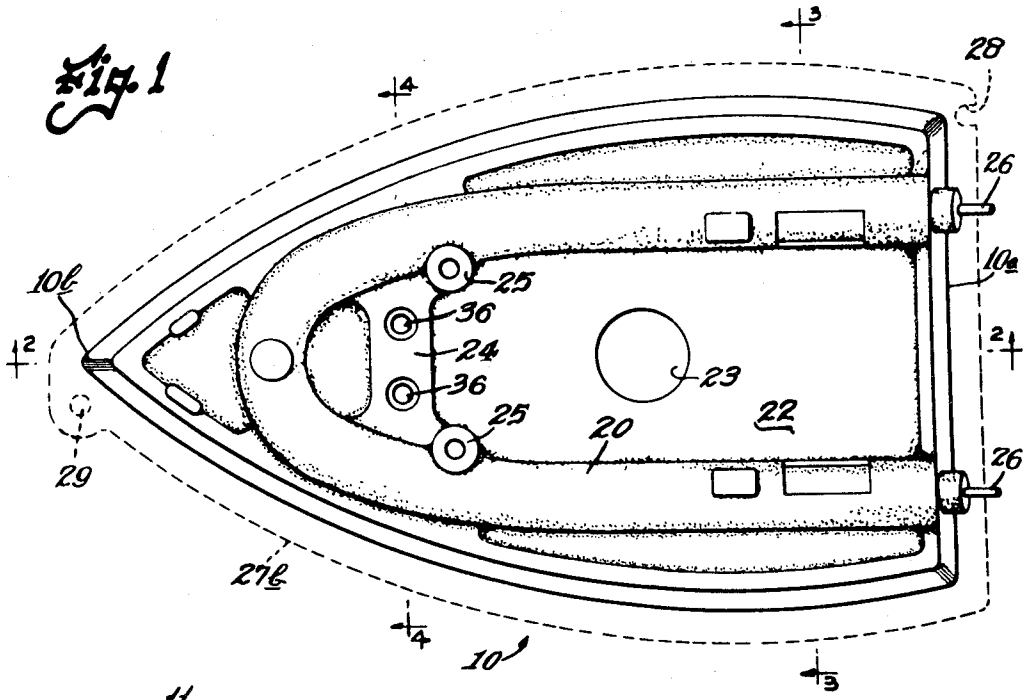
July 9, 1963 I. JEPSON 3,096,566

LIGHTWEIGHT COMPOSITE SOLE PLATE AND METHOD OF MAKING THE SAME

Original Filed Feb. 2, 1953 2 Sheets-Sheet 1

Fig. 1



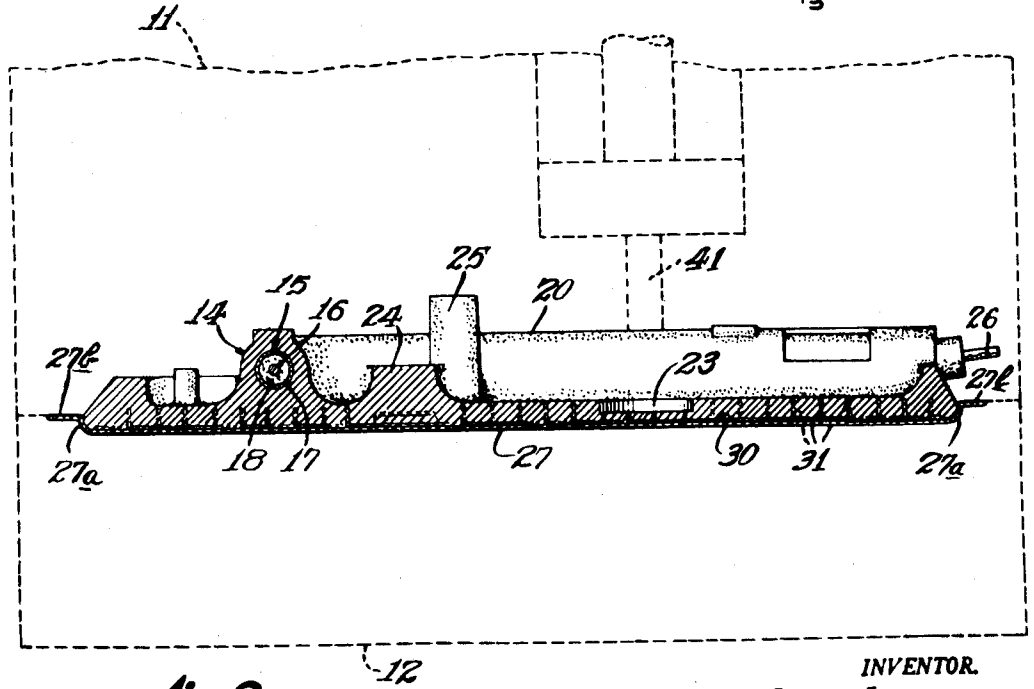




Fig. 2

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LIGHTWEIGHT COMPOSITE SOLE PLATE AND METHOD OF MAKING THE SAME

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Fig. 3

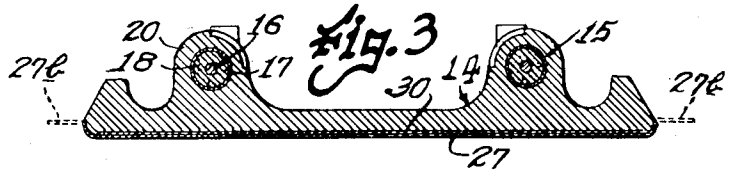



Fig. 4

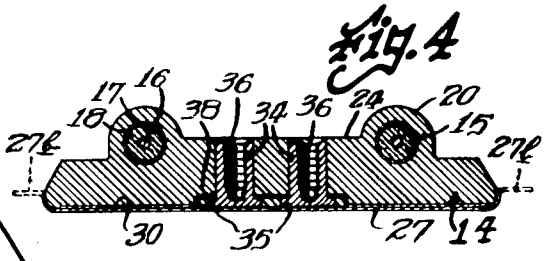



Fig. 5

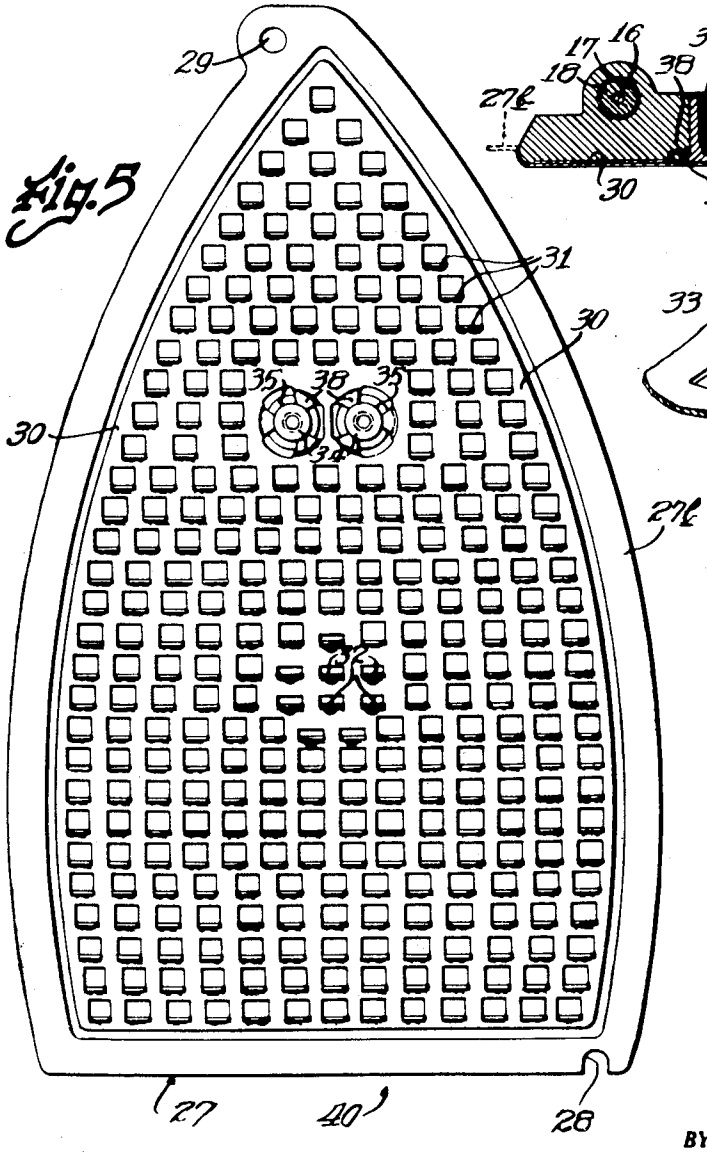
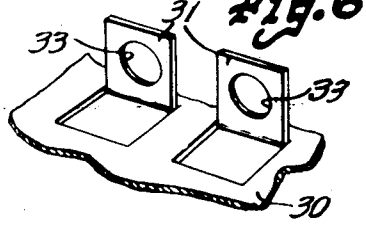



Fig. 6



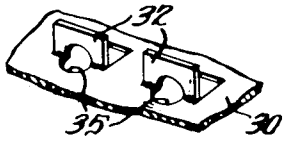




Fig. 7

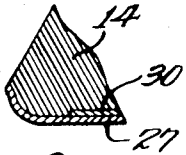



Fig. 8

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United States Patent Office

3,096,566

Patented July 9, 1963



3,096,566

# LIGHTWEIGHT COMPOSITE SOLE PLATE AND METHOD OF MAKING THE SAME

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Original application Feb. 2, 1953, Ser. No. 334,573, now Patent No. 2,807,700, dated Sept. 24, 1957. Divided and this application Feb. 19, 1957, Ser. No. 641,169

1 Claim. (Cl. 29—155.5)

This invention relates to sole plates for sadirons and to a method of making a composite sole plate for such sadirons. Specifically, this application is a division of a prior application, Serial No. 334,573, filed February 2, 1953 (now Patent No. 2,807,700), assigned to the same assignee as the present application, which said prior application is an improvement on the arrangement disclosed in McArdle et al. Patent No. 2,042,953, also assigned to the same assignee as the present application.

In recent years there has been a decided tendency toward making sadirons or electric irons of light weight, which means that such irons are constructed primarily of aluminum or a similar lightweight metal. In the past the sole plates for electric irons have been made of cast iron or steel, which has made them relatively heavy, and, under the modern trend, undesirable. However, such prior art sole plates formed of steel or cast iron had a number of advantages not present in the lightweight aluminum sole plate. In the first place, the steel or cast iron, being a relatively hard metal, was not easily damaged through scratching or the like. Furthermore, the metal was not only easily plated, but took a firm adherent coating of plating material. Thus, with the advent of the lightweight iron, generally cast from aluminum or aluminum alloys, the benefits of a lightweight iron were obtained but the disadvantages of a soft and easily scratched iron were incurred. Extensive use of the lightweight aluminum sole plates without a hard ironing surface have demonstrated that such ironing surfaces becomes scratched and otherwise, disfigured very easily, and, in fact, with ordinary ironing operations such as contact with buttons or other hard portions of clothing in connection with which such iron is used. Additionally, an aluminum sole plate is not easily plated, and even when plated the plating has a tendency to be cracked and chipped off in service by distortion of the soft metal beneath the plated surface.

Many attempts have been made to produce a lightweight sole plate having all of the advantages of the older type sole plate made of heavy materials, particularly with respect to nonscratchability as well as ease of plating the same. Also, numerous attempts have been made to provide a composite sole plate comprising a main body of aluminum to which is bonded or otherwise secured a thin sheet of hard material such as steel defining the ironing surface. The various arrangements heretofore proposed in the line of composite sole plates have been inordinately expensive where satisfactory results were obtained, or else the arrangement resulted in a poor bond between the hard surface material and the lightweight body material. It would be desirable to provide a lightweight iron having an aluminum or aluminum alloy sole plate with a stainless steel ironing surface, since such a composite sole plate would provide all the desirable characteristics set forth above. The aluminum sole plate would give the desired light weight, and the stainless steel ironing surface would give the hard smooth surface so desirable in an electric iron or in any other type of iron for that matter. Unfortunately, there has not been available any simple method of bonding aluminum and stainless steel so that the bonded structure will withstand the high temperatures experienced in electric irons.



The common lightweight electric iron generally comprises a sole plate of aluminum or an aluminum alloy into which is cast a heating element. At the present time a predominant number of such heating elements are what is generally termed as sheathed heating elements comprising an outer tube of steel or similar material containing at the central portion thereof a coiled heating or resistance element. This coiled resistance element is spaced from the sheath by suitable material which is a good electric insulator and at the same time a good heat conductor. In any event, the steel sheath employed in such heating elements embedded in the aluminum sole plate had a substantially different coefficient of expansion than the aluminum from which the sole plate was manufactured, with the result that the main aluminum body formed of a material having a higher coefficient of expansion as contrasted with the steel tube of the heating element would warp so as to provide a convex ironing surface. It would be desirable to provide a composite iron having a lightweight aluminum body for the major portion thereof and a thin sheet of hard material defining the ironing surface, which thin sheet would have a coefficient of expansion quite similar to that of the embedded steel tube, with the result that the two steel elements would counteract each other and preclude warping of the ironing surface.

Accordingly, it is an object of the present invention to provide an improved composite lightweight sole plate for a sadiron.

It is another object of the present invention to eliminate the problems existing in prior art sole plates as set forth above.

It is a further object of the present invention to provide a new and improved method of manufacturing lightweight sole plates which will have a hard ironing surface.

It is another object to provide an improved method of joining a sheet of stainless steel to an aluminum body in a manner to define a firm bond therebetween which will not be affected by wide temperature changes.

Still another object of the present invention resides in the production of a composite sole plate having a thin, hard ironing surface and a lightweight body portion wherein the thin, hard ironing surface has such a coefficient of expansion relative to the main body portion including the embedded heating element, and is so proportioned as to eliminate warpage due to different coefficients of expansion of the lightweight material and the other materials employed.

A further object of the present invention resides in the provision of an improved method of uniting a thin sheet of hard material to an aluminum body portion without the problem of having the aluminum flow beneath the thin, hard metal portion.

It is a further object of the present invention to provide a sole plate for a sadiron comprising a stainless steel shell having bonded thereto as by copper brazing in an atmospherically controlled furnace a sheet of material having a plurality of protrusions capable of being molded into the cast aluminum body.

Further objects and advantages of the present invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention, reference may be had to the accompanying drawings, in which:

FIG. 1 is a top view of a composite sole plate embodying the present invention and having been manufactured in accordance with the method of the present invention,

a portion of the stainless steel shell being shown in phantom to indicate that it is removed upon completion of the sole plate;

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1 with the extension of the ironing surface sheet being shown in solid lines, and the mold for molding the main body portion of the sole plate being shown in dotted lines, thus illustrating one step in the process of manufacturing the composite sole plate of the present invention;

FIG. 3 is a sectional view taken on line 3—3 of FIG. 1 with the cutaway portion of the ironing surface being shown in dotted lines;

FIG. 4 is a view similar to FIG. 3 taken on line 4—4 of FIG. 1;

FIG. 5 is an enlarged plan view of the ironing surface and attached plate prior to the operation of casting the aluminum body thereto, thus illustrating another stage of the product during the process of manufacture thereof;

FIG. 6 is an enlarged perspective view illustrating the upstanding projection associated with the arrangement of FIG. 5;

FIG. 7 is a view similar to FIG. 6 illustrating the details of another type of projection employed in the arrangement of FIG. 5; and

FIG. 8 is an enlarged detailed view of a portion of FIG. 4.

Briefly, the present invention is concerned with placing a thin, stainless steel sheet to which has been bonded in a very satisfactory manner as by copper brazing in an atmospherically controlled furnace a sheet of ordinary material such as carbon steel or the like which has been deformed to provide a plurality of projections capable of being embedded in a cast aluminum body. The stainless steel sheet is provided with a peripheral extension capable of being sealed between the two mold halves within which are the cast aluminum portions of the sole plate to insure that no material may move beneath the stainless steel shell during the casting operation. The heating element, which is preferably of the sheathed type, including a steel sheet, is positioned in the mold so that during the casting operation it becomes an integral part of the sole plate and the molten aluminum firmly grasps the projections which have become integrally united with the stainless steel sheet. Upon removal from the mold, the peripheral extension of the stainless steel sheet is cut away, and the exposed portion of the aluminum sole plate polished to provide a very satisfactory sole plate which is substantially free from warping due to the counteracting forces provided by the stainless steel sheet and the embedded sole plate, which is substantially scratchproof as far as the ironing surface is concerned and which provides a very lightweight iron so much in vogue today. Moreover, no polishing of the stainless steel ironing surface is necessary.

Referring now to the drawings, there is illustrated a sole plate for a sadiron generally designated in FIG. 1 by the reference numeral **10**. This sole plate may have the conventionally accepted configuration obtained by suitably designing the mold cavity defined in the mold comprising the upper mold portion **11** and the lower mold portion **12** shown in phantom in FIG. 2 of the drawings. The sole plate **10** has been indicated as having an outline of conventional configuration with a heel portion **10***a* and a pointed toe portion **10***b*, the heel and toe portions being joined by a relatively smooth curve defining either side of the sole plate. It should be understood that the particular shape or configuration of the sole plate is immaterial as far as the present invention is concerned, and is determined entirely by the cavity defined in the mold sections **11** and **12**.

In accordance with the well-established present practice, the sole plate of the present invention comprises a main body portion of aluminum generally designated in FIGS. 2, 3 and 4 by the reference numeral **14**, thereby to define a lightweight sole plate which has become so popular in recent years. Also in accordance with conventional practice, the sole plate **10** of the present invention has embedded in the aluminum body **14** thereof a heating element **15** which is preferably of the so-called sheathed type. The sheathed heating element **15** is of generally U-shaped configuration, or, roughly, in the shape of a hairpin, with the extremities of the legs of the hairpin-shaped element being disposed adjacent the heel **10***a* of the sole plate, and the bight of the U-shaped heating element being disposed in the toe **10***b* of the sole plate **10**. The sheathed heating element **15** is a well-known type of heating element which generally comprises a helical resistance conductor **16** centrally disposed within an outer metallic sheath **17** generally formed of steel or similar material. The helical conductor **16** is supported in spaced relationship with reference to the sheath **16** by an insulating heat conducting mass **18** formed of a suitable material such as highly compressed magnesium oxide. This latter material has been found to provide the desired insulation and at the same time has sufficiently good heat conducting properties so as not to delay the transfer of heat from the coiled resistor element **16** disposed centrally of the sheath **17**, and, hence, to the sole plate which it is desired to heat. The ends of the legs of the U-shaped sheathed heating element **15** are arranged to extend outside the cast aluminum body and suitable terminals **26** are connected to the helical resistor element to permit electrical connection with a power circuit conventionally included in electric sadirons. Although the present invention is particularly adaptable for use with electric irons having an embedded heating element, it will be understood that the invention is not limited to such application and can be employed for other irons.

In order to keep the mass of the sole plate at a minimum, the mold section **11** is preferably provided with a cavity so defined as to provide in the finished casting a raised rib of hairpin-shaped configuration **20** to accommodate therein the sheathed heating element **15** when the casting operation has been completed. It will be understood that a sadiron embodying the sole plate **10** preferably includes suitable control means of various sorts, and to this end the space defined between the legs of the U-shaped rib **20** provides a control chamber **22**. Preferably, however, the mold section **11** is so constructed that a suitable well **23** of substantial depth is defined in the upper surface of the lightweight sole plate to accommodate certain control portions. Likewise, for attaching the sole plate to the remainder of a sadiron, the mold section **11** has its cavity therein defined in a manner so that upon completion of the casting operation there is also provided a transverse rib **24** uniting the two legs of the rib **20** near the bight portion of the rib. Additionally, the cavity is defined to provide raised extensions **25** and any other desired recesses or extensions which can be obtained merely by proper design of the cavity in the mold section **11**. The particular configuration of the upper portion of the sole plate **10** forms no part of the present invention, but a predetermined construction of a commercial device is illustrated by way of example.

In accordance with the present invention, the sole plate **10** comprises an ironing surface defined by a thin sheet **27** of hard metal, preferably stainless steel. In a preferred embodiment this stainless steel sheet was of the order of twenty-five thousandths of an inch in thickness. This sheet is of sufficient thickness to define a very desirable ironing surface which is effectively scratchproof. However, the bonding of a stainless steel sheet such as **27** to an aluminum body has been a very difficult and expensive proposition prior to the present invention. In accordance with the present invention, the stainless steel sheet **27** has a configuration conforming to the bottom of the sole plate, including a slightly raised portion **27***a* around the

periphery thereof to define a somewhat dished construction with a flat surface defining the ironing surface. Additionally, the stainless steel sheet 27 includes a peripheral flange 27*b* which is parallel to the flat bottom surface 27 thereof, and which extends around the entire periphery of the iron. This peripheral flange 27*b* preferably includes suitable means such as 28 and 29 to locate the same relative to the mold section 12. Moreover, the lower mold section 12 has its cavity defined to receive this peripheral flange, and, hence, provide a seal to insure that molten aluminum cannot get beneath the stainless steel sheet 27 which is inserted in the bottom of the cavity defined in the mold section 12.

To provide an arrangement whereby a satisfactory bond unaffected by temperature changes may be obtained between the aluminum body 14 and the stainless steel sheet 27, there is provided in accordance with the present invention a junction sheet which is illustrated in the drawings as a thin sheet 30 preferably formed of cold rolled carbon steel or the like. Such a sheet may have a thickness of the order of seven thousandths of an inch. In accordance with the present invention, the sheet 30 is shaped in the form of the ironing surface of a sole plate and has a plurality of keys 31 and 32 stamped from its surface so as to extend upwardly for the purpose of being embedded within the aluminum body 14 of the sole plate, as will become apparent from the following description. These keys may have any suitable configuration, and, as illustrated, the entire surface of the sheet 30 is stamped to provide a great number of these projections. As best shown in FIG. 6, the majority of these projections are designated by the reference numeral 31 and are indicated as rectangular or square stampings merely cut from the body of the sheet 30 to improve the bonding operation. Each of the tabs or projections 31 is provided with a suitable opening 33.

Since the projections 31 extend a substantial distance into the aluminum body 14, they would interfere with the recess 23, and, accordingly, on the surface of the sheet 30, beneath the recess 23, there are provided the tabs 32 which have a much shorter vertical extent. These tabs also include an opening 35 which is preferably drilled therein before the stamping operation, so that when the stamping operation has been performed the openings 35 are partially in the tab and partially in the flat sheet portion of the sheet 30.

It will be understood that suitable means must be provided for attaching the sole plate 10 to the remainder of the sadiron, and to accomplish this purpose there preferably are provided a pair of inserts 34 having an enlarged head 35 and a tapped opening 36 to receive suitable fastening means, not shown. These inserts are cast into the body 14 of the sole plate, as clearly shown in FIG. 4 of the drawings, within the rib section 24 thereof. For the purpose of holding the inserts 34 in position, the bonding sheet 30 is provided with a plurality of deformations 38 which are engageable by the heads 35 of the inserts 34. These deformations 38 merely perform a temporary holding function. After the casting operation is completed, the cast aluminum will hold the inserts in position.

It will be understood that the ironing surface defined by the stainless steel sheet 27 must be firmly bonded to the bonding sheet 30. Preferably and in accordance with the present invention, the bonding sheet 30 is firmly bonded to the stainless steel sheet as by copper brazing in an atmospherically controlled furnace. Essentially, then, and as illustrated in FIG. 5, there is provided a subassembly which may be generally designated by the reference numeral 40 in the form of a two-part shell capable of being firmly bonded to a cast aluminum body to define a lightweight sole plate having a hard, smoothly polished, substantially scratchproof ironing surface.

In accordance with the present invention, the subassembly 40 is placed within the cavity in mold section 12, and the upper mold section 11 is put in place. Instead of gating the mold at the side as is common practice, in accordance with the present invention the mold is gated as indicated at 41, so that the molten aluminum or aluminum alloy enters the mold at the top center, whereby all the pressure is applied to one side of the composite sheet or subassembly 40, which includes the inserts 34 already described. This has a tendency to force the relatively thin composite sheet comprising portions 27 and 30 against the flat surface of the mold, thus resulting in a completely flat bottom. Furthermore, the peripheral flange 27*b* prevents any molten metal from flowing beneath the sheet 27 which would result in buckling of the sheet and a very unsatisfactory operation. The peripheral flange 27 effectively provides a peripheral seal when the mold is closed. The molten metal will, of course, completely embed the heating element 15 therein, and, additionally, will receive the projections 31, 32 and 38, a firm bonding action being insured by the openings 33 and 35 already described into which the molten metal flows.

An important feature of the present invention resides in the fact that in lightweight irons heretofore constructed having an embedded sheathed heating element, warpage occurred upon heating of the sole plate due to the fact that the higher expansion aluminum, having embedded therein at a point relatively remote from the ironing surface the lower expansion steel sheath, would tend to warp and become convex. With the present invention, by adding the composite thin sheet having a low coefficient of expansion at the ironing surface, this warpage is neutralized, and by properly dimensioning the thickness of the sheet with respect to the tubular sheathed element, warpage can be eliminated. In a commercial embodiment with the thickness set forth above, this has been substantially accomplished.

Upon removing the cast sole plate with the composite sheet ironing surface from the mold including sections 11 and 12, the peripheral flange 27*b* is trimmed off and the exposed edge of aluminum is polished to provide a very satisfactory and finished sole plate 10. The stainless steel ironing surface requires no further attention, thereby eliminating the extensive polishing operation heretofore required.

In view of the detailed description included above, the method of manufacturing the present invention and the opration of the present arragement will be obvious to those skilled in the art and no further description thereof is included herewith. It will suffice to say that there has been provided a lightweight sole plate having a very satisfactory ironing surface formed of sheet material which is bonded to the lightweight portion of the sole plate in a manner which is foolproof and will insure against any separation between the ironing surface portion, which is a composite sheet, and the main body.

While there has been illustrated and described an improvide sole plate and an improved method of manufacturing the same, including numerous advantageous features as contrasted with prior art arrangements, it will be apparent that numerous changes and modifications will suggest themselves to those skilled in the art, and it is aimed in the appended claims to cover all such changes and and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

The method of bonding to a mass of lightweight metal, a thin sheet of hard, scratchproof metal, which comprises placing a first thin sheet of said hard metal within a mold and directly against the bottom of said mold so as to cover the entire bottom of said mold, said sheet being provided with a peripheral portion extending beyond the

limits of the mold cavity thereby to prevent molten material from entering the mold cavity beneath said thin sheet, said first sheet having bonded thereto on the side thereof opposite the side in engagement with the bottom of said mold a second sheet of a different material including interlocking members, filling the remainder of said mold cavity with molten lightweight metal to provide a body having an upper exposed portion of said lightweight metal and a lower exposed portion of said hard metal, removing the contents of said mold cavity and cutting away said peripheral portion flush with said lightweight metal to define a smooth surface at the junction between said two exposed metals.

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