Dec. 9, 1947. J. H. WATSON 2,432,463

HEATING ELEMENT FOR SHEET-METAL SHAPING MACHINES

Original Filed Sept. 7, 1942

FIG. 1

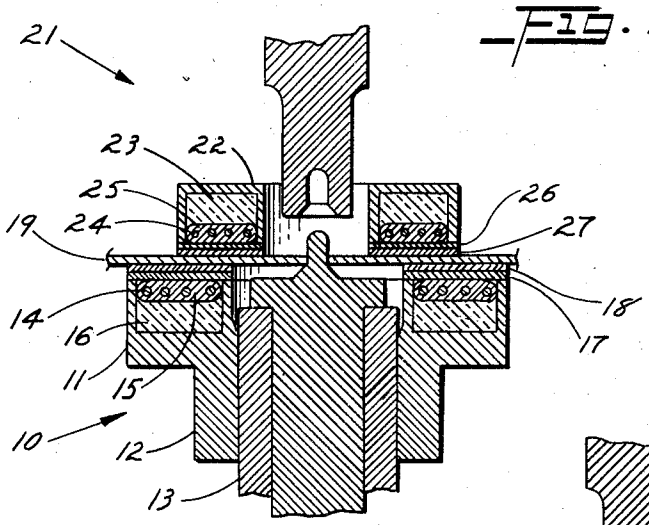


FIG. 2

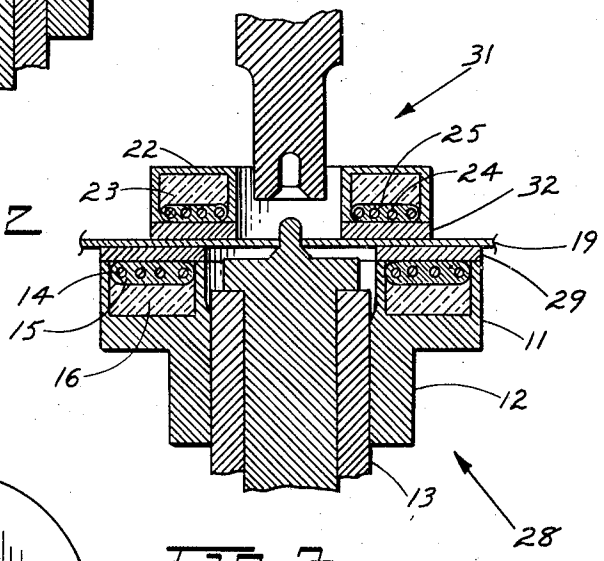
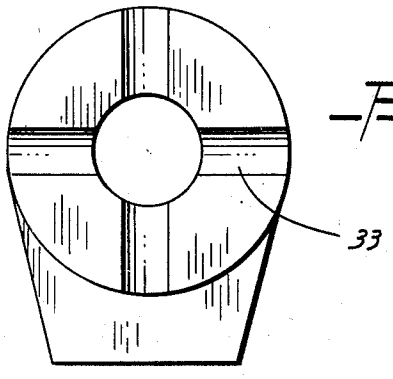


FIG. 3



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HEATING ELEMENT FOR SHEET-METAL SHAPING MACHINES

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Original application September 7, 1942, Serial No. 457,630, now Patent No. 2.372,516, dated March 27, 1945. Divided and this application August 22, 1944, Serial No. 550,611

5 Claims. (Cl. 219—19)

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This invention relates to heating elements and more particularly to a heating element adapted to be used in forming processes such as disclosed in my copending application, Serial No. 457,630, filed September 7, 1942, and issued March 27, 1945, as Patent Number 2,372,516, of which this application is a division.

The element of the present invention is particularly useful for heating materials either by radiation and convection or by direct contact, that is, by conduction. The element may take any shape desired and in the broadest aspects of the invention the element can be heated by any known practical means.

Heating elements have been used for many years but many of these prior elements have been subject to the criticism that if the same possessed a high thermal conductivity the material used to form the same had a low specific heat or oxidized at the high temperatures at which the elements are often used. Elements which oxidize are only efficient for a very short time as the oxidation thermally insulates the element from the article to be heated. Other elements heretofore proposed have been formed of materials having high specific heat but as the thermal conductivities of the same were low the elements were slow to heat up and could not be used in all heating processes.

The element of the present invention obviates these difficulties for in the preferred form of the same, the body of the element is formed of a material having a high specific heat and a relatively high thermal conductivity. The contact or heating face of the element comprises a material which not only has a high thermal conductivity and specific heat but is also one which is slow to oxidize even at relatively high temperatures.

The element therefore can be used in many processes where previously proposed elements either failed in use after short periods of operation or could not be used effectively because of the inherent faults mentioned above.

In one embodiment of the present invention the element comprises a casing of copper housing the heating means, and carrying on one surface thereof a relatively heavy layer of substantially pure silver. The silver may be deposited by any known method and should be thick enough to form an adequate protection for the copper casing of the element.

In a modified form of the invention the one wall of the element is formed of a plate or sheet of substantially pure silver secured across an

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opening in the casing. The plate or sheet should be thick enough to render the wall sufficiently rigid to withstand pressural contact with the work to be heated.

Thus in both forms of the element, the silver forms the contact face, that is, the face which is brought into engagement with the article to be heated. Since the contact face is formed of silver there is little likelihood of an oxidization growth insulating the face from the article to be heated as in many of the previously proposed elements.

Other features and advantages of the present invention will be apparent from the following description taken in connection with the accompanying drawing, in which:

Figure 1 is a sectional view of a pair of heating elements of the present invention showing the same contacting a piece of sheet material to be formed by a pair of forming tools;

Figure 2 is a view similar to Figure 1 but showing a modified form of the heating element of the present invention; and

Figure 3 is a plan view of one of the heating elements shown in Figure 1.

The heating element of the present invention, referring now to the drawing, has been shown as annular in form and will be described as used in applicant's copending application above identified. It is to be understood however that the heating element of the present invention may take any shape desired or dictated by the shape of the work piece to be heated or the process in which the element is to be used.

In the illustrated embodiment of the invention, referring particularly now to Figure 1 of the drawing, the lower element 10 comprises a casing 11 and tubular flange 12 adapted to be secured to some suitable support 13. Although the casing 11 can be separately formed and subsequently assembled with the flange 12, in the form of the invention now preferred, the casing as shown in Figure 1 is formed integral with the flange 12. The flange and casing are formed of a metal having a high thermal conductivity and a high specific heat, and in the now preferred embodiment of the element, the same is formed of copper or an alloy rich in copper having the desired properties.

The casing is provided with a chamber for receiving the heating medium and although any medium can be used to heat the element it is preferred now to use an electrical heater comprising a suitable conductor 14 carried by and imbedded in a holder of insulating material 15. The conductor 14 is connected, through a suitable lead-in

connector and cable not shown, to any suitable source of electrical energy.

To prevent excessive absorption of heat by the walls of the element not used for heating, a layer of thermal insulating material 16 is disposed within the casing between the holder 13 and the lower wall of the element as viewed in Figure 1.

In the form of the invention illustrated in Figure 1, the open end of the casing is closed by a plate 17 of copper carrying on the outer face thereof a relatively heavy layer 18 of a material which has a high specific heat and one which readily conductos heat from the plate 17 to the outer surface thereof but yet will not be oxidized at temperatures at which the element is used. Although any material possessing these characteristics can be used, I have found that substantially pure silver produces excellent results. Silver not only has a high specific heat and will readily conduct heat but also it is slow to oxidize even at relatively high temperatures.

Silver also lends itself to this use as it can be deposited at any thickness desired by several known processes. Furthermore, the silver will readily bond to the copper and the adhesion between the silver and the copper is such that the copper is fully protected against oxidization.

The outer surface of the layer of silver forms the contact face of the element and, as clearly shown in the drawing, is brought into engagement with the sheet 19 to be heated. As the silver is not apt to oxidize, there is no troublesome growth of oxidization which could decrease the transfer of heat from the element 14 to the sheet 19 by forming an insulating layer on the contact face.

The upper heating element 21 shown in Figure 1 is formed in the same manner as the lower element 10. The element 21 also comprises a casing 22 housing the thermal insulating material 23 and the conductor 24 and its carrier 25. The lower face of this element forms the contact or heating face and like the heating face of the element 10 is formed of a layer 26 of copper and a protecting or outer layer 27 of substantially pure silver.

In the form of the invention shown in Figure 2 the heating element 28 is similar to the heating element 10 with the exception that the upper or contact face of the element is formed by a relatively heavy plate 29 of pure silver. The plate 29 should be sufficiently rigid to prevent buckling of the plate if the same should be accidently struck during use. The upper element 31 shown in Figure 2 is identical with the element 21 with the exception that here again the lower or contact wall of the element is formed from a relatively heavy plate 32 of substantially pure silver.

If desired the contact face may be provided with a plurality of grooves or channels 33, referring now to Figure 3, to permit the heating elements to be moved relative to the surface of the sheet material to be heated where the sheet material carries previously attached rivets or other protuberances.

While certain embodiments of the present invention have been illustrated herein, it is to be understood that the invention need not be limited to the embodiments illustrated, for it is susceptible to changes in form and detail coming within the scope of the appended claims.

I claim:

1. A heating element of the type described comprising: an annular body member formed of a thermal-conductive material having a high specific heat, said body member having an annular groove formed in the one end face thereof; an electric heating unit of annular form filling said groove; and an annular plate-like member secured to said body member and closing the groove therein, said plate-like member being formed of a material having a high copper content and a high thermal conductivity, and having an outer surface of substantially pure silver forming the face of the element to be brought into contact with the article to be heated.

2. A heating element of the type described comprising: an annular body member formed of a thermal-conductive material having a high specific heat, said body member having an annular groove formed in the one face thereof; a layer of thermal insulating material carried within said groove; an electric heating unit of annular form mounted in contact with said insulating material and of such thickness that it completely fills said groove; an annular plate-like member formed of a material having a high copper content and a high thermal conductivity secured to said body member and closing the groove therein; and a layer of substantially pure silver carried by the outer surface of said plate-like member and forming the surface of the element to be brought into contact with the article to be heated.

3. A heating element of the type described comprising: a substantially cylindrical member having a relatively large coaxially formed passageway therethrough, said body member having an annular groove concentrically formed in the one face thereof; an electric heating unit of annular form carried within said groove for heating said element; and an annular plate-like member secured to the end face of said body member and closing the groove therein, said plate-like member being formed of a material having a high copper content and a high thermal conductivity, and having an outer surface of substantially pure silver forming the face of the element to be brought into contact with the article to be heated, and being formed with a plurality of radially extending grooves to provide clearance passages for protuberances carried by an article as the element is moved thereover.

4. A heating element of the type described comprising: a substantially cylindrical body member having a relatively large coaxially formed passageway therethrough, said body member having an annular groove concentrically formed in the one face thereof; a ring-shaped member of thermal insulating material disposed in said groove; an electric heating unit of annular form filling said groove; and an annular plate-like member secured to the end face of said body member and closing the groove therein, said plate-like member being formed of a material having a high copper content and a high thermal conductivity, and having an outer surface of substantially pure silver forming the face of the element to be brought into contact with the article to be heated, the opening in said plate-like member being aligned with the passageway of said body member whereby a tool can be moved through said passageway and opening into engagement with the article heated by said element.

5. A heating element of the type described comprising: an annular body member formed of a thermal-conductive material having a high specific heat, said body member having an annular groove formed in the one face thereof; a ring-shaped member of thermal insulating material disposed in said groove; means carried within the groove for heating said body member; and

an annular plate-like member secured to the end face of said body member and closing the groove therein, said plate-like member having an outer surface of substantially pure silver forming the face of the element to be brought into contact with the article to be heated, the openings through said body member and said plate being in alignment when said plate is mounted to said body to permit the passage of a tool through said heating element and into engagement with the article heated by said element, said plate-like member being formed with at least one radially extending groove forming a clearance passage for protuberances carried by an article as the heating element is moved over it.

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