the invention is characterized in that activation of the actuating means causes the further valve to be closed



before said certain electrical current is set. This measure counteracts that a short shot of steam is generated when the spray function is activated.

An embodiment of the ironing machine according to the invention is characterized in that said actuating means cooperate with a chamber with a variable volume, the chamber being connected to the duct at a position between the pump and said further valve, release of the actuating means resulting in subsequently resetting the electrical current of the pump, increasing the volume of the chamber and opening said further valve. It has been found that at the end of a spray operation, the pressure built up in the duct results in a shot of steam when the valve to the steam generator is opened. Especially when the duct is made of a flexible material, which is required to obtain a flexible connection between the stand and the iron, this shot of steam may be large. By providing a chamber of which the volume is increased after resetting the electrical current and before opening the valve to the steam generator, the pressure in the duct is reduced and a shot of steam at the end of a spray operation is counteracted.

15 An embodiment of the ironing machine according to the invention is characterized in that the volume of said chamber is variable by means of a movable piston, the actuating means comprising a manually depressible knob at the outside of the iron cooperating with said further valve, said piston and a switch being connected to the electrical drive circuit, the valve being opened or closed, respectively, by depressing or releasing, respectively, the knob over a first range of its stroke, the piston being moved by moving the knob over a third range of its stroke and the switch being opened or closed, respectively, by depressing or releasing, respectively, the knob over a third range of its stroke. These measures can easily be realised by conventional techniques using plastic injection moulded parts and result in the reduction of the pressure in the duct before opening the valve to the steam generator so that a shot of steam at the end of a spray operation is counteracted.

Embodiments of the invention are represented in the drawing and will be further described hereafter, in which drawings:

30 Fig. 1 shows a diagrammatic representation of a first embodiment of the ironing machine according to the invention and

Fig. 2 shows a detail of an iron of a second embodiment of the ironing machine according to the invention.

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Fig. 1 shows a diagrammatic representation of a first embodiment of the ironing machine according to the invention. The ironing machine comprises an iron 1 and a stand 2. The iron 1 comprises a steam generator 11, in this case in the form of a steam chamber in the sole plate 15 of the iron 1. The stand 2 comprises a reservoir 21 which is connected to the steam generator 11 by means of a duct 3. The ironing machine further comprises a pump 22 in the duct 3, which pump 22 can be driven by an electrical current and flow-rate adjustment means 41. The flow-rate adjustment means 41 have at least three settings corresponding to different flow-rates of water into the steam generator 11 and comprise an electrical drive circuit, in this case in the form of a control unit 41 and a driver 45, to control the electrical current supplied to the pump 22 dependent on the setting. The control unit 41 comprises a manually adjustable selector 42 for selecting a setting and a trigger 43 for activating the pump 22. During use the user can depress the trigger 43 when steam operation is required. This will cause the pump 22 to be activated generating a flow-rate of water into the steam generator 11 dependent on the setting set by the adjustable selector 42. Preferably, the control unit 41 is located in the grip of the iron 1 so that the trigger 43 and the selector 42 can be operated by the hand which holds the iron 1. The sole plate 15 is heated by means of a heating element 12 which is connected to the mains via a thermostat 13. The driver 45 comprises an electric power supply which supplies to the pump 22 an electrical current which is controlled by the control unit 41. The driver 45, which is located at the stand, is connected to the control unit 41 by means of the cable 44 and can be connected to the mains via a mains cable 46. The cable 44 also serves to connect the heating element to the mains cable 46. In this embodiment the electrical current supplied to the pump 22 by the driver 45 is pulsating or alternating with a frequency which is dependent on the setting of the manually adjustable selector 42. For example, the frequency of the mains is reduced to multiples of 2.5 Hz so that the frequency of the electrical current supply to the pump 22 can be set at 2.5, 5 and 7.5 Hz. Each of these frequencies corresponds to a different flow-rate of water from the waterreservoir 21 to the steam generator 11. To obtain a self-clean operation the selector 42 may have a special setting or a separate switch (not shown) may be provided to operate the pump at the mains frequency. In that case the pump 22 will deliver full flow into the steam generator 11. This large quantity of water will serve to flush out soluble salt and bits of insoluble scale.

Fig. 2 shows a detail of an iron of a second embodiment of the ironing machine according to the invention. In this second embodiment the iron 1 comprises a spray nozzle 5 at the outside, which spray nozzle 5 is connected to the duct 3 via a valve 51,



another duct 32 and a chamber 63. The valve 51 is loaded with resilient means, in this case a spring 52. When the pump 22 is operated at a low frequency the pressure in the duct 3 will be such that the valve 51 remains closed. However, when the pump 22 is operated at the mains frequency the pressure in the duct 3 will rise causing the valve 51 to be opened and a spray operation will result. In order to prevent increased steam production the iron 1 comprises a further valve 61 located between the duct 3 and the steam generator 11 and actuating means, in this case in the form of a knob 62, for closing said further valve 61 and setting a predetermined electrical current for the pump 22. The iron 1 comprises a chamber 63 which is connected to the duct 3 at the position between the pump 22 and the further valve 61. A piston 64, which bounds the chamber 63, is connected to the manually depressible knob 62 and held in its upper position by a spring 68. The manually depressible knob 62 can activate a switch 47 via a lever 66. When the piston 64 is in its upper position an extension 64a of the piston 64 holds the further valve 61 against the force of another spring 69 in its open position. In that position of the further valve 61, water can flow from the duct 3 through the chamber 63 to a further chamber 67 and through a further duct 31 into the steam generator 11. The flow of water from the duct 3 into the steam generator 11 will be dependent on the electrical current supplied to the pump 22. In the following the spray operation will be explained. When the knob 62 is depressed by the user over a first range of its stroke, the piston 64 will move downwards and the further valve 61 will be closed due to a force of the further spring 69 causing flow of water from the duct 3 to the steam generator 11 to be blocked. When the knob 62 is depressed over a second range of its stroke, the piston 64 will move further downwards, causing the volume of chamber 63 to be reduced, the purpose of which will be explained hereinafter. When the knob 62 is further depressed over a third range of its stroke, the knob 62 will activate the switch 47 via the lever 66. The switch 47 is connected to the control unit 41 (see Fig. 1) in such a way that closing the switch 47 will cause the pump to be operated at the mains frequency and a spray operation will result. When the user releases the knob 62 the switch 47 will be opened which resets the electrical drive current to the pump 22 and subsequently the piston 64 will move up due to the spring 68 causing the volume of the chamber 63 to be increased and the pressure in the chamber 63 and the duct 3 to be reduced. When the pressure in the chamber 63 is reduced the valve 51 will close under the pressure of the spring 52 and the spray operation will end. Finally, the further valve 61 is lifted so that the duct 3 has an open connection with the steam generator 11. As the volume of the chamber 63 is increased after the electrical current to the pump is reset, the pressure in the duct 3 is reduced and it is prevented that a large



amount of water flows into the steam generator 11 when the further valve 61 is opened.

Hereinbefore the invention has been described for embodiments using modulation of the frequency of the electrical current supplied to the pump 22. However, the flow of water may also be adjusted by modulating the level of the current supplied to the
5 pump or the level of the voltage applied to the pump 22 dependent on the setting. It is also to be noted that the driver 45 and the control unit 41 may be integrated into one unit located either at the iron or the stand.

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CLAIMS:

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1. An ironing machine comprising an iron (1) and a stand (2), the iron comprising a steam generator (11) and the stand comprising a water reservoir (21), the water reservoir being connected to the steam generator by means of a duct (3), the ironing machine further comprising a pump (22) driven by an electrical current for pumping
- 5 water from the reservoir to the iron, and flow rate adjustment means having settings corresponding to at least two different flow rates of water to the steam generator, characterized in that, the flow rate adjustment means comprise an electrical drive circuit (41, 45) for controlling the electrical current supplied to the pump dependent on the setting.
- 10 2. An ironing machine according to claim 1, characterized in that the flow rate adjustment means comprise a manually adjustable selector (42) for selecting a setting.
3. An ironing machine according to claim 2, characterized in that the selector (42) is located at the iron (1).
4. An ironing machine according to any of the preceding claims,
15 characterized in that the electrical current is pulsating or alternating with a frequency which depends on the setting.
5. An ironing machine according to any of the preceding claims, characterized in that the iron (1) comprises a spray nozzle (5), the spray nozzle being connected to the duct (3) via a valve (51).
- 20 6. An ironing machine according to any of the preceding claims, characterized in that the valve (51) is loaded with resilient means (52).
7. An ironing machine according to claim 5 or 6, characterized in that the iron (1) comprises a further valve (61) located between the duct (3) and the steam generator (11), the iron further comprising actuating means (62) for closing said further valve and
25 setting a predetermined electrical current for the pump.
8. An ironing machine according to claim 7, characterized in that activation of the actuating means (62) causes the further valve (61) to be closed before said predetermined electrical current is set.
9. An ironing machine according to claim 7 or 8, characterized in that said



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actuating means (62) cooperate with a chamber (63) with a variable volume, the chamber being connected to the duct (3) at a position between the pump (22) and said further valve (61), release of the actuating means resulting in subsequently resetting the electrical current of the pump, increasing the volume of the chamber and opening said further valve.

- 5 10. An ironing machine according to claim 7, 8 or 9, characterized in that the volume of said chamber is variable by means of a movable piston (64), the actuating means comprising a manually depressible knob (62) at the outside of the iron cooperating with said further valve (61), said piston and a switch (47) being connected to the electrical drive circuit (41, 45), the valve being opened or closed, respectively, by depressing or releasing, respectively, the knob over a first range of its stroke, the piston being moved by moving the knob over a second range of its stroke and the switch being opened or closed, respectively, by depressing or releasing, respectively, the knob over a third range of its stroke.

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