June 8, 1965 R. A. BRIDWELL 3,187,544

METHOD FOR EFFECTING A METAL WORKING PROCESS

Original Filed Dec. 9, 1958

Fig. 1

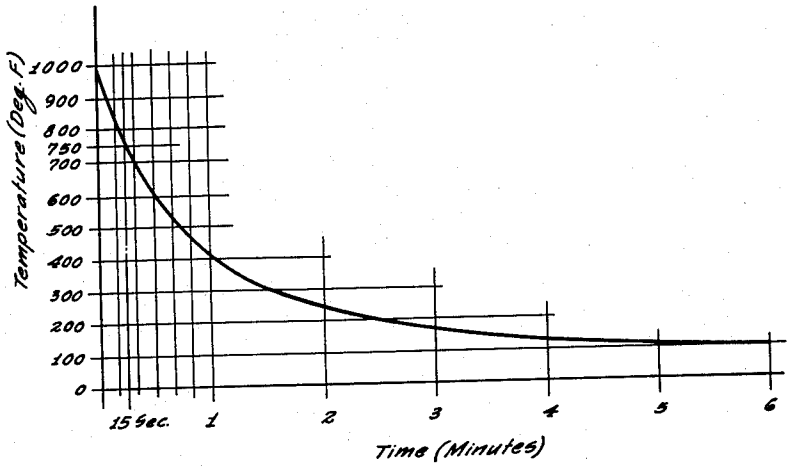
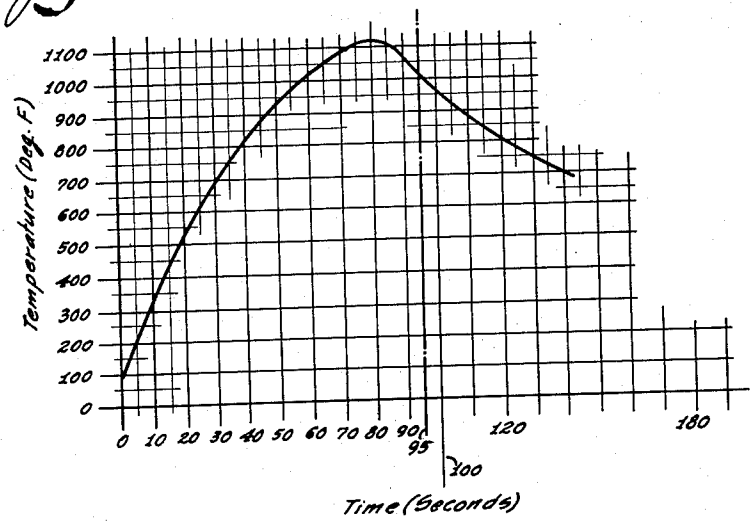


Fig. 2



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METHOD FOR EFFECTING A METAL WORKING PROCESS

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Original application Dec. 9, 1958, Ser. No. 779,243. Divided and this application July 31, 1962, Ser. No. 214,464

1 Claim. (Cl. 72—364)

This invention pertains to a metal working process and more particularly to a method of heating material to a desired temperature while placed in a specific position and subsequently forming the material at or near the desired temperature without repositioning the material. This application constitutes a division of our copending application, 779,243, filed December 9, 1958, now U.S. Patent 3,073,172.

It is a prerequisite of certain types of material that they must be heated prior to their fabrication. This is particularly true of titanium and magnesium sheets, etc., and alloys thereof if they are to be effectively fabricated into sheet metal parts by stamping, pressing, drawing, and like operations. These blanks must be worked at elevated temperatures to render them sufficiently ductile to eliminate the occurrence of cracks, tears, and the like which normally occur during the working of these materials at ordinary room temperatures. Elevated temperatures as used throughout the specification refer to temperatures in the 300–1500° F. range.

It is well known in the metal working art that an elongation loss of approximately 66% is experienced in the forming of titanium, magnesium and like sheets should their temperature drop 200° from the maximum allowable temperature of approximately 900–1300° F. It, therefore, becomes apparent that sheet material of this type must be worked at a high predetermined temperature, or as near to the predetermined temperature as possible, if optimum results are to be achieved.

To the best of applicant's knowledge blank sheet material as described above are at present heated in an oven located in the immediate vicinity of a forming facility. However, this method is not satisfactory due to the time lag which necessarily occurs between the removal of a blank from an oven and an actual forming operation. A time lag of 12–15 seconds is required to remove the blank from an oven and place it in a forming facility during which time the blank experiences a temperature drop of as much as 250° and a corresponding loss in elongation.

Accordingly it is an object of the present invention to disclose a method of forming titanium, magnesium and like sheets at or near a predetermined elevated temperature without first preheating the sheets to temperatures exceeding the predetermined elevated temperature.

Another object is to disclose a method of forming sheet metal parts from metal sheets in which the elapsed time occurring between a heating and a forming operation thereon is minimized.

Another object is to disclose a method of forming sheet metal parts from metal sheets in which oxidation thereof is minimized.

Although the characteristic features of the present invention are particularly pointed out in the appended claim, the invention itself, also the manner in which it may be carried out, will be better understood by referring to the following description taken in connection with the accompanying drawings forming a part of this application and in which:

FIGURE 1 is a graph showing the temperature losses encountered by an oven heated titanium alloy sheet in transferring the sheet from an oven to a forming area.

FIGURE 2 is a graph showing of the heating and cooling of a titanium alloy sheet heated by radiation as disclosed herein, the radiantly heated sheet being of the same size and thickness and otherwise having the same characteristics as the oven heated sheet referred to in the description of FIGURE 1.

This invention utilizes a radiant heat source (not shown) for the heating of titanium, magnesium and like sheet metal blanks which subsequently are to be formed into sheet metal parts. The blank sheets are first coated with a high temperature drawing compound so that they will absorb heat more readily.

The blanks are then positioned in their exact forming attitude in a forming facility (not shown). The aforementioned radiant heat source comprises a plurality of quartz tube radiant heaters mounted in a suitable reflector, the number of heater tubes depending upon the size of the blanks to be heated. The reflector and heater tubes are now juxtapositioned above the blank so that the rays from the heater tubes are directed on the subject blank. The heater tubes are now energized and remain energized until such time as the temperature of the subject blank reaches a predetermined temperature. The reflector and heater tubes are then withdrawn from their juxtapositioned position above the blank allowing the forming operation to be effected without delay and with a minimum temperature loss.

Referring to the drawing, the curve in FIGURE 1 graphically illustrates the temperature loss which is experienced in an oven heated blank in moving the blank from the oven to a forming area. For example, if a blank is heated to 1000° F. in an oven and 15 seconds is required to move the blank from the oven to a forming facility it is seen that the temperature of the blank will drop approximately 250° F. during the transfer. Thus a high percentage of the ductility of the metal is lost during the transfer operation.

The curve of FIGURE 2 graphically illustrates the heating and cooling of a sheet metal blank heated by radiant heaters as disclosed herein. This method of heating is fast and efficient, the temperature of the blank raising from 70° to 1125° F. in approximately 80 seconds. The time required to remove the radiant heaters requires approximately 4–5 seconds. During this time delay the temperature of the blank does not change appreciably, it is posible to form the sheet at approximately or slightly less than its maximum temperature and accordingly the blank is formed while its ductility is high.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprises a preferred form of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claim.

What is claimed is:

The method of minimizing heat loss while fabricating parts from titanium sheet material which can only be effectively worked at elevated temperatures comprising the following steps: positioning a blank sheet of titanium in its forming position in a forming facility while each is at normal room temperatures; positioning a radiant heat source in a juxtaposed position with respect to one of the major sides of said blank sheet; said radiant heat source constituting a bank of quartz tubes adapted to transmit heat to said sheet solely by radiation maintaining said heat source in said juxtaposed position until the temperature of said blank sheet is elevated to a predetermined temperature exceeding 800° F.; removing said heat source from said juxtaposed position to a position

removed from said facility immediately after the temperature of said blank sheet has been elevated to said predetermined temperature; and actuating said facility to form said blank sheet while the sheet is in said forming position and the temperature thereof is near said predetermined temperature.

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