Nov. 18, 1941. A. SUSSMAN 2,263,532

STEAM IRON

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FIG. 1.

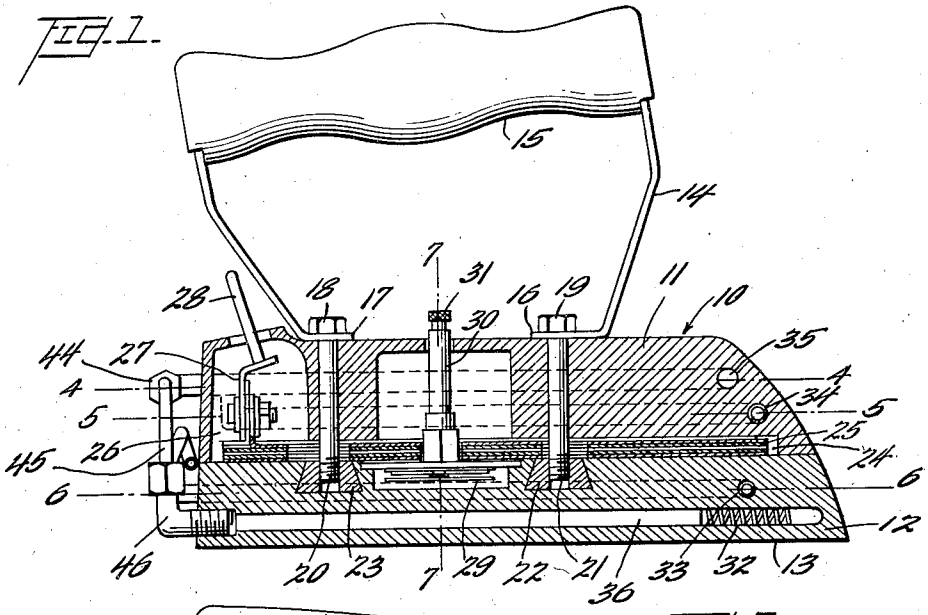


FIG. 2.

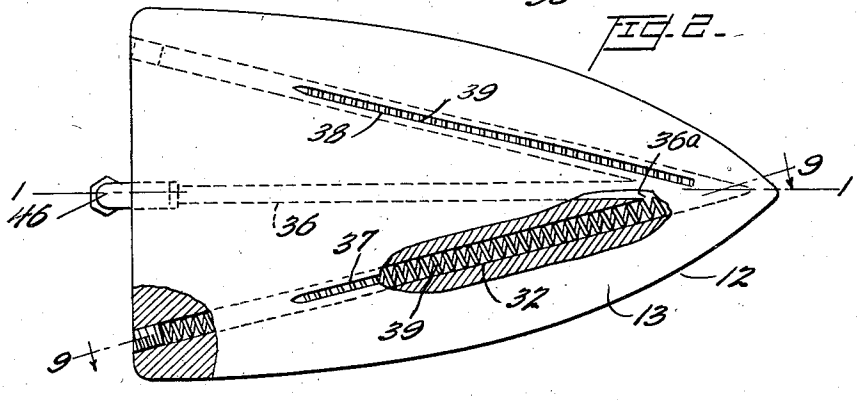
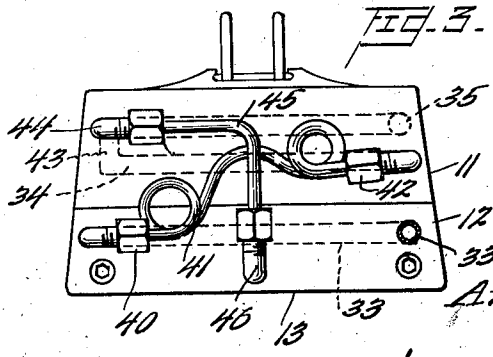


FIG. 3.



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STEAM IRON

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FIG. 4.

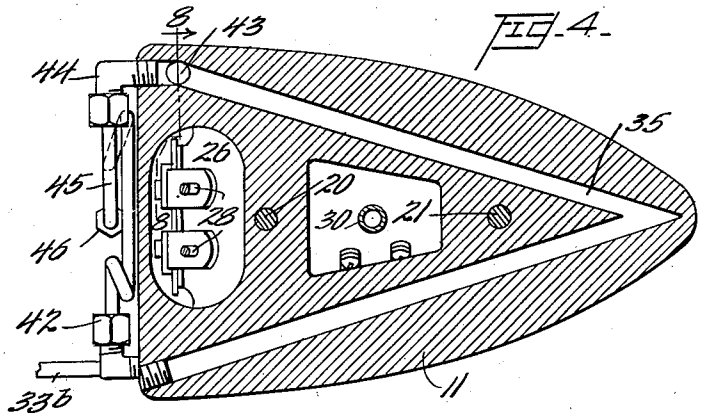


FIG. 5.

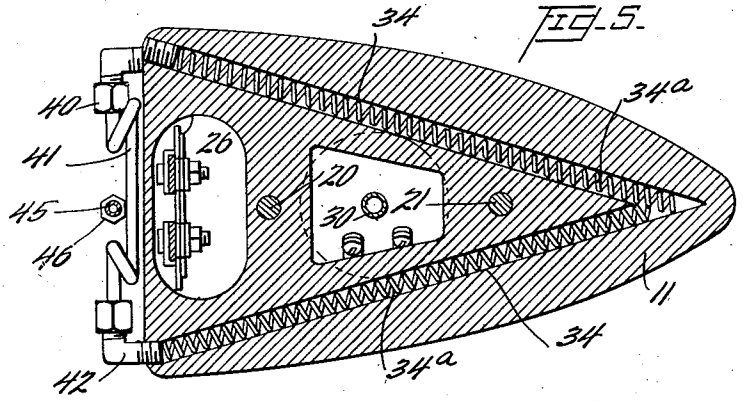
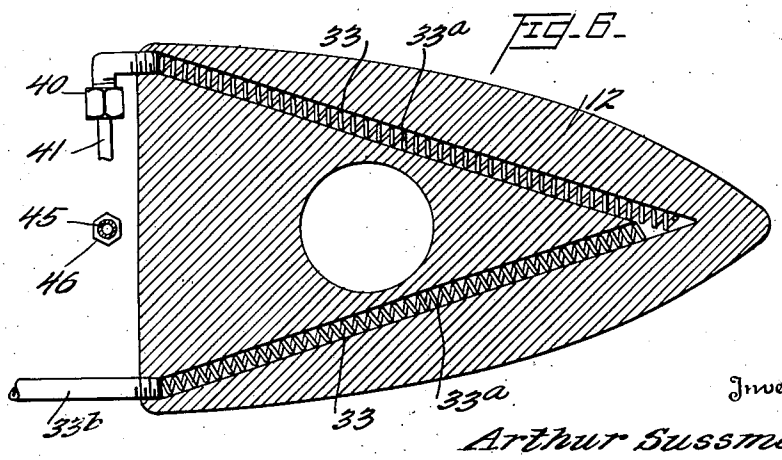


FIG. 6.



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STEAM IRON

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FIG. 7.

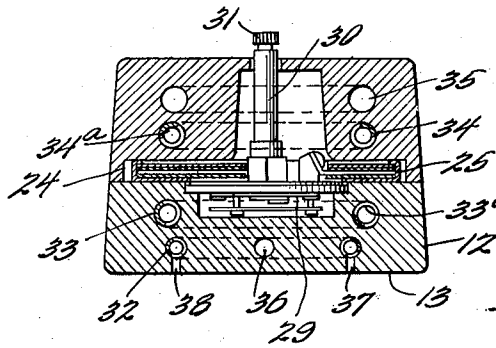


FIG. 8.

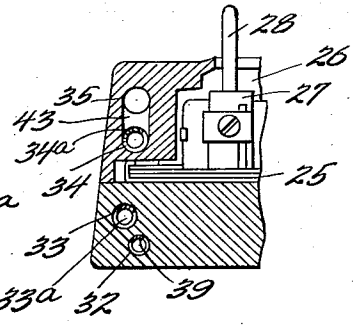


FIG. 9.

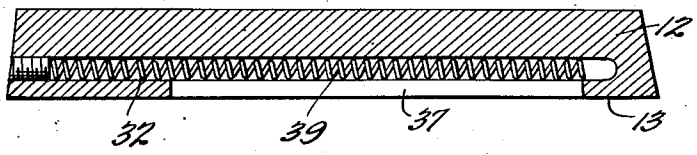


FIG. 10.

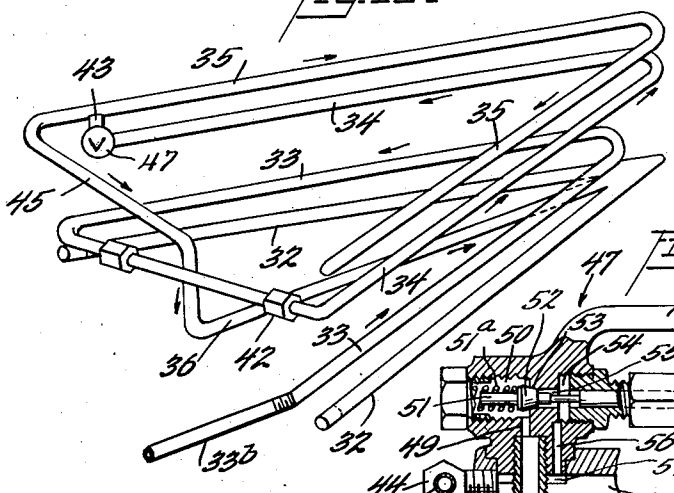
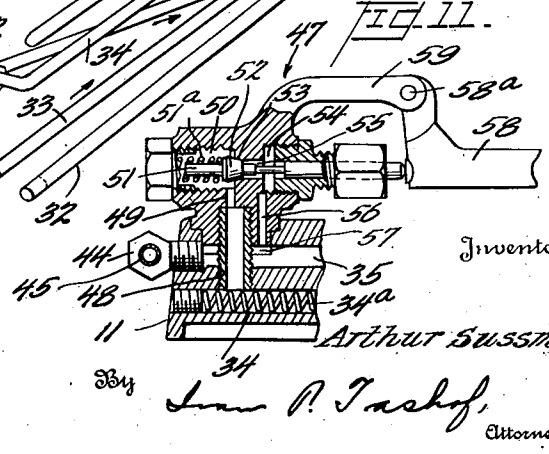


FIG. 11.



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Patented Nov. 18, 1941 2,263,532

UNITED STATES PATENT OFFICE

2,263,532

STEAM IRON

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Application November 22, 1939, Serial No. 305,723

14 Claims. (Cl. 38—77)

The present invention relates to a steam iron incorporating novel means for producing and feeding steam.

More particularly, the present invention relates to an iron of the type which contains, in addition to a heating element, a series of openings in the pressing surface and means to feed steam through these openings onto the surface of the material undergoing treatment.

Preferably, the present invention relates to an iron of the type wherein the steam is generated within the iron itself and water is fed into the iron to produce the steam.

One of the disadvantages of irons of this character is that the steam when generated within the iron is not continuously and smoothly fed to the pressing surface. This is particularly true in irons where no valve is provided to hold back the flow of steam and to produce a storage of steam within the iron. Where water is delivered to an iron of this character from a tank or source at a relatively constant pressure, the heating element within the iron generates steam from the water being fed until a steam pressure has been built up which is equal to or greater than the pressure of the water being fed. As soon as this pressure is built up the flow of water from the source stops until sufficient steam has been emitted from the pressing surface to lower the pressure, whereupon the flow of water is once again started and steam produced. This phenomena causes the flow of steam from the pressing surface to be relatively irregular and in some instances portions of unconverted water are trapped within the iron and forced out during irregular pressure conditions.

This condition may also be partially due to the fact that the normal thermostatic control of irons is not especially adapted to the steam producing iron. In other words, the normal thermostatic control is more concerned with the temperature at the pressing surface of the iron than with the production of an even amount of steam throughout the period of operation.

It is one of the objects of the present invention, therefore, to provide a steam iron capable of producing a steady and even flow of steam through the pressing surface.

Another object of the present invention is to provide in a steam generating iron, a pressure equalizing chamber which is capable of preventing steam delivery in a series of pulsations and of promoting a steady and even flow of steam from the iron.

A third object of the present invention is the provision of a channel or chamber having one end closed and the other end communicating with the steam-producing channels of the iron at a point intermediate the outlet end of the steam-producing channel and the supply channel of the iron.

A fourth object of the present invention is the provision of an iron wherein the production of steam takes place continuously and gradually as the water proceeds through the various channels thereof.

A fifth object is a thermostatic control of a heating element of a steam-producing iron which is in heat exchange with the water being fed into the iron.

A sixth object is the provision of a thermostat which will be capable of terminating the flow of current to the heating element of an iron when no water is being fed into the iron.

A seventh object is the provision in a steam iron of a series of channels, one of the channels being situated in close proximity to a thermostatic control.

Other objects will become apparent from the accompanying drawings and description.

In the drawings:

Figure 1 is a vertical section of an iron according to the present invention, taken along the line 1—1 of Figure 2.

Figure 2 is a bottom plan view of the base plate of the iron partly broken away in order to show the feeding channels.

Figure 3 is a rear elevation of the iron with the handle omitted.

Figure 4 is a horizontal section taken on the line 4—4 of Figure 1.

Figure 5 is a horizontal section taken on the line 5—5 of Figure 1.

Figure 6 is a horizontal section taken on the line 6—6 of Figure 1.

Figure 7 is a vertical section taken on the line 7—7 of Figure 1.

Figure 8 is a vertical section taken on the line 8—8 of Figure 4.

Figure 9 is a section taken on the line 9—9 of Figure 2.

Figure 10 is a diagrammatic showing of the channels illustrating the flow of water and steam.

Figure 11 is a section illustrating a modification of the device, incorporating a control valve.

Referring to Figure 1 there is illustrated a steam iron provided with a body indicated in general by the reference numeral 10, and provided with an upper portion 11, which may be cast integrally of any suitable metal and a lower

portion 12, provided with a pressing surface or sole 13. The iron proper is provided with a handle 14 of any suitable type, which is provided with a wooden or plastic portion 15 shaped to be grasped by the palm of the user, and a pair of ears 16 and 17, which are adapted to be fastened by bolts 18 and 19 to the iron 10. It is to be noted that the bolts 18 and 19 are provided with suitable heads and with threaded portions 20 and 21, which are adapted to cooperate with suitable nuts 22 and 23, fastened into the lower portion 12. The bolts 18 and 19 thus serve to not only retain the handle on the base of the iron, but also to hold together the portions 11 and 12. The upper portion of the iron 11 is preferably provided with a hollowed-out section 24 in its base, which is adapted to form a chamber closed by the upper surface of the lower iron portion 12. Within the chamber thus formed there is provided a heating element 25 of the usual type consisting of a plurality of flat strips of resistance material wound upon a suitable insulating core and separated from the remainder of the iron by a suitable insulating material, such as mica. At the rear end of the portion 11 there is provided another hollow portion 26, which is adapted to contain a pair of terminals 27 of the usual type. The ends of these terminals project through the upper surface of the iron at 28 and are adapted to fit into the usual connecting plug. A hollow portion is provided in the upper surface of the member 12, which is adapted to contain a thermostatic unit, indicated in general at 29. The thermostatic unit is provided with a shaft 30, which passes through the heating element and is insulated therefrom. The shaft 30 forms a control shaft for the thermostat and is provided at its upper end with a knob 31. The manual operation of this knob is adapted to set the thermostatic control in a manner well known in the art, so that the heating unit 25 may be operated at a plurality of heating temperatures. It is to be understood that the thermostat is connected in circuit between the terminals 27 and the heating unit 25, so that it serves to regulate the flow of current through the heating unit and when the thermostat is subjected to a temperature in excess of the upper heating limit, as regulated by the knob 31, it serves to shut off the flow of current to the heating element 25. When the thermostat cools down it also serves to once again supply current to the heating unit 25.

Formed in the body of the iron 10 are a plurality of heating channels. These channels are vertically spaced one from the other and are of general V-shape. As shown in Figure 1 there are four sets of channels, 32, 33, 34, and 35. The channel 32, which is shown in detail in Figure 2, has a feed or supply channel 36, communicating with its forward end, as at 36a. The forward end of the channel 32 is open to the pressing surface 13 as by a pair of slots 37 and 38. The channel 32 is also provided with a spring member 39, for a purpose to be hereinafter described. Located in the lower portion 12 of the iron, and just above the channel 32, is a channel 33, which functions to heat the water fed to the iron. It may be noted that the channel 33 surrounds and is in close proximity to the thermostat 29. Two sets of channels are provided in the upper portion 11 of the iron, which are designated by the reference numerals 34 and 35. The channel 34 is located just above the heating unit and is the main steam-producing channel of the iron, whereas the channel 35 is a dead end or pressure equalizing channel. It may be noted that both channels 33 and 34 are provided with metal springs 33a and 34a throughout their length. The metal springs in these channels serve to promote a better heat transfer to the steam and water passing therethrough. The channel 35 does not contain a spring, since the function of this channel is to act merely as a pressure equalizing chamber. The shape of the channels and their connections are illustrated in Figures 4 to 6. Figure 4 showing the channel 35 in detail, Figure 5 illustrating the channel 34 and Figure 6 illustrating the channel 33.

One of the ends of the channel 33 is provided with a coupling which is adapted to be connected to a water hose, leading to a suitable water source of a relatively constant low pressure, i. e., a water supply having a pressure of approximately ten to twelve pounds. The other end of the channel 33 is connected by a coupling or elbow 40 with a short section of copper tubing 41. The other end of the tubing is connected by means of another elbow 42 with one end of the channel 34. The other end of the channel 34 communicates as by a vertical bore 43 and an elbow 44 with a section of tubing 45 connected as by the elbow 46 with the supply channel 36. The vertical bore 43 also opens into one end of the dead end channel 35.

The operation of the iron hereinbefore disclosed is as follows:

Water at a constant pressure is fed into the channel 33, through the inlet or coupling 33b. As best shown in Figure 10. The water passes through the channel 33 in the direction shown by the arrows to the coupling member 40. During the passage through the channel 33, the water is not converted into steam, but simply heated up to greater or lesser extent. The water then passes through the connecting tube 41 and the connection 42 into the main steam-producing channel 34, which is located above the heating unit in position to receive the greater amount of heat therefrom. During the passage through the steam-producing channel 34 the relatively warm water is gradually converted into steam and then passes through the vertical bore 43 into the elbow 44. From the elbow 44 the steam is fed through the tube 45 into the supply channel 36. Since the forward end of the supply channel communicates with the channel 32, steam is fed to this channel and passes through the slots 37 and 38 out of the pressing face 13 of the iron. It is to be noted that the springs 39 in the channel 32 serve to subdivide the steam and, therefore, enables the use of relatively wide slots 37. In the irons of the prior art, relatively small perforations are used, which are subject to many disadvantages. The slot of the present iron is preferably of approximately one-sixteenth of an inch in width and is provided with a spring having convolutions approximately one-sixteenth of an inch apart.

By using a slot of the approximate width stated the danger of the slot clogging because of scale deposition from the steam is minimized. This is a wide divergence from the prior art wherein very narrow slots or small perforations are used. However, the use of the relatively wide slot is possible in accordance with the present disclosure when the slot is provided with baffling means such as for example, the spring 39. Other equivalent means may also be used such as a screen member having relatively large openings

of the order of one sixteenth of an inch, or the channel 32 may be loosely packed with steel wool etc. Other suitable constructions and advantages are disclosed in my copending application Serial No. 305,724, filed November 22, 1939.

The function of the dead end channel or pressure equalizing chamber 35 is to prevent surges of steam from the generating channel 34 being fed to the inlet slots 37, and also to prevent water hammer in the iron. During the initial operation of the iron a certain amount of water remains unconverted into steam, even after passage through the main generating channel 34. A certain amount of atmospheric air in the water is trapped during its passage through the channel and this air in moving up the vertical bore 43 is fed to the dead end channel 35; since it cannot escape from the channel it forms a permanent compressible cushion during the further operation of the iron. It may be noted that some water may exist in the steam, even during the further operation, but that this water is largely converted during its passage through the supply channel 36 and the channel 32. It is also possible during temporary increases in pressure in the system for steam to be forced into the dead end chamber against the cushion of air and be to some extent compressed therein. The function of this dead end chamber or channel is to smooth out the operation of the iron and to prevent uneven feeding of the steam through the pressing surface. The positioning of the water-heating channel 33 about the thermostat 29 subjects the thermostat to the temperature of the water in this channel. The thermostat is, therefore, exceedingly sensitive to the water being fed and in the event that the water supply is shut off the thermostat will be effective to immediately stop the flow of current to the heating unit 25. This type of control is also more sensitive during normal operation, since the thermostat is also subjected to the temperature of the water being fed and in the event pressures tend to build up which will check the flow of water, it is effective to immediately cut off the current to the heating element.

In accordance with the present invention there has, therefore, been provided in a steam iron, which includes means to feed steam to a material being treated and means to supply steam to the feeding means, a pressure balancing chamber having one end closed and the other communicating with a connecting means between the steam supplying means and the feeding means.

The present device also preferably comprises a thermostatic means in heat exchange with a water inlet channel and a steam generating channel in heat exchange with a heating unit and means to connect the steam generating channel and the water inlet channel.

In the modification illustrated in Figure 11 a control valve for the iron is provided. The valve is indicated in general by the reference numeral 47. In this modification the vertical bore 43 is provided with a threaded bushing 48. The valve 47 is mounted on the bushing 48, as by a suitable screw thread, and the interior of the bushing communicates with the port 49 of the valve. The port 49 opens into the chamber 50 of the valve 47. The chamber 50 houses one end of a valve core 51. The valve core 51 is provided with a conical portion 52, which is adapted to be seated against the seat 53 by a spring 51a within the chamber 50. When the conical portion 52 is moved to the left, as viewed in Figure 11, the conical portion 52 is moved away from the seat 53, so as to establish communication between the chamber 50 and the valve chamber 54 by means of the port 55. The chamber 54 in turn communicates, by means of a port 56, with an annular chamber 57, which opens both into the dead end chamber 35 and into the elbow 44 provided in the iron, as hereinbefore described. The valve core 51 is moved to the left by means of a manually operated handle 58, pivoted on a valve ear 59, by means of a suitable rivet 58a. Clockwise movement of the handle 58 about the rivet 58a will, therefore, push the valve core to the left against the action of the spring 51a. In this modification of the device, therefore, the steam generating channel 34 is cut off from the dead end chamber 35 and the fitting 44, whenever the valve 47 is closed. When the handle 58 is moved in a clockwise direction, the conical portion 52 will be moved from the seat 53 and steam will flow through the center of the bushing 48, the port 49, the chamber 50, the chamber 54, the port 56 to the annular chamber 57, and from the annular chamber be fed both as to the dead end chamber 35 and the fitting 44. From the fitting the steam will, of course, be fed to the supply channel 36 and out of the openings 37 in the pressing face. As long as the valve is open, therefore, the feeding of steam to the pressing face will be regular, due to the action of the dead end channel or pressure equalizing chamber 35.

It will be noted particularly that in the iron under consideration when the valve is open or when no valve is employed, the steam may be continuously generated for an indefinite period and is continuously delivered to the objects to be pressed. It may be stated further that when water is delivered under a pressure of, as for example, ten (10) pounds from a tank, the amount of water which can be delivered per minute and the volume of the water heating channels, the steam converting channel and the equalizer or pressure equalizing channels are so correlated that steam will be generated continuously and continually delivered over a long period of time, that is, over a normal working period of eight hours.

It is desired to point out further that although the channel 33 has been described as a water inlet channel and the channel 34 as a steam generating channel, that actually it is rather indefinite during operation as to just where the water ceases to exist as water and where it begins to be steam, except that there is no steam conversion in the channel 33 under any normal operating condition. There is a progressive heating of the water from the time it enters the inlet from the channel 34 to the time it leaves at the outlet thereof or through the bore 43. Probably the greater part at least of the water has been converted into steam at the bore 43 and is superheated to a greater or lesser extent from that point on, as for example, during its passage through the conduit 45 and the channel 36.

Although the channels of the iron herein disclosed have been provided with spring members for retarding the flow and increasing the heat transfer between the steam and water and the body of the iron, other flow retarding and heat transfer means can be used. For example, the channels may be provided with suitable packing, or with angularly disposed metal ribbons as in my prior Patent No. 1,942,579. The flow retarding and heat transfer means should be of such nature, however, that the effect thereof will tend

to promote the smooth production of steam and so supplement the action of the pressure equalizing chamber hereinbefore described.

While it has been stated that the slots present in the sole of the iron are approximately one sixteenth of an inch wide, it is obvious that this may be departed from and still come within the spirit of the present invention. The slots may be considerably wider or somewhat less than one sixteenth of an inch in width, the criterion being that no fine openings, perforations or the like are present which may become clogged because of the deposition of scale, and that preferably, although not absolutely necessary, baffling means are provided in combination with the slot, said baffling means functioning to prevent a large volume of steam issuing from the broad slots, and in the preferred form of the invention the baffling means serve to subdivide the steam.

It is to be noted further that it is desirable, in order to promote the smooth, even feed of steam of known characteristics, i. e., steam of a given quality, that the means, for feeding the steam to the material being treated, desirably does not restrict the flow of steam to any great extent. Restriction of the flow of steam tends to produce relatively dry steam in accordance with the well known throttle effect. The use of relatively wide, preferably suitably baffled slots in combination with the cushioning means or dead end chamber hereinbefore described will result in a smooth even flow of steam of a desired quality to the materials undergoing treatment. This smooth even flow will not vary during the life of the iron since the orifice is of a sufficient width to prevent clogging with a resultant change in orifice size and outlet pressure.

It is desired to point out that the basic concept of one form of the invention is to use a slot wide enough to inhibit any tendency for clogging and combine therewith a means which will prevent a stream of steam the size of the slot from issuing therefrom.

It is desired to further point out that although in the preferred embodiment a spiral baffling member having spaced convolutions is spoken of as a spring, it is to be understood that the term spring is to be used in a broad sense, i. e. any suitable spiral member having spaced convolutions is to be deemed the full equivalent thereof and that where the term "spring" is used in the specification and claims, such a member is intended whether or not the member possesses resilient and/or spring-like qualities.

It is to be further understood that although in the specific form of the invention the steam cushioning means and/or the thermostatic control has been shown applied to a steam iron of the self-generating type, it may be used in an iron which is fed with live steam generated outside the iron. When used with such an iron the condensate return may be omitted. In other words, instead of a steam inlet which is pitched downwardly and a steam outlet or condensate return which is also pitched downwardly a single steam inlet line pitched in an upward direction may be used.

The steam cushioning means and/or the thermostatic control of the present invention is also suitable for use not only in steam irons, but in other steaming and/or pressing implements of a similar character, such as pressing machines provided with movable platens or pressing rolls.

The relatively wide steam feeding orifice herein set forth, as typified by slots, the latter preferably being used in combination with baffling means, may be incorporated in an iron fed with live steam generated extraneously of the iron, or may be used as feeding means in any suitable pressing and/or steam treating implements, as typified by pressing and steaming machines provided with movable platens or rolls.

Preferably, the baffling means herein disclosed as the "spring" members, etc., are removable from the iron so that any accumulation of scale or similar material may be cleaned from the baffling means, the orifices, and/or the channel behind the orifices.

It is claimed:

1. In a steam iron including means to feed steam to material being treated, means to generate steam within said iron, means to supply water to said generating means, and connecting means between the first and second means; a relatively long pressure balancing chamber having one end closed and the other end communicating with said connecting means, said pressure balancing chamber being sufficiently narrow and having a sufficient length to entrap air at its closed end to form a pressure cushion.

2. In a steam iron including means to feed steam to material being treated, means within said iron to produce steam, a heating unit adapted to heat said steam generating means, and connecting means between the generating means and the steam feeding means; a pressure balancing chamber extending substantially the entire length of the iron and having one end closed and the other end communicating with said connecting means, said pressure balancing chamber being sufficiently narrow to entrap air at its closed end to form a pressure cushion.

3. In a steam iron, a heating unit including a thermostat for regulating the same, a water inlet channel in intimate thermal association with said thermostat and at least partially circumscribing the same, a steam generating channel in heat exchange with said heating unit, means to connect said steam generating channel with said water inlet channel, means to emit steam from the iron on a material being treated, means to connect said steam generating channel with said last-mentioned means, and a pressure balancing chamber having one end closed and the other end communicating with the last mentioned connecting means, said pressure balancing chamber being sufficiently narrow to entrap air at its closed end to form a pressure cushion.

4. In a steam iron, a water inlet channel, a steam generating channel, a pressure balancing channel extending substantially the entire length of the iron, a transversely extending bore in said iron connecting the last two mentioned channels, means to connect the water inlet channel to the steam generating channel, and means to connect the transversely extending bore to a steam outlet, said pressure balancing channel being sufficiently narrow to entrap air at its closed end to form a pressure cushion.

5. In a steam iron, including means to feed steam to material being treated, a steam-producing channel, a heating unit adapted to heat said steam-producing channel, means to connect said steam-producing channel and said steam feeding means, a substantially unobstructed relatively long pressure balancing chamber having one end closed and the other end communicating with said connecting means, and a heat transfer and flow retarding member within said steam-producing channel, said pressure balancing

chamber being sufficiently narrow to entrap air at its closed end to form a pressure cushion.

6. In a steam iron, a heating unit, including a thermostat for regulating the same, a water inlet channel opening at each end to the rear of the iron and extending about said thermostat and in intimate thermal association therewith, a steam generating channel above said heating unit, means to connect said steam generating channel and said water inlet channel, and means to supply steam from said generating channel to an article being treated.

7. In a steam iron, a water inlet channel, a steam generating channel, a substantially unobstructed relatively long pressure balancing channel, a transversely extending bore in said iron connecting the last two mentioned channels, means to connect the water inlet channel to the steam generating channel, means to connect the transversely extending bore to a steam outlet, and a pair of metallic spring members, one of said spring members being within the water inlet channel and the other within the steam generating channel.

8. In a steam iron, a metal body member including an upper and a lower portion, a heating unit between said upper and lower portion, a thermostat in said lower portion beneath said heating unit and operatively connected thereto, a water inlet channel in said lower portion opening at each end to the rear of the body and extending about said thermostat, a steam generating channel in said upper portion immediately above said heating unit, a steam balancing chamber having a closed end in said upper portion above said generating channel, a vertical bore in said upper portion connecting said balancing chamber and said steam generating channel, means to connect said vertical bore to a steam outlet in the lower face of the lower portion, and means to connect said water inlet channel and said steam generating channel.

9. In a steam iron, a metal body member including an upper and a lower portion, a heating unit between said upper and lower portion, a thermostat in said lower portion beneath said heating unit and operatively connected thereto, a water inlet channel in said lower portion opening at each end to the rear of the body and extending about said thermostat, a steam generating channel in said upper portion immediately above said heating unit, a substantially unobstructed steam balancing chamber in said upper portion above said generating channel, a vertical bore in said upper portion connecting said balancing chamber and said steam generating channel, a steam outlet channel in said iron opening to the lower face thereof, means to connect the vertical bore and the last-mentioned channel, a plurality of spring members, one of said spring members being within each of the aforementioned channels and means to connect said water inlet channel and said steam generating channel.

10. In a steam iron, including means to feed steam to material being treated, means to supply steam to said feeding means and connecting means including a manually operated valve between the first and second means, and a pressure balancing chamber having one end closed and the other end communicating with said connecting means and said valve.

11. In a steam iron, a water inlet channel, a steam generating channel, a pressure balancing channel, a transversely extending bore in said iron connecting the last two mentioned channels, a valve interposed in said transversely extending bore and adapted when closed to prevent passage of steam between the two channels, means to connect the water inlet channel to the steam generating channel, and means to connect the valve to a steam outlet.

12. In an iron including upper and lower body members and a heating unit positioned therebetween, a recess in the upper surface of said lower body portion, a thermostat for regulating said heating unit positioned in said recess, a water inlet channel in the upper portion of said lower body member laterally circumscribing said recess, and a steam generating means in the upper body member communicating with the water inlet channel.

13. In a steam iron including upper and lower body members and a heating unit positioned therebetween, a recess formed centrally in the upper surface of said lower body portion, a thermostat for regulating said heating unit depending from said heating unit and positioned in said recess, a water inlet channel in the upper portion of said lower body member, opening at its rearward end to receive water and laterally circumscribing said recess and thermostat and a steam generating means in the upper body member communicating with the water inlet channel.

14. In an iron including upper and lower body members and a heating unit positioned therebetween, a recess in the upper surface of said lower body member, a thermostat for regulating the heating unit depending from said heating unit and positioned in said recess, a water inlet channel in the upper portion of said lower body member laterally circumscribing said recess, a steam generating channel in the lower portion of the upper body member and above said heating unit, a pressure balancing channel having one end connected to said steam generating channel and its other end closed, a steam feeding channel in the lower portion of the lower body member provided with outlets in the lower surface of the iron, and means to connect said water inlet channel, steam generating channel and steam feeding channel.

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