Feb. 7, 1933. S. H. CAMPBELL ET AL 1,896,837

METHOD OF FORMING BOLTS

Filed April 29, 1931

Fig. 1.

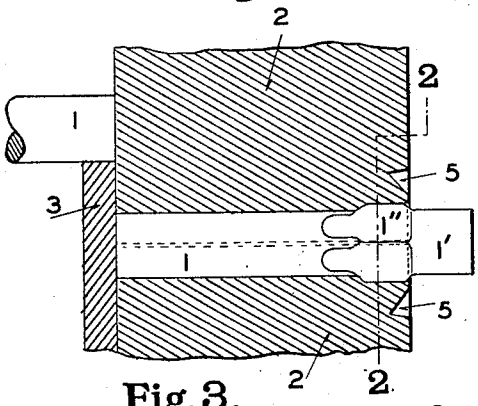


Fig. 2.

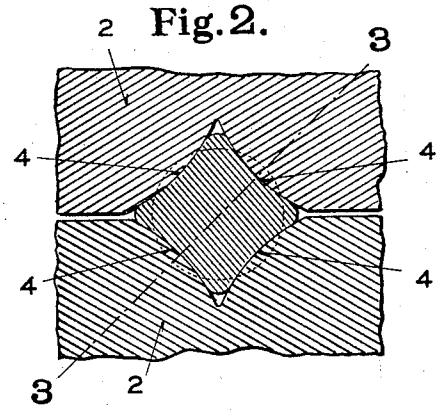


Fig. 3.

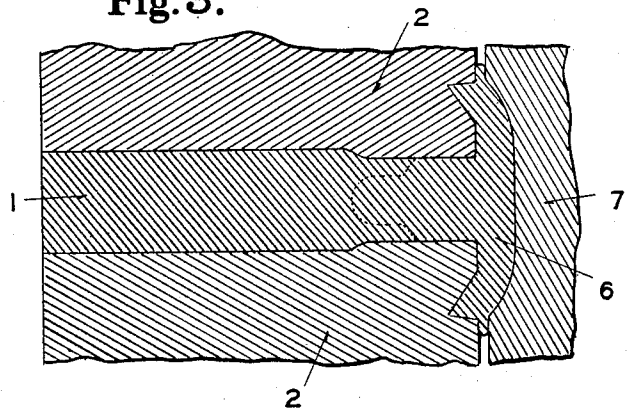


Fig. 4.

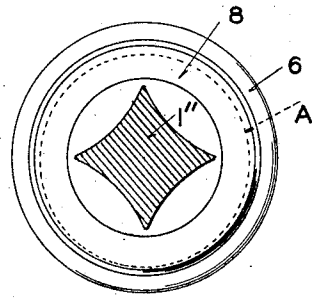
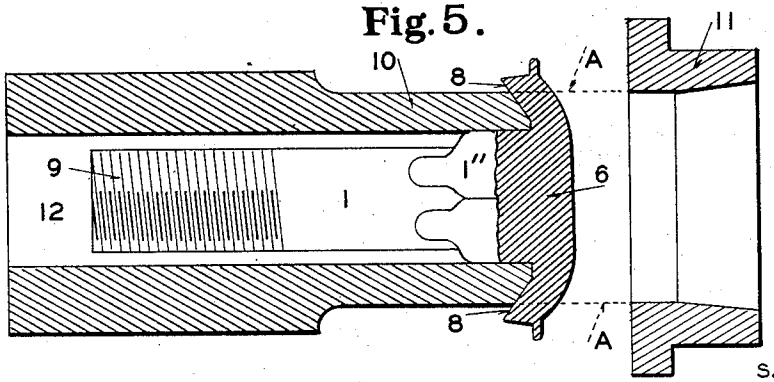


Fig. 5.



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1,896,837

UNITED STATES PATENT OFFICE

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METHOD OF FORMING BOLTS

Application filed April 29, 1931. Serial No. 533,650.

Our invention relates to a method of forming bolts and particularly to forming bolts of the type known as self-countersinking in which the under face of the bolt head is provided with a cutting edge adapted to be drawn into the timber to which the bolt is applied. Such bolts cannot be satisfactorily produced by the usual swaging operations due to the difficulty of securing a sharp cutting edge by the action of swaging dies. This difficulty is increased by the tendency of the stock to move longitudinally in the holding dies during the operation of swaging the head, either by slipping bodily in the dies or by reason of a certain amount of flow of the metal resulting in more or less upsetting of the shank portion of the bolt, such longitudinal movement resulting in variation in the amount of metal forming the head with consequent imperfections in the finished product.

It is the object of our invention to provide an improved method whereby bolts of the type named may be satisfactorily manufactured. With this object in view our invention consists, first, in providing the holding dies with means for deforming the stock to produce a shoulder adjacent the portion from which the head is formed, thus preventing longitudinal movement of the stock with consequent uniformity in the amount of material in the heads; and secondly, in trimming the heads after swaging to secure sharp cutting edges on the under faces of the bolts.

In the accompanying drawing, which illustrates one form of apparatus by means of which our improved method may be carried out, Figure 1 is a longitudinal section through the holding dies; Figure 2 is a section, on an enlarged scale, taken on the line 2—2 of Figure 1; Figure 3 is a section taken on the line 3—3 of Figure 2; Figure 4 is a cross section of the bolt, showing the underside of the head; and Figure 5 is a longitudinal section through the trimming dies.

The bolts are formed from pieces of round stock 1 gripped in holding dies 2. The pieces of stock may be cut into uniform lengths by a separate machine but we prefer to cut and grip the stock by a single operation, as shown in Figure 1, the stock being severed by the downward movement of the upper die 2, the lower die being stationary, in which case the severing is accomplished by the cooperation of the rear corner of the upper holding die with a shearing blade 3. However the stock is cut it is essential that the part 1′ projecting beyond the faces of the holding dies be of a predetermined length so as to provide the proper amount of material for the formation of the bolt head. This is readily accomplished, in the manner shown, by feeding the stock forward a uniform distance between each stroke of the upper holding die. The interior of each of the holding dies is provided, adjacent its front face, with a pair of convex faces the central parts of which project inwardly beyond the periphery of the stock 1. These faces 4, when the dies are in closed position against the stock, define a prismatic space of approximately square cross section, and their action is to deform the stock, as shown in Figure 2, forcing part of it out into the prismatic space and so substantially completing the formation of an angular portion 1″ on the shank of the bolt. At the same time they form a shoulder adjacent the projecting end 1′, which shoulder prevents any longitudinal movement of the stock when the swaging die is applied to form the head, except such slight flow of metal as takes place to complete the filling of the corners of the angular portion 1″. The amount of this is so small that it does not materially affect the mass of stock available to form the head.

Formed in the ends of the dies 2 is an annular groove 5 of V-shaped cross section. The outer face of the groove is inclined from the perpendicular with respect to the end faces of the dies just sufficiently to provide draw so that the head 6 formed by the action of the swaging die 7 will not stick in the holding dies. The inner face of the groove is inclined in the opposite direction and at a greater angle so as to produce a tapered annular face 8 on the under side of the bolt head.

After the head is swaged the bolt is removed from the holding dies and threads 9

are formed thereon. The purpose of threading the bolt at this stage of the operation rather than after completion of the head by trimming, is to prevent injury to the cutting edge of the head by the threading mechanism. Trimming of the head is accomplished by means of cooperating dies 10 and 11. Formed in the cameo or punch die 10 is a longitudinal passage 12 adapted to receive the shank of the bolt and is of a diameter substantially equal to the diagonal of the angular portion 1'' so that the bolt is centered in the die by contact of the corners of the angular portion with the wall of the passage 12. The end of the punch is beveled to correspond with the bevel of the face 8, and its external diameter is that of the finished bolt head. The intaglio die 11 has an internal diameter equal to the external diameter of the die 10 plus the necessary clearance and the head is trimmed to circular form, as indicated by dotted lines "A" in Figures 4 and 5, by forcing the die 11 over the end of the die 10. The diagonals of the angular portion 1'' may vary slightly due to the corners of the square being more or less completely filled, with the result that the bolt will be imperfectly centered and the trimming cut will be eccentric to the axis of the bolt as shown by dotted line "A" in Figure 4. Furthermore, the corner of the groove 5 is not always completely filled so that the effective diameter of the face 8 may be somewhat less than its nominal diameter. For these reasons the diameter of the trimming dies is substantially less than the diameter of the face 8 so that the trimming line "A" will, under all conditions, intersect this face and so produce an unbroken short annular cutting edge.

Having fully described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. The method of forming a self-countersinking bolt which comprises forging on a length of stock a head having an annular flange with an inwardly tapering under face, and trimming the head to a diameter substantially less than the diameter of said face, the trimming cut intersecting the tapering face, whereby a continuous annular cutting edge is formed on the under side of the head.

2. The method of forming a bolt which comprises gripping the stock between holding dies with a predetermined amount of stock projecting beyond the dies to form a head, said dies being provided with inwardly projecting faces for deforming the stock to provide a non-circular part and to form adjacent to the projecting portion a shoulder extending beyond the periphery of the stock for preventing longitudinal movement of the stock, said holding dies being provided with an annular groove surrounding the stock receiving opening of the dies and having a tapered face, upsetting the projecting end by a swaging die to produce a head having an inwardly tapering under face, and trimming said head to a diameter substantially less than the diameter of said face, the trimming cut intersecting the tapering face, whereby a continuous annular cutting edge is formed on the under side of the head.

3. The method of forming a bolt which comprises gripping the stock between holding dies with a predetermined amount of stock projecting beyond the dies to form a head, said dies being provided with inwardly projecting faces for deforming the stock to provide a non-circular part and to form adjacent to the projecting portion a shoulder extending beyond the periphery of the stock for preventing longitudinal movement of the stock, said holding dies being provided with an annular groove surrounding the stock receiving opening of the dies and having a tapered face, upsetting the projecting end by a swaging die to produce a head having an inwardly tapering under face, threading the bolt, and trimming the head of the threaded bolt to a diameter substantially less than the diameter of said tapering face, the trimming cut intersecting the tapering face, whereby a continuous annular cutting edge is formed on the under side of the head.

In testimony whereof, we hereunto affix our signatures, this 27th day of April, 1931.

STERLING H. CAMPBELL.
FREDERICK K. HABENICHT.