

CLOTHES IRON WITH MEANS FOR INDUCING ORBITAL OSCILLATORY MOTION INTO THE SOLE PLATE

This invention relates to an improved clothes iron and, in the preferred embodiment, provides a clothes iron which produces an enhanced ironing effect with a reduction in user effort, as compared with conventional clothes irons. Although the iron in the present invention will be herein referred to as the “clothes iron” it is to be understood that the iron may be used for purposes other than ironing clothes, for example, it may be used for ironing sheets, towels, tablecloths and similar items or may be used for pressing seams, etc during manufacture of cloth items.

Traditional clothes irons, which may be described as “dry irons” consist of a smooth plate (the sole plate) which is connected to a handle. The sole plate is heated by suitable means (for example electric heating elements) to an appropriate temperature and ironing is effected by pressing and/or repeatedly moving back and forth of the sole plate against the clothes or other items to be ironed. Whilst such irons can accomplish the work they require repeated passes and are generally ineffective against cloth items which have dried in a creased state or against fabrics the inherent properties of which make them difficult to iron back into a flat state. Also, all irons require a considerable amount of manual effort, in terms of both downward pressure and horizontal force to work repeatedly over the surface being ironed to get the desired finish.

With a view to improving the performance of irons, so called “steam irons” have been devised. These consist of essentially the same elements as a traditional dry iron, but with the addition of a mechanism for creating steam which flows out through holes provided in the sole plate to assist in the ironing process. Whilst steam irons provide advantages over dry irons, they nonetheless still require significant effort and work to remove persistent creases despite the aid of steam.

With a view to improving the performance of an iron it has been proposed in US-A-5094021 to incorporate an ultrasonic generator to produce ultrasonic movement of the sole plate. However, it is believed that such an

arrangement will not be as effective as the oscillation motion proposed in the present invention. Also, it is not clear from US-A-5094021 the mode in which the sole plate is vibrated by the ultrasonic oscillator. Apparently, the ultrasonic oscillator is mounted on top of the sole plate and in the circumstances it is likely that any vibratory movement of the sole plate will be perpendicular to the face of the sole plate.

A further oscillating iron is illustrated in US-A-2080682. In this case, the sole plate is mounted for rotary movement relative to the body and a motor driven crank is used to rotate the sole plate back and forth relative to the body so that the sole plate makes alternate clockwise and anti-clockwise rotational movements about its rotational axis.

I have now devised an improved iron, which may be embodied as a dry iron or a steam iron, which provides significantly improved ironing performance and/or a significant reduction in the manual effort required to effect the ironing of a garment or other cloth item.

In accordance with a first aspect of the present invention a clothes iron comprises: a body; a manually graspable handle secured to the body; a sole plate connected to the body, the sole plate having a substantially planar face for engaging items to be ironed; and means for inducing orbital oscillatory motion into the sole plate in the plane of the face thereof to enhance the performance of the iron.

The term "orbital" as used herein means that when the clothes iron hereof is operating, at least some points on the face of the sole plate move in a closed path from a start position to a displaced position and then from the displaced position back to the start position without re-tracing the route taken during the initial movement from the start position to the displaced position. The orbital path may be a circular orbital path, a figure of 8 orbital path or indeed any other orbital path. The use of an orbital path, in contrast to the simple back and forth movement used in US-A-2080682, produces an enhanced ironing performance.

In the preferred embodiment of the invention the sole plate is connected to the body by flexible coupling means so that the sole plate may orbitally oscillate in the plane of the face thereof relative to the body. In a particularly preferred embodiment of the invention the flexible connecting means are elastomeric mouldings, for example mouldings of a silicone compound. Such mouldings have the required properties as springs and are also effective to provide a degree of thermal isolation between the sole plate and the body. Alternatively, the flexible connecting means may be laterally resilient but longitudinally stiff metal or plastic strip springs.

The orbital oscillation generating mechanism is preferably powered by an electric motor mounted on the body or the handle. Preferably, the motor is positioned remote from the sole plate to reduce the exposure of the motor to the heat of the sole plate. Preferably, airflow ways are provided to allow a flow of cooling air over and/or through the motor.

In the preferred embodiment of the invention the orbital oscillation generating mechanism comprises a motor mounted above the sole plate and attached to the body. Preferably, the motor shaft is perpendicular to the plane of the lower surface of the sole plate and carries an eccentric extension which engages an appropriate aperture provided in the sole plate. Accordingly, as the motor shaft is rotated the sole plate executes orbital oscillatory motion in the plane of the face thereof. In a particularly preferred embodiment of the invention the motor shaft carries an eccentric weight to dynamically balance the eccentricity of the eccentric. Accordingly, the orbital oscillation motion is dynamically balanced to reduce vibration of the body and handle and only produce orbital oscillatory motion in the sole plate generated by the eccentric.

The aperture in the sole plate which receives the eccentric is preferably in the form of the inner race of a parallel-roller bearing, the outer race which is secured to the sole plate. If the eccentric is snugly received in the race the motion of the sole plate will be circular orbital oscillatory motion.

In an alternative embodiment, the eccentric of the shaft is received in a slot or other profile provided in the sole plate (either directly or by means of an adaptor located within the inner race of a bearing). By appropriately shaping and/or orientation of the slot the form of orbital oscillatory movement applied to the sole plate can be tailored. For example, a figure of 8 orbital oscillatory pattern may be provided by a suitable drive mechanism.

In the preferred embodiment of the invention an attitude and/or motion sensitive switch is incorporated for automatically initiating oscillation of the sole plate when the iron is tipped from a generally upright rest position to a generally horizontal use position, and for interrupting oscillatory movement when the iron is again turned to its rest position. Means may be provided for manually or automatically controlling the speed of oscillation. For example, a manual switch may be provided allowing appropriate selection of the motor speed and accordingly appropriate selection of the oscillatory frequency. Additionally or alternatively, automatic feedback means may be provided for, for example, increasing the frequency of oscillation in response to increased downward pressure on the iron handle, or on a manual pressure switch which when pressed turns on and/or boosts the oscillation to a maximum.

In one embodiment of the invention all downward load applied to the iron will be reacted onto the surface being ironed via the sole plate. However, in a preferred embodiment of the invention means are provided for reacting part of the downward imposed load via the sole plate and part of the downwardly imposed load through one or more support members. The or each support member may project through the sole plate to engage the surface being ironed or may be positioned laterally outside of the sole plate. Alternatively, a combination of support members projecting through and located laterally outside of the sole plate may be provided. Provision of support members provides the advantage that the load which can be imposed on the sole plate is limited by the flexible couplings that connect the sole plate to the body. Excessive downward pressure on the handle of the iron will be reacted direct onto the surface being ironed through the

support members leaving the sole plate free to oscillate under a pre-determined pre-load force generated by the flexible couplings. Such an arrangement helps to prevent excessive vibration being transmitted to the handle of the iron and ensures that the oscillation motor is not overloaded.

The invention will be better understood from the following description of preferred embodiments thereof wherein:

Figure 1 is a schematic view of an iron in accordance with the present invention with the handle and cover removed;

Figure 2 is a schematic and perspective bottom view of the iron of Figure 1;

Figure 3 is a longitudinally cross-sectioned perspective view of the iron of Figure 1;

Figure 4 is a detailed cross-sectional view of a portion of the iron of Figure 1; and

Figure 5 is a perspective view from the base of a second embodiment of the invention.

Referring firstly to Figures 1 to 4 a preferred embodiment of the invention is illustrated. In the interests of clarity, the handle, electrical wiring to the sole plate elements and motor, the temperature control mechanism and other conventional parts have been omitted from the drawing. As illustrated, the invention is embodied as a dry iron. It is to be understood, however, that the invention may be embodied as a steam iron by incorporating appropriate steam producing mechanisms within the body.

The illustrated iron 1 comprises a body 2 and a sole plate 3. The body 2 is supported on the sole plate 3 by means of laterally resilient springs 4. Typically, in a conventional boat-shaped sole plate three springs 4 may be provided, one at the nose 5 of the sole plate and two at the rear 6 of the sole plate 3. The springs 4 locate the sole plate 3 relative to the body 2 but can be resiliently deformed sideways to permit sideways movement of the sole plate 3 relative to the body in the plane of the lower face 7 of the sole plate. The springs are able to transfer load between the body 2 and the sole plate 3 in the direction perpendicular to the plane

of the face 7 of the sole plate to allow a user to press on the sole plate by pressing on a handle which is secured to the body.

In accordance with the invention, means are provided for inducing orbital oscillation motion into the sole plate 3 in the plane of the lower face 7. In the embodiment of Figures 1-4 a motor 8 is mounted on the body 2 or, optionally within the handle. A switch may be provided for activating/deactivating the motor. Additionally or alternatively an attitude sensitive switch may be provided for automatically deactivating the motor when the iron is rotated to place the iron in a rest position. The motor 8 has a shaft 9 that extends perpendicular to the face 7. It is to be understood, however, that various alternative arrangements are possible within the scope of the present invention. The shaft 9 carries an eccentric portion 10 that projects into an aperture provided in the sole plate. In the preferred embodiment, the aperture is provided by the inner race 11 of a parallel-roller bearing 12, the outer race 13 of which is received within a recess of the sole plate. If the eccentric portion is a snug fit in the aperture, as the shaft rotates, the sole plate performs circular orbital oscillatory motion in the plane of the face 7, relative to the body.

In a particularly preferred embodiment of the invention, in addition to the eccentric portion 10, an eccentric weight is provided and positioned to dynamically balance the shaft assembly in order to reduce so far as possible lateral loading on the shaft bearings accordingly reduce to a minimum the vibrations created or transmitted to the body 2.

In the above described embodiments of the invention the eccentric portion 10 is snugly received within the inner race 12 of a bearing the outer race 13 of which is mounted in the upper surface of the sole plate 3. However, other arrangements are possible and in particular by modifying the nature of the connection between the eccentric portion and the sole plate the nature of the orbital oscillations transmitted to the sole plate may be varied. By way of example, the eccentric portion may be located to work in a slot provided in a bush. The bush is secured to the sole plate by any suitable means. The slot is shorter than the throw

of the eccentric portion and as a result the sole plate will perform a figure of 8 orbital oscillations movement. Further, by adjusting the position of the connection relative to the centre of the sole plate the nature of the orbital oscillatory movement performed by the sole plate may be varied. In particular, by shifting the connection nearer to the nose 5 of the sole plate an arrangement may be produced in which there is more orbital oscillation at the nose than at the rear, and by shifting the point of connection towards the rear 6 the alternative arrangement in which there is more orbital oscillation at the rear than at the front can be produced.

In further possible embodiments of the invention the sole plate may be split into two or more parts with, for example, one side of the base plate oscillating in a clockwise rotary orbital movement whilst the other side rotates in an anti-clockwise orbital movement, the movement of the two sides being synchronised.

In a further possible embodiment of the invention the sole plate is filled with a fluid and constructed from flexible material. To this end a rigid sole plate base may be fitted with a thin Kevlar/polymer sandwich filled with a suitable fluid, for example colloidal copper or silver in an oil. The exposed surface of the sandwich may be coated with a low friction material, for example PTFE. Such an arrangement can be provided with a combination of oscillations and vibrations in any of the above described manners.

If desired, the whole of the applied load resulting from downward pressure on the body from the handle may be reacted onto the surface being ironed via the sole plate. However, in the preferred embodiment of the invention support members are used to react part of the imposed load onto the surface being ironed thereby limiting the downward force which can be applied to the sole plate. In the embodiment of the invention illustrated in Figures 1-4 the support members are in the form of three mushroom-shaped studs 15,16,17 located respectively one at the nose 5 of the sole plate and two at the rear 6 of the sole plate. Conveniently, the studs 15,16,17 may be preformed of a relatively rigid material onto which an elastomeric material, for example a silicon material, is moulded to produce the springs 4.

With the arrangement of support members of Figures 1-4, when no downward load is applied to the iron the entire weight of the iron is supported on the sole plate. Increased downward pressure on the handle will initially compress the springs 4 which connect the sole plate to the body, and the load on the sole plate will increase in proportion to the increased load applied to the handle. However, once a pre-determined load has been applied to the handle the support members 15,16,17 will engage the surface being ironed and any further downward load applied to the handle will be reacted via the support members rather than via the sole plate. Thus, the provision of the support members limits to a maximum the load which is reacted via the sole plate. If the downward load on the handle is greater than this maximum, part of the load will be reacted through the sole plate and the balance will be reacted through the support members. With such an arrangement if an excessive load is applied to the handle the sole plate 3 is able to "float" subject to a pre-load determined by the sole plate support springs 4. This arrangement prevents excessive loading of the oscillation motor and, in turn, prevents excessive vibrations being transmitted to the handle if a high load is applied to the handle in use. This arrangement also prevents excessive stress being applied to delicate fabrics by the orbital oscillation mechanism.

Referring now to Figure 5 an alternative embodiment of the invention is shown. In this case, the body 2A has been fitted with a cover and handle 18 of substantially conventional form. The sole plate 3A includes longitudinal curved slots 19,20 through which arcuate support members 21,22 project. The support members 21,22 are connected to the body 2A to react part of any imposed load directly from the body onto the surface being ironed in a similar manner to the studs 15,16,17 of Figures 1-4. In this case, the iron is embodied as a steam iron with apertures 23 provided to direct steam outwardly through the sole plate onto material being ironed in conventional manner. In all other respects, the assembly of Figure 5 is functionally the same as that of Figures 1-4.

Finally, if desired ancillary means may be provided for enhancing the effectiveness of the iron. Such ancillary means may, for example, comprise means

for emitting steam through apertures in the base plate, means for emitting a spray of water either through apertures in the base plate or ahead of the nose, and ancillary means for producing high frequency vibrations of the base plate, for example by means of an ultrasonic oscillator.

CLAIMS

1. A clothes iron comprises: a body; a manually graspable handle secured to the body; a sole plate connected to the body, the sole plate having a substantially planar face for engaging items to be ironed; and means for inducing orbital oscillatory motion into the sole plate in the plane of the face thereof to enhance the performance of the iron.
2. A clothes iron according to claim 1 wherein the means for inducing orbital oscillatory motion comprises: a rotary motor mounted in the body or the handle, the motor shaft having an output shaft and eccentric means on the shaft.
3. A clothes iron according to claim 2 wherein the eccentric means comprises an eccentric portion of the shaft which is received in a socket in the sole plate.
4. A clothes iron according to claim 3 wherein the eccentric means comprises an eccentric weight mounted on the shaft.
5. A clothes iron according to claim 3 or claim 4 wherein the eccentric portion of the shaft is received as a snug fit in a socket in the sole plate.
6. A clothes iron according to claim 5 wherein the socket in the sole plate is provided by the inner race of a bearing, the outer race of which is secured to the sole plate.
7. A clothes iron according to claim 3 wherein a lost motion connection is provided between the eccentric portion of the shaft and the sole plate.
8. A clothes iron according to claim 7 wherein the lost motion connection is provided by a slot in which the eccentric works, the slot having a length shorter

than the throw of the eccentric so that the sole plate moves in a figure of 8 pattern as the shaft rotates

9. A clothes iron according to any preceding claim wherein the sole plate is connected to the body by flexible coupling means so that the sole plate may oscillate in the plane of the face thereof relative to the body.

10. A clothes iron according to claim 9 wherein the flexible connecting means are resilient connecting means which tend to maintain the sole plate in a pre-determined position relative to the body.

11. A clothes iron according to claim 10 wherein the resilient means comprise laterally resilient elastomeric bodies or laterally resilient springs.

12. A clothes iron according to any preceding claim wherein support means are provided for engaging the surface being ironed to react part of downward load imposed on the iron onto the surface being ironed, the support means being independent of the sole plate and connected to the body.

13. A clothes iron according to any preceding claim wherein an attitude sensitive switch is incorporated for automatically initiating vibration of the sole plate when the iron is tipped from a generally upright rest position to a generally horizontal use position, and for interrupting vibratory movement when the iron is again turned to its rest position.

14. A clothes iron according to any preceding claim wherein means are provided for manually or automatically controlling the speed of oscillation.

15. A clothes iron according to any preceding claim wherein the sole plate comprises a rigid base and a sandwich structure secured to the base, the sandwich structure comprising an envelope filled with a liquid or paste.

16. A clothes iron according to claim 15 wherein the envelope is of Kevlar and the paste comprises an oil and metal particles.

17. A clothes iron according to any preceding claim including an ultrasonic transducer for inducing ultrasonic waves in the surface of the sole plate that contacts the clothes.