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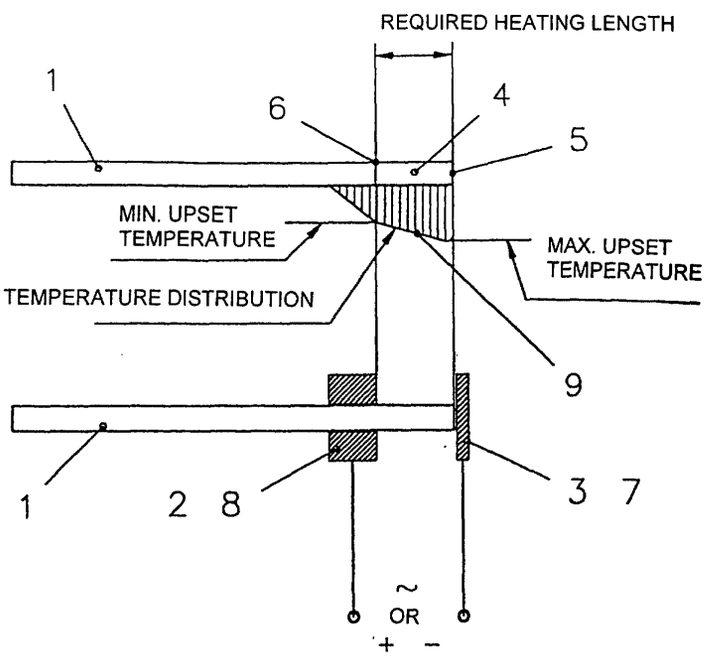
(54) Method for upsetting an end of a steel bar

(57) 1. Method for making an expansion formed at the end of metal bars (1) of steel, such as a conical expansion (10) formed at the end of concrete anchors, in which method

- the end portion (4) of a bar (1) is heated in a controlled manner by starting the heating from a point (6) of said portion (4) opposite to the bar end (5) and increasing the heating to a temperature rising towards the end (5) of the bar, and
- the heated bar (1) is locked immovably in place and it is compressed from the bar end (5) disposed at a distance from a mould/boss (2), starting with a press plate (3) or a similar pressing element towards the mould/boss (2), thus causing, due to the temperature differences occurring between different parts (5, 6) of the end portion of the bar, an upsetting process to begin from the hotter end (5) of the bar (1) and to advance towards the bar portion (6) of falling temperature, especially creating conditions for optimal shaping of the end portion (4) of the bar.

Fig. 1



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Description

[0001] The present invention relates to a method as defined in the preamble of claim 1 for making an expansion at the end of a steel bar by upsetting.

[0002] In general, a hot-forging method is known whereby the end of a bar is heated in a forge hearth or equivalent and forged in a mould. To produce a larger expansion by this method, the heating/forging has to be repeated several times because the bar end has to be heated over a short length only to avoid buckling. This is largely manual work and difficult to automate, and it does not meet the requirements of modern industrial procedures.

[0003] In another known method, the end of the bar is heated over a short length and upset by means of a press. To prevent buckling, the heating length has to be small, and the operation has to be repeated several times when conventional expansions are being made. As a consequence of this, no shapes of a more difficult nature can be created because the shapes already formed and reheated are not reshaped by pressing as in hot-forging. Because of the repetitions involved, this method is not an advantageous industrial method especially in the production of larger series.

[0004] Another method applied is the cold-upset heading process, where the cold forgeability of steel greatly limits the degree of expansion.

[0005] The object of the present invention is to eliminate the drawbacks of prior art and to achieve a new type of method for making an expansion at the end of a steel bar, whereby a large expansion or deformation can be produced at the end of the bar via a single heating and pressing operation.

[0006] The details of the features characteristic of the invention are presented in the claims below.

[0007] In the following, the invention will be described in detail by the aid of an example with reference to the attached drawing, wherein

Fig. 1 presents the area where the end of a steel bar is heated, a diagrammatic illustration of the temperature distribution in the bar end and the disposition of electric heating electrodes.

Fig. 2 presents a simplified view of an upsetting apparatus, and

Fig. 3 shows a conical expansion as formed at the end of concrete anchors.

[0008] In the method of the invention, the end portion 4 of a bar 1 is heated in a controlled manner by starting the heating from a distance 6 from the bar end 5 corresponding to the required heating length and increasing the heating to a temperature rising towards the end of the end portion 4 of the bar 1. The heated-bar is placed in a mould/boss 2 leaving the end 5 of the bar protruding out of it by a length corresponding to the required upset length. The bar 1 is immovably locked in place and a pressing operation is started by pressing the bar end 5 protruding from the mould/boss 2 towards the mould/boss 2. Due to the temperature distribution 9 in the end portion 4 of the bar, the upsetting effect starts from the hottest part of the bar 1, i.e. from its end 5, and advances towards the bar 1 portion of falling temperature, producing a shape favorable to upsetting even before the material is finally upset into the mould 2.

[0009] At the final stage, when the mould 2 and the press plate 3 are pressed against each other, the small extra amount of steel in the mould is subjected to pressure and extruded into every part of the mould 2. The small burr that may arise may be acceptable in some products, and in some products it has to be removed.

[0010] The temperature distribution 9 in the end portion 4 of the bar, where the end 5 of the bar 1 is hottest and the temperature gradually falls towards the mould/boss 2, allows thin bars, in which the ratio of diameter to heating length is small, to be moulded without buckling, thus avoiding the need for several repetitions for achieving the same moulding. When very thin bars are to be moulded, it may be necessary to first upset a smaller length and then move the bar outwards to be upset again, yet without intermediate heating.

[0011] A preferred embodiment of the present invention is an electric heating method in which both heating and upsetting are performed in the same apparatus, the mould/boss 2 functioning as one electrode 7,8 and the press plate 3 as the other electrode 7,8. This method can be easily automated, and the pressing can be combined with partially simultaneous heating, which can be used for fine adjustment of the upsetting process if necessary. In electric heating, although immediately after turn-off of power the temperature may be nearly uniform over the entire heating length, after a small delay some heat is conducted into the unheated part of the bar and electrode 8, whereas no heat is conducted from that bar end 5 from which the electrode 7 has been slightly released for a moment. Thus, a temperature distribution 9 favorable for upsetting is produced in natural way.

[0012] The bar 1 may also be heated by some other controlled method in a separate heating apparatus, from where it is removed into an upsetting apparatus. This allows a higher capacity to be achieved because heating and upsetting can be performed simultaneously, whereas in a combined apparatus heating and upsetting are performed sequentially.

[0013] It is obvious to the person skilled in the art that different embodiments of the invention are not limited to the example described above, but that they may be varied within the scope of the following claims. The expansion to be made at a bar end may be e.g. a conical expansion 10 formed at the end of concrete anchors (Fig. 3) or a polygonal or cylindrical head of formed at the end of a bar.

Claims

1. Method for making an expansion formed at the end of metal bars (1) of steel, such as a conical expansion (10) formed at the end of concrete anchors, in which method

   - the end portion (4) of a bar (1) is heated in a controlled manner by starting the heating from a point (6) of said portion (4) opposite to the bar end (5) and increasing the heating to a temperature rising towards the end (5) of the bar, and
   - the heated bar (1) is locked immovably in place and it is compressed from the bar end (5) disposed at a distance from a mould/boss (2), starting with a press plate (3) or a similar pressing element towards the mould/boss (2), thus causing, due to the temperature differences occurring between different parts (5, 6) of the end portion of the bar, an upsetting process to begin from the hotter end (5) of the bar (1) and to advance towards the bar portion (6) of falling temperature, especially creating conditions for optimal shaping of the end portion (4) of the bar,

   characterized in that, in the case of bars of a relatively small diameter relative to the upset length, upsetting is first applied to a smaller length of the bar to prevent buckling, whereupon the bar is moved on and the upsetting process is repeated one or more times.

2. Method according to claim 1, **characterized in that** the bar (1) is heated by electric power within the heating area (4), starting from a point (6) opposite to the bar end (5), with one electrode (8) placed on the bar (1) and another electrode (7) on the end (5) of the bar.

3. Method according to claim 1, **characterized in that** the heating with electric power and the upsetting are performed in the same apparatus so that one electrode (8) simultaneously functions as a mould/boss (2) while another electrode (7) simultaneously functions as a press plate (3).

4. Method according to claim 1, **characterized in that** the heating is performed in a controlled manner in a separate heating apparatus so that heating starts from the point (6) opposite to the bar end (5) and the heating is increased to a temperature rising towards the end (5) of the bar.

5. Method according to claim 1, **characterized in that** additional heat is supplied during the upsetting process to achieve more perfect shaping.

6. Method according to claim 1, **characterized in that** the press plate (3) or similar pressing element is a planar surface, part of the mould or the entire mould, and that, correspondingly, the mould/boss (2) is a planar surface, part of the mould or the entire mould.

Fig. 1

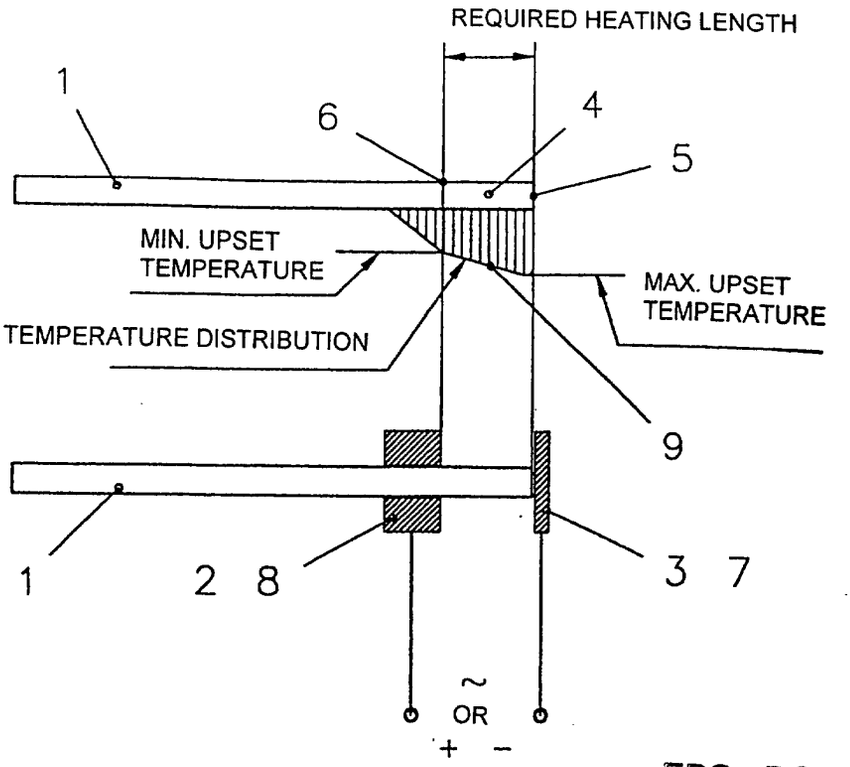

Fig. 3

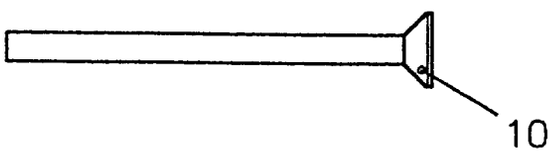

Fig. 2