

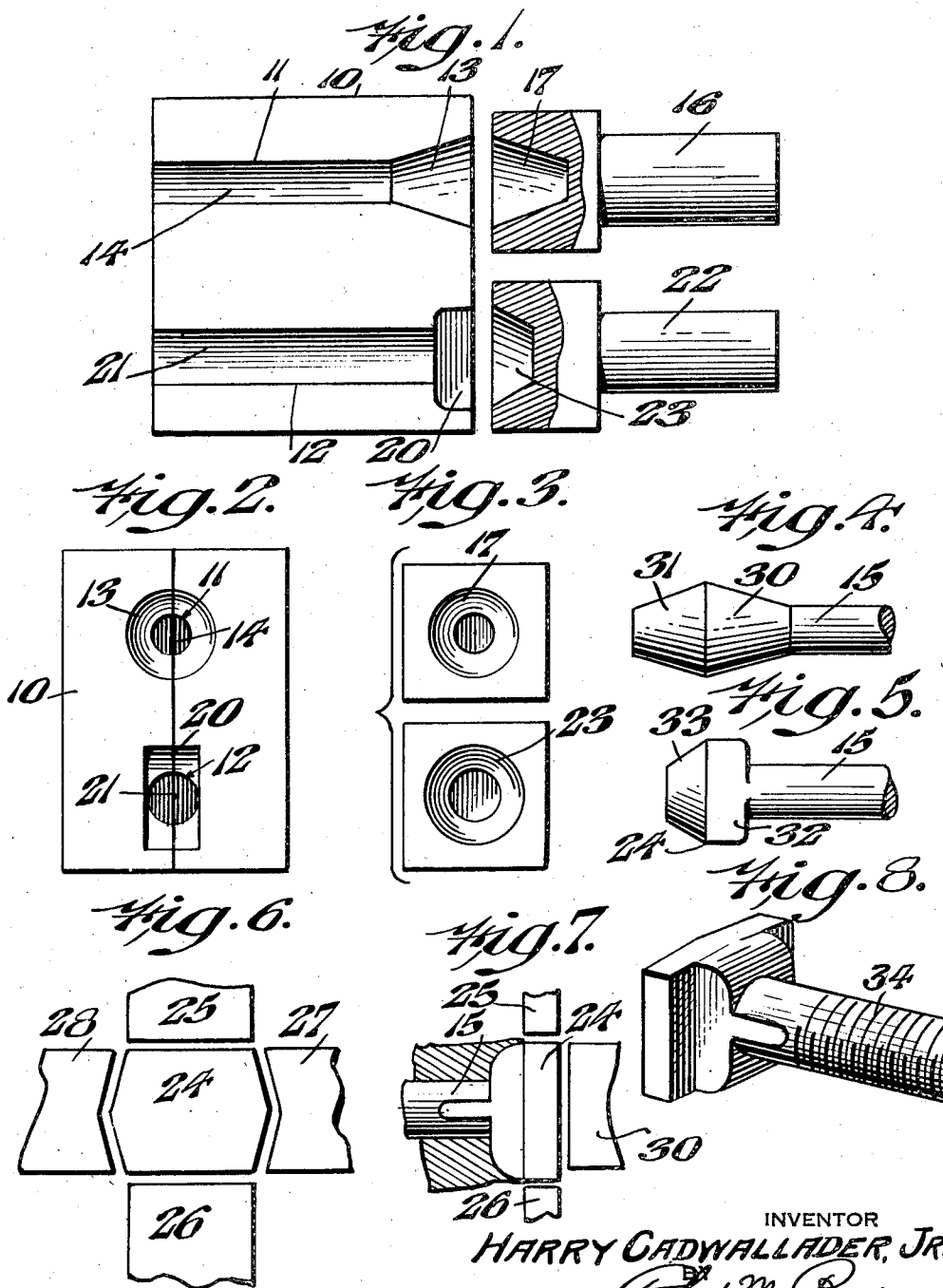
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METHOD OF FORMING BOLT HEADS

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METHOD OF FORMING BOLT HEADS

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The present invention relates to a method of making machine bolts and more particularly to a method of forming the heads thereof. In bolt heads as heretofore made by the drop forging method the partially completed blank or completed bolt head requires considerable machining such as grinding, trimming, and the like, to remove the fins and forging angles which have been a necessary adjunct of the forming operations. Furthermore by prior methods there has been no certainty that the head flanges will be of the same thickness, and more often than otherwise one is thin while the other is thick and therefore an additional machining operation is necessary to complete the head.

Some of the objects of the present invention are to provide an improved method of making a bolt head for a machine bolt; to provide a method wherein the material for the head is upset and gathered into a preliminary shape without the formation of fins; to provide a step in the method of making a bolt head wherein a second gathering operation is employed to reduce the head to a second formed shape without producing excess metal at the forging angles or forming fins thereon; to provide a bolt head forming method wherein the flanges of the head are of uniform thickness; to provide a method wherein the head is formed partially in a die and partially in a punch of die shape, the two members coacting in such a way as to provide a head shape without fins; and to provide other improvements as will hereinafter appear.

In the accompanying drawing Fig. 1 represents an elevation of one part of a two part die with the associated punches in part section as arranged to carry out two successive steps of the method of the present invention; Fig. 2 represents a front elevation of the die block; Fig. 3 represents a front elevation of the punches; Fig. 4 represents a side elevation of the bolt stock after the first gathering operation; Fig. 5 represents a side elevation of the stock after the second gathering operation; Fig. 6 represents a diagrammatic plan of the mechanism used in the final operation; Fig. 7 represents a diagrammatic elevation of the mechanism of Fig. 6; and Fig. 8 represents a perspective of the finished bolt.

Referring to the drawing one form of apparatus for carrying out the method of the present invention consists of a die block 10 which forms an anvil having preformed die shapes 11 and 12 by means of which two successive operations are performed. The invention is not limited to the

particular single block construction here shown as obviously two separate dies can be made to serve the same purpose. The die shape 11 is in the form of a frusto-conical socket 13 opening into a cylindrical hole 14 of such diameter as will snugly receive the round rod or blank 15 upon which the head of the bolt is to be formed. A punch 16 mounted for reciprocating movement towards and away from the front face of the block 10 is provided and located to register with the die shape 13. This punch 16 is provided with a forming head having a frusto-conical socket 17 in the face thereof, the arrangement being such that when the punch 16 is in face contact with the block 10 bases of the two sockets 13 and 17 will register one with another to form a die or mold having oppositely tapered end portions.

The die shape 12 has a generally rectangular socket 20 opening into a cylindrical hole 21 which is to receive the rod 15 or part which becomes the shank of the finished bolt. Preferably the inner corners of the socket 20 are rounded to give a more finished effect. A punch 22 mounted for reciprocating movement towards and away from the front face of the block 10 is provided and located to register with the die shape 20. This punch 22 is provided with a forming head having a frusto-conical socket 23 in the face thereof but which is of less depth than the socket 17 and its volume is definitely calculated to receive approximately the required amount of metal necessary for working into the head shape by the final operation.

Following the action of the punch 22, the partially formed bolt is transferred to a sliding head type of forging machine wherein the upset head 24 is placed in position to be acted upon by a top slide hammer 25, a bottom slide hammer 26, and two oppositely disposed side slide hammers 27 and 28. These hammers are reciprocated in the well known manner of such machines, the action being such that the top and bottom hammers 25 and 26 strike alternately with the side hammers 27 and 28. While the four sides of the head are thus being shaped by the alternately operated pairs of hammers, the metal is prevented from end displacement by the action of an end hammer 30 which is actuated in proper timed relation with the aforesaid working pairs of hammers. It will be understood that between the steps of the present method the bolt blank is heated to a proper forging temperature for shaping under the action of the punches and hammers.

In carrying out the steps of the present method a piece of round bar stock of proper length is placed in a heated condition within the die 11 with the end upon which the bolt head is to be formed projecting outwardly from the face of the block 10. The punch 16 is now shot forward giving the end of the bar a sharp blow and since this end has entered the socket 17 it will be upset or gathered into a shape complementary to the two sockets 13 and 17. This is shown in Fig. 4 at 30 and 31. Thus the preliminary step provides a partial head having a substantially smooth double tapered face minus any fins or projections. Upon the withdrawal of the punch 16 the partially shaped blank is removed and placed in the die 12, whereupon the punch 22 is projected against the enlarged end and causes the tapered part 30 to flow into the socket 20 and form the same, while the part 31 which is in the socket 23 is enlarged in diameter but shortened in length giving the appearance of the head as shown in Fig. 5 wherein the part 32 consists of flat sides spaced by the diameter of the shank and at its ends extending in both directions to merge into the frusto-conical part 33 resulting from the gathering of the metal in the socket 23. Thus again a more complete blank is formed but without fins or other irregularities such as are usually present in bolt manufacture. Following this operation the blank is again heated to forging temperature and placed in position between the sliding hammers of the header forging machine where the head is worked into shape by successive blows of the pairs of hammers 25 and 26, and 27 and 28. These pairs as heretofore explained operate alternately, while the end hammer 30 operates simultaneously with each pair. This operation not only works the head into final dimensions and shape, but also does the work without producing fins or forging angles which ordinarily would have to be removed. The resulting completed bolt is shown in Fig. 8 and it will be evident that it has a smooth machine finished appearance and has been produced without the ordinary auxiliary steps of machining and trimming. The threads 34 which complete the bolt are cut in the usual manner and form no part of the present invention.

Broadly considered the steps by which the shapes shown in Figs. 4 and 5 are formed may or may not include treating between the two operations, because in some blank sizes the metal will hold its initial heat sufficiently long to enable

both steps to be carried out, but in other sizes it may be found necessary to reheat between these steps.

While but one form of apparatus has been shown in which this invention may be embodied, it is to be understood that the invention is not limited to any specific construction, but might be applied to various forms without departing from the spirit of the invention or the scope of the appended claims.

Having thus described my invention, I claim:—

1. The method of forming a bolt head which consists in upsetting the end of a heated rod to form a head blank of double frustum shape, reheating the shaped blank and gathering the flowing metal to form a substantially rectangular base part having a frustum shaped head blank, reheating the blank, and hammering the sides and end of said head blank to form a bolt head of predetermined shape.

2. The method of forming a bolt head which consists in upsetting the end of a heated rod to form a head blank of double frustum shape, reheating the shaped blank and gathering the flowing metal to form a substantially rectangular base part having a frustum shaped head blank, reheating the blank, and alternately hammering the sides of the head blank in pairs while hammering the end of the head blank.

3. The method of forming a bolt head which consists in placing a heated rod blank in a fixed anvil die with an end projecting therefrom, striking the projecting end with a punch having a die socket to receive the projecting end, removing the partially formed blank and reheating it, placing the reheated blank in another fixed anvil die with a portion of the formed head projecting therefrom, striking the projecting head portion with a punch having a die socket to gather the projecting portion into a predetermined shape, removing the partially formed blank and reheating it, and then hammering the sides and end to the finished size and shape.

4. The method of forming a bolt head which consists in upsetting the end of a heated rod to form a head blank of substantially double frustum shape, then gathering the flowing metal under pressure to form a substantially rectangular partly curved base part having a frustum shaped head blank, reheating the blank, and hammering the sides and end of said head blank to form a bolt head of predetermined shape.

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