METHOD OF AND DEVICE FOR FORGING

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This invention relates to forging and, in particular, to hot forging.

When forging a work piece with heads or enlarged portions at each end, such as a wrench, it has been customary heretofore to insert stock material in a forging press and then to forge first one head in one die or group of dies, and thereafter to forge the other head in a second die or group of dies.

This method, however, requires quite a number of operations, for instance, eight operations in the case of a simple double head wrench.

Accordingly, it is an object of the invention to provide an improved forging method which will materially reduce the time and number of operations heretofore required for forging work pieces of the above-mentioned type.

It is another object to provide an improved forging method, which will make it possible, in a single operation, to forge from stock material a work piece which is wider at its ends than intermediate its ends.

Still another object of the invention consists in the provision of an improved method of forging work pieces with heads at each end by inserting stock material in a multi-part die or mold, floatingly supporting the said die or mold, and exerting forging pressure upon one end of the said stock material so as to move the floating die or mold against a stationary die member.

It is also an object of the invention to provide improved forging means which will make it possible to forge from bar or stock material in a single operation a work piece with enlarged parts at its ends.

A still further object of the invention consists in the provision of forging means comprising a floating mold or die for forging work pieces with enlarged ends in a single operation.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

Figure 1 is a section along the line 1—1 of Figure 4, and illustrates the beginning of a forging operation according to the invention.

Figure 2 shows an intermediate state of the forging operation according to the invention.

Figure 3 shows the work piece and the forging means at the end of the forging operation.

Figure 4 is a section along the line 4—4 of Figure 3.

General arrangement

According to the improved forging method of the invention, the material to be forged, preferably stock material, is first heated at least at its ends and then inserted in hot condition into a floatingly supported mold so that the lower end of the material rests upon a stationary die.

Pressure is then exerted upon the other end of the material by means of a punch or die so that the upper portion of the material fills in the adjacent mold cavity, while simultaneously the mold moves toward the stationary die, which latter presses the adjacent material into the adjacent cavity of the mold.

When the work piece has thus been forged, the mold, which preferably consists of two parts, is opened and the work piece removed.

Structural arrangement

In the drawings, 10 designates a mold which comprises two mold halves 11 and 12 hinged together by means of a hinge 13 and adapted to be locked in closed position by locking means, generally designated 14. These locking means comprise a lever 15 having linked thereto a hook 16 which, when the molds are in locked position, engages a locking pin 17.

The mold 10 is preferably provided with two or more locking means 14. The mold 10 shown in the drawings confines a cavity, generally designated 18, with an upper chamber 19 and a lower chamber 20, interconnected by a bore 21.

The mold 10 is furthermore provided with guiding bosses 22 slidably engaged by guiding bolts 23, which are screwed into or otherwise connected to a base member 24. The base member 24 carries a stationary die 25 which, in the embodiment shown in the drawings, is of hexagonal shape and screwed into the base member 24. The base member 24 is furthermore provided with a recess 26 carrying a supporting bolt 27 passing through the bottom 28 of the recess 26 and being provided with a head 29. Surrounding the bolt 27 and arranged between the bottom 28 of the recess 26 and the bolt head 29 is a spring 30. The head 29 has inserted therein a shim 31 which is held on the head 29 by means of a pin 32 connected to the shim 31 and entering a corresponding bore in the bolt 27.

The base member 24 carries a plurality of bolts 27, as indicated in Figure 4. Each shim 31 of bolt 27 is guided in a groove 33 at the bottom of the mold 10. If it is desired to vary the maximum distance between the base member 24 and the mold 10, it is merely necessary to exchange the shims 31 or to omit them altogether, in which latter instance the head 29 of each bolt 27 is guided in the grooves 33.
Slidably arranged in the upper chamber 19 of the mold cavity 18 is a hollow die member 34 for screwing or otherwise securing thereto a punch 35. Slidably arranged intermediate the punch 35 and die member 34 is a guiding member 36 which simultaneously acts as a die. To prevent rotation of the guiding member 36 relative to the hollow die member 34, the guiding member 36 is provided with a groove 37 engaged by a key 38 connected to the hollow die member 34.

To carry out a forging operation, the hollow die member 34, together with the punch 35 and guiding member 36, is withdrawn from the mold 10, while the mold is closed. Then the work piece 38, after having been heated at its ends or throughout its entire length, is inserted into the mold 10 so that its lower end rests upon the stationary die member 25. Thereupon the hollow die member 34, which is connected to the press plunger (not shown), is moved downwardly so that the guiding member 36 surrounds the upper portion of the work piece 38, while the punch 35 begins to exert pressure upon the upper portion of the work piece 38. Due to this pressure, the material of the work piece, at both ends thereof, begins to spread and to fill a portion of the upper and lower chambers, 19 and 20 respectively, as indicated in Figure 2. Simultaneously, due to the pressure exerted by the punch 35, the mold 10 yields and moves downwardly against the thrust of the springs 30.

At the end of the forging operation, the elements occupy the position shown in Figure 3, at which time the upper end of the work piece 39 has been forged into a hollow hexagonal head, whereas the lower part has been forged into a smaller solid hexagonal head. The mold halves 11 and 12 are then opened by operation of the lever 15 and the work piece is removed. Then the mold may then be closed and is ready for a new forging operation.

It is, of course, understood that the new forging method according to the invention is by no means limited to the structure of the mold shown in the drawings.

It will also be clear that the die member 25 and die member 34 and punch 35, as well as the guiding member 36, may be exchanged for different sized members to make it possible to provide the work piece 39 with differently shaped heads while still utilizing the same mold. To vary the thickness of the lower head on the work piece, it is merely necessary to exchange the shims 31, or to remove them altogether.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a method of forging an article having enlarged ends, the steps of inserting a heated workpiece of substantially uniform cross-section into a mold having a cavity therein defining the contour of the finished article, the mold having a cavity at each end to provide enlarged ends of the workpiece, confining the middle portion of said workpiece to prevent deformation thereof relative to the cross-section of the workpiece, confining the workpiece from one end thereof for a substantial distance inwardly of said end to prevent deformation of said end relative to the cross-section of the workpiece during initial forging, and exerting forging pressure on both ends of the workpiece to form the enlarged ends, the flow of metal adjacent the confined end being radially outwardly from the workpiece and then upwardly in a direction opposite to the forging pressure of said end.

2. In a method of forging an article having enlarged ends, the steps of inserting a heated workpiece of substantially uniform cross-section into a mold having a cavity therein defining the contour of the finished article, the mold having a cavity at each end to provide enlarged ends of the workpiece, confining the middle portion of said workpiece to prevent deformation thereof relative to the cross-section of the workpiece, confining the workpiece from one end thereof for a substantial distance inwardly of said end to prevent deformation of said end relative to the cross-section of the workpiece during initial forging, and exerting forging pressure on both ends of the workpiece to form the enlarged ends, the flow of metal of the confined end being in the direction of the forging pressure of said end and the flow of metal adjacent the confined end being radially outwardly from the workpiece and then upwardly in a direction opposite to the forging pressure of said end.

3. A method of forging an article having enlarged ends including the steps of inserting a heated workpiece into a mold having a cavity therein defining the finished article, the mold having a cavity at each end to provide enlarged ends of the workpiece, confining the workpiece from one end thereof for a substantial distance inwardly of said end by a sleeve surrounding the workpiece to prevent deformation of said end relative to the original cross-sectional shape of said workpiece during initial forging and exerting forging pressure on both ends of the workpiece to form the enlarged ends, the forging pressure adjacent the confined end forcing metal radially outwardly beyond the end of the sleeve and then upwardly surrounding the sleeve.

4. A method of forging an article having enlarged ends including the steps of inserting a heated workpiece into a mold having a cavity therein defining the finished article, the mold having a cavity at each end to provide enlarged ends of the workpiece, confining the workpiece from one end thereof for a substantial distance inwardly of said end by a sleeve surrounding the workpiece to prevent deformation of said end relative to the original cross-sectional shape of said workpiece during initial forging and exerting forging pressure on both ends of the workpiece to form the enlarged ends, the forging pressure adjacent the confined end forcing metal radially outwardly beyond the end of the sleeve and then upwardly surrounding the sleeve to form said end of the finished article with a substantially centrally positioned cavity.

5. In a method of forging an article having enlarged ends, the steps of inserting a heated workpiece of substantially uniform cross-section into a mold having a cavity therein defining the contour of the finished article, the mold having a cavity at each end to provide enlarged ends of the workpiece, confining the middle portion of said workpiece to prevent deformation thereof relative to the cross-section of the workpiece, confining the workpiece from one end thereof for a substantial distance inwardly of said end by a sleeve surrounding the workpiece to prevent deformation of said end relative to the cross-section of the workpiece during initial forging.
forging, and exerting forging pressure on both ends of the workpiece to form the enlarged ends, forging pressure on the confined end forcing the confined end in the direction of the forging pressure and the flow of metal adjacent the confined end being radially outwardly from the workpiece and then upwardly in a direction opposite to the forging pressure of said end to form said end of the finished article with a substantially centrally positioned cavity.

6. A method of forging an article having enlarged ends including the steps of inserting a heated workpiece into a mold having a cavity therein defining the finished article, the mold having a cavity at each end to provide enlarged ends of the workpiece, confining the workpiece from one end thereof for a substantial distance inwardly of said end by a sleeve surrounding the workpiece to prevent deformation of said end relative to the original cross-sectional shape of said workpiece during initial forging, and inserting forging pressure on both ends of the workpiece to form the enlarged ends, the forging pressure adjacent the confined end forcing metal radially outwardly beyond the end of the sleeve, the flow of the metal then causing a partial withdrawal of said sleeve after which the continued forging pressure on said end causes said sleeve to be forced into the metal extending radially outwardly and then causing the metal to flow upwardly in a direction opposite to the forging pressure to surround said sleeve.

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