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UPSETTING OF ELECTRICALLY HEATED RODS

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Fig.1

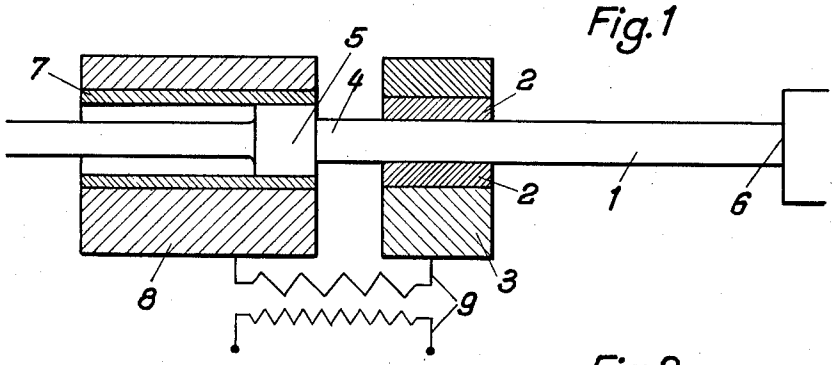


Fig.2

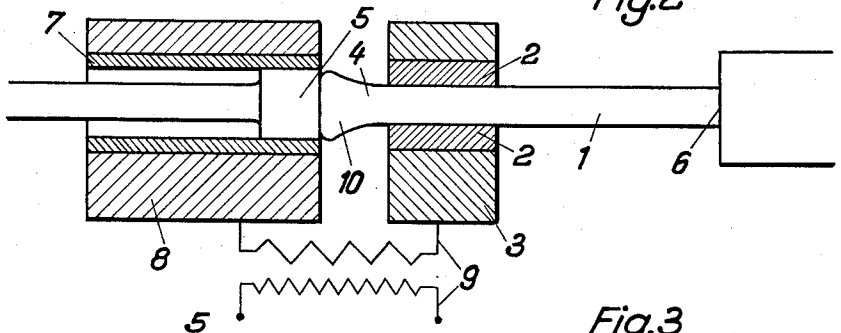


Fig.3

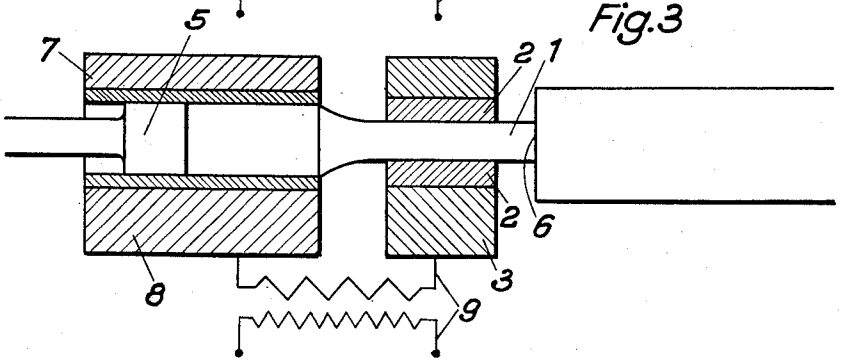
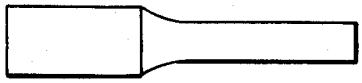


Fig.4



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UPSETTING OF ELECTRICALLY HEATED RODS

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9 Claims. (Cl. 219—3)

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This invention relates to a method and device for the upsetting and finishing of the electrically heated end of a rod-shaped material, of the type in which the distance between the electrodes, one of which is constructed as a guiding electrode, is increased by displacement of the other electrode which serves as an abutment.

It is an object of the present invention to eliminate the heretofore necessary finishing by further working of the surfaces of the upset areas, as by hammering, rolling, or after-pressing, which required relatively complicated machines and burdensome operations which have prevented prior proposed processes of this type from being introduced into practice.

It is a further object of the present invention to carry out the electrical heating and the deformation of the workpiece in the manner of a free-form upsetting (free-form forging), the deformation occurring at one end of a malleable metal rod and the rod being heated only at such end.

It is a still further object of the invention to provide a process and apparatus whereby the electrically heated and thereby plastically deformable workpiece is introduced even during the current passage into a hollow swage which opens gradually to the final shape and size-determining position, so that the deformation proceeds gradually, whereby it is made possible to upset the ends of rods of any desired length into the desired shape directly in the electric upsetting machine.

It is also an object of the invention to provide a process and apparatus of the type indicated wherein the upsetting is completed in a single step, and wherein the extent or length of the upset region can be readily controlled.

The above and other objects of the invention, which will become evident as the further description of the invention proceeds, are accomplished by the process and apparatus, hereinafter more fully described, for upsetting and finish-shaping of the electrically heated end of a rod-shaped workpiece in which, during the upsetting, the distance between the electrodes, of which one acts as a guide electrode, is increased by displacement of the other electrode which acts as an abutment in such manner that the workpiece is first upset during a period in which the distance between the electrodes remains unchanged, after which, with simultaneous displacement of the abutment electrode in the same direction as the pressure applied to the workpiece and continuation of the upsetting, the upset portion of

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the rod is confined within a predetermined outline as by a hollow sleeve or swage, to prevent spreading of the upset region transversely to the upsetting movement and beyond the outline of the desired finished piece.

In the accompanying drawing a now preferred embodiment of the invention is shown by way of illustration and not by way of limitation.

Fig. 1 is an axial section of the operative parts of the upsetting machine, in their initial position,

Fig. 2 is a similar view, showing the parts after the beginning of the upsetting,

Fig. 3 is a similar view, showing the parts at the end of the upsetting process, and

Fig. 4 is a side view of a workpiece produced in this manner.

Similar reference numerals denote similar parts in the different views.

Referring now to the drawings in greater detail, and first to Fig. 1, it will be seen that the cold malleable metal rod 1 which is to be upset is chucked or clamped between the jaws 2 of the so-called guide electrode 3 and forced into engagement of its end 4 with the movable bottom part 5 of the die or swage, by exerting pressure on the opposite end 6 of the rod. The plunger 5 is slidably guided in the cavity sleeve 7. The cavity sleeve 7 is fixedly accommodated in an electrode block 8. The two electrode blocks 3 and 8 are connected to the two secondary poles of transformer 9 and are insulated from each other except for the connection through the rod 1 which when inserted constitutes a direct connection between the electrodes. When the primary circuit is closed, a current flow between the electrodes 3 and 8, whereby the rod part denoted 4 is heated. The pressure on the cold end 6 of the rod will cause upsetting of the heated rod part 4 at 10.

When the upsetting operation has proceeded to such an extent that the diameter of the upset part 10 has reached the inner diameter of the matrix or die sleeve 7, Fig. 2, the abutment electrode 5 is retracted into the cavity sleeve 7. The uniformly compressed heated material will adapt itself to the walls of the cavity as the upsetting operation is continued. The motion of the plunger 5 has to be adapted to the advance of the continuously upsetting material. Thus the upset material will gradually fill up the entire cavity and adapt itself to the inner shape thereof, without showing any folds, overlaps or burning (Figs. 3 and 4).

The cavity sleeve 7, the clamping jaws 2 and

the abutment electrode or plunger 5 are replaceable by corresponding parts of different shapes and dimensions. The distance between the two electrodes 3 and 8 is variable. Workpieces of different cross section and material can thus be worked by adjusting the distance between the electrodes, the upsetting pressure, and the heating voltages.

While the invention has been described in detail with respect to a now preferred example and embodiment of the invention it will be understood by those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed is:

1. A method of swaging metallic rod-shaped materials comprising the steps of moving the end face of said rod-shaped material in an axial direction into contact with a first abutment member, connecting said first abutment member to one pole of a source of electric current, arranging a second, profiled abutment around the end of the rod, connecting to the second pole of said source of electric current a surface of the rod which is not surrounded by the second abutment, closing the circuit of the source of current, heating to upsetting temperature the part of the rod traversed by current, exerting on the rod a pressure force sufficient to cause upsetting of the part of the rod traversed by current, and moving the first abutment in an axial direction of the rod, said movement causing the upset material to engage the second abutment and to assume the shape defined by the second abutment.

2. A method of swaging metallic rod-shaped materials comprising the steps of moving the end face of said rod-shaped material in an axial direction into contact with a first abutment member, connecting said first abutment member to one pole of a source of electric current, arranging a second, profiled abutment around the end of the rod, connecting to the second pole of said source of electric current a surface of the rod which is not surrounded by the second abutment, closing the circuit of the source of current, heating to upsetting temperature the part of the rod traversed by current, exerting on the rod a pressure force sufficient to cause upsetting of the part of the rod traversed by current, and moving the first abutment in an axial direction of the rod from the moment when the upset material begins to assume the free cross section of the second abutment, said movement causing the upset material to engage the second abutment and to assume the shape defined by the second abutment.

3. A forging press comprising, in combination, an abutment electrode for rod-shaped metallic malleable material, a guide electrode for said material, insulating means between the two electrodes, a source of current which is electrically connected with the abutment and guide electrodes, a swage surrounding the abutment electrode in the form of a sleeve, the abutment electrode being constructed in the form of a movable swage bottom and being movable within and relative to the surrounding swage, and means for exerting on the rod-shaped material a pressure force directed towards the bottom of the swage.

4. A forging press comprising, in combination, an abutment electrode for rod-shaped metallic malleable material, a guide electrode for said material, insulating means between the two electrodes, a source of current which is electrically connected with the abutment and guide electrodes, a swage surrounding the abutment electrode in the form of a sleeve, the abutment electrode being constructed in the form of a movable swage bottom and being movable within and relative to the surrounding swage, said abutment electrode being arranged in such a way in relation to the swage that the abutment electrode in its position of rest is flush with the end face of the swage directed towards the workpiece, and means for exerting on the rod-shaped material a pressure force directed towards the bottom of the swage.

5. A forging press comprising, in combination, an abutment electrode for rod-shaped metallic malleable material, a guide electrode for said material, insulating means between the two electrodes, a source of current which is electrically connected with the abutment and guide electrodes, a swage surrounding the abutment electrode in the form of a sleeve, the abutment electrode being constructed in the form of a movable swage bottom and being movable within and relative to the surrounding swage, the abutment electrode, the guide electrode, and the swage being removable for replacement, and means for exerting on the rod-shaped material a pressure force directed towards the bottom of the swage.

6. A forging press comprising, in combination, an abutment electrode for rod-shaped metallic malleable material, a guide electrode for said material, insulating means between the two electrodes, a source of current which is electrically connected with the abutment and guide electrodes, a swage surrounding the abutment electrode in the form of a sleeve, the abutment electrode being constructed in the form of a movable swage bottom and being movable within and relative to the surrounding swage, the distance between the abutment and guide electrodes being variable, and means for exerting on the rod-shaped material a pressure force directed towards the bottom of the swage.

7. A forging press comprising, in combination, an abutment electrode for rod-shaped metallic malleable material, a guide electrode for said material, insulating means between the two electrodes, a source of current which is electrically connected with the abutment and guide electrodes, a swage surrounding the abutment electrode in the form of a sleeve, the abutment electrode being constructed in the form of a movable swage bottom and being movable within and relative to the surrounding swage, and means for exerting on the rod-shaped material a variable pressure force directed towards the bottom of the swage.

8. A forging press comprising, in combination, an abutment electrode for rod-shaped metallic malleable material, a guide electrode for said material, insulating means between the two electrodes, a source of current which is electrically connected with the abutment and guide electrodes, means for adjusting the heating voltage of the source of current, a swage surrounding the abutment electrode in the form of a sleeve, the abutment electrode being constructed in the form of a movable swage bottom and being movable within and relative to the surrounding swage, and means for exerting on the rod-shaped material a pressure force directed towards the bottom of the swage.

9. A method of swaging a metallic rod or the like, comprising the steps of moving the end face of said rod into contact with an abutment member, guiding the rod at an intermediate portion thereof, heating the part of the rod between said end face and said intermediate portion to upsetting temperature, exerting on the rod a degree of pressure sufficient to cause upsetting of the heated end part of the rod, and moving the abutment axially of the rod and in the direction of the applied pressure, while confining the upset portion of the rod within a predetermined outline, whereby upon continued movement of

the abutment, the heated portion of the rod is swaged to the said predetermined outline.

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