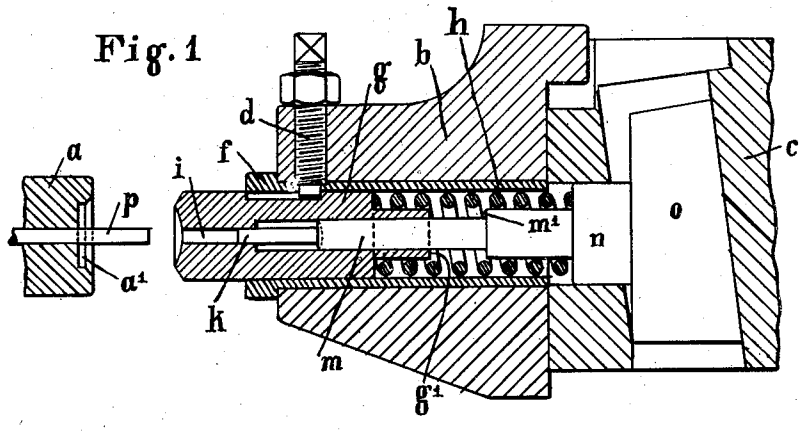
Feb. 22, 1927. 1,618,445

J. KUHNE

SINGLE STROKE HEADING MACHINE

Filed Jan. 28, 1924

Fig. 1



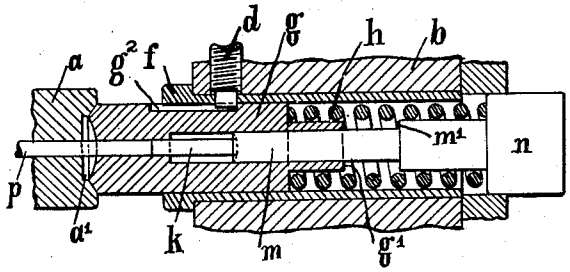


Fig. 2

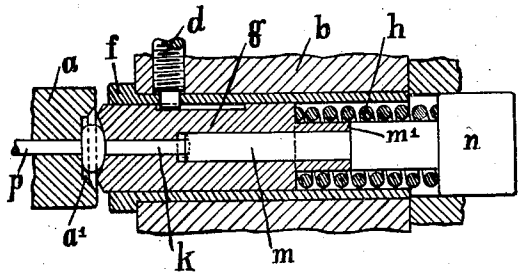


Fig. 3

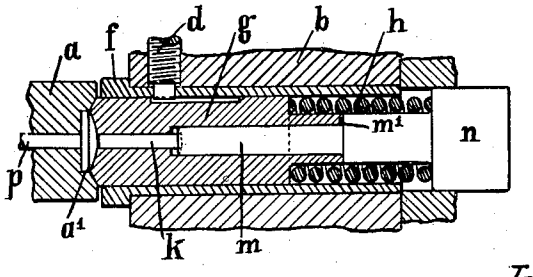


Fig. 4

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UNITED STATES PATENT OFFICE.

JOSEPH KUHNE, OF ISERLOHN, GERMANY.

SINGLE-STROKE-HEADING MACHINE.

Application filed January 28, 1924, Serial No. 689,200, and in Germany June 26, 1922.

My invention has reference to improved means for cold upsetting or heading blanks in the manufacture of set screws, cap screws, rivets, bolts, and similar headed articles, and it relates more specifically to improved mechanism for the purpose indicated by means of which a relatively large portion of the stock or blank is worked up to form a correspondingly large head, and the primary object of the invention is to provide means for carrying through the complete heading operation in a single uninterrupted operative stroke of the reciprocating header slide, during the first part of which stroke the operative pressure is applied only upon the normal cross-section of the blank, guided within the movable header part, to compress and express the exposed portion of the blank to form a preliminary head, and during the latter part of which operative stroke the upsetting pressure is extended over the primarily formed head to spread it out further and complete the heading operation.

The specific method of upsetting the blank by the present mechanism is described in my co-pending application, Serial No. 12,377, filed February 28, 1925.

My invention will best be understood when described in connection with the accompanying drawing, in which Fig. 1 is a longitudinal section through the improvement, with the parts in their relative position just prior to the beginning of the pressure stroke; Figs. 2 and 3 are similar sections with the parts at intermediate operative stages, and Fig. 4 shows the termination of the pressure stroke.

The stationary, axially perforated die *a* is provided with the matrix a^1 of the size and shape of the lower portion of the head to be formed. In the head block *b* of the reciprocable pressure slide *c*, forming part of a suitable heading or upsetting machine, is secured by means of the set screw *d* a sleeve *f* in which the plunger *g* is reciprocably guided, the extent of its operative travel being suitably controlled, for instance by the inner end of the screw *d* engaging in the plunger slot g^2. A coil spring *h* tends to urge the plunger *g* into its forward end position (Fig. 1). A bore *i* extends axially through the plunger *g* in line with the bore of the die *a*, these complemental bores having the diameter of the stock to be worked up. In the bore *i* is reciprocably guided a pressure rod or punch *k*, the rear end of which bears against the reduced portion *m* of the stepped thrust member, *m*—*m'*—*n* whose rear portion *n* contacts with the adjustable wedge member *o* in the reciprocable pressure slide *c*. The punch *k* and the thrust member *n*, *m* together constitute the preliminary stamping punch and in later coaction with the plunger *g* serve as final heading member, the plunger in its front face showing the replica of the top conformation of the finished blank head.

The co-operation of the described parts is as follows: The stock blank *p* is fed in well known manner through the central bore in the stationary die *a* until it projects an amount corresponding to the volume of the head to be formed. The pressure slide *c* is now advanced in suitable manner the bore *i* of plunger *g* engaging over the protruding portion of the blank *p* (Fig. 2). On contact with the stationary die *a* the plunger *g* is checked in its advance and closes the matrix *a'* for the first forming operation, but the member *c* continues its forward pressure movement and the blank material embraced by the plunger head is compressed and forced out of the latter's bore *i* by the punch *k* and into the matrix *a'* where it spreads out, as shown in Fig. 3, to form an inchoate head, the plunger *g* receding within the steadily advancing header block *b* under compression of the spring *h* so that its forward shaping end moves away from the matrix to such an extent as to allow the inchoate head to be formed and to project partially beyond the face of the matrix. By this means an amount of metal may be upset in this preliminary operation sufficient to form a complete head of the desired large diameter when flattened out by the second upsetting action into finished form. Finally, when the front edge of the punch *k* reaches a position flush with the front edge of the plunger *g*, the inner annular extremity g^1 of the latter is engaged by the shoulder m^1 of the member *m*, with the result that, on further advance of the slide *c*, the plunger *g* and the punch *k*, are together positively advanced in relative immovability toward the die *a* so as to conjointly form a finishing patrix die, whereby the inchoate head is finally compressed and shaped to a finished

form, as shown in Fig. 4. The pressure slide c is then retracted and the headed article pushed out of the die a and cut off in suitable, well known manner.

The tension of the coil spring h is so adjusted that it readily allows the plunger g to recede a relatively slight distance away from the stationary die a upon the blank material being crowded in between the matrix and the complemental plunger depression (Fig. 3), whereupon the shoulder m^1 of the still advancing punch member k, m immediately contacts with the inner plunger edge g^1, forcing the plunger into its final heading position (Fig. 4).

The advantages of a machine operating as above described over prior machines and method are, briefly stated, as follows: In making headed articles of the character set forth, two general processes are commonly employed. In one of these processes the stock is heated and upset while in a heated state. Articles so made possess the requisite strength, but the cost of manufacture is comparatively great because of the necessity of preliminarily heating the stock. In the other of these processes, commonly known as the cold process, the blank is upset in an unheated state in two stages, when a large-sized head is to be formed, i. e., by successive upsetting or swaging actions. These actions are performed by a so-called "double-pressure press" in which, on one stroke of the press, a plunger acts to force an enclosed end of the blank projecting beyond the matrix back into the matrix to form an inchoate head, and on a second stroke of the machine a second plunger acts to press the inchoate head into finished head shape. Such double-pressure presses, as heretofore constructed, are cumbersome and clumsy in construction, requiring the use of shifting means to successively dispose the plungers at different levels for working actions, they are slow in action because two working motions or cycles are required for the production of each article, and they are defective in operation because of an inherent fault due to the fact that a measurable time interval occurs in the action upon the blank of the two working punch members. When the first punch member exerts its working pressure on the blank a certain amount of heat is generated in the blank. I have discovered that this amount of heat is sufficient to cause the metal to flow readily under a succeeding pressure if the metal is again acted upon in due time, i. e., before the heat comes to the surface, but that, unless the second pressure is immediately applied, the engendered heat passes to the surface of the blank and is given off, allowing the blank to chill and cool. This chilling or cooling of the blank is undesirable, for the reason that, if the second pressure is applied after chilling occurs, and the blank is again heated up by reason of this second pressure, molecular adjustments causing structural stresses occur making the formed head weaker than the body or shank of the bolt. Heads formed under such conditions very often break off upon a mere tap being given them, so that the additional and costly operation of annealing must be resorted to in order to produce bolts of proper strength. All prior double-pressure presses with which I am familiar have this faulty action because of the time interval ensuing between the operation of the punches, the stock chilling and cooling off after the first pressure is applied to form the inchoate head and before the second pressure can be applied to complete or finish the head.

By the use of the method of operation employed by my machine the expense of heating the blank prior to upsetting, as in the heat swaging process, and the above-noted objections to the two-stage cold swaging process heretofore in use, are wholly overcome. In the operation of my machine, the instant the pressure stroke of the first pressure plunger k is completed, the second pressure plunger q comes into action, the two plungers then moving together as a unit coaxially, whereby immediately upon the formation of the inchoate head by the plunger k both plungers work together to conjointly apply their pressures over the full area of the inchoate head to flatten out the same into finished head form. These successive actions are so timed, and are so rapid, that before the heat in the inchoate head engendered by the stroke of plunger k can come to the surface, and while the metal of the inchoate head is still therefore in a more or less fluent or plastic state, the plunger q comes into action with the plunger k and the forces of both plungers are applied at a time when the material will readily and easily flow from one formation into the other, so that no cooling or other undesirable structural changes in the material can take place during the time period of the formation of the complete head. Headed articles having superior strength are thereby produced from cold stock without annealing or other further treatment. Furthermore, my construction, admitting of the use of plungers operating in the manner described, enables a simple type of machine to be employed which dispenses with the use of time and power consuming mechanisms for shifting successively acting punches into and out of a proper working plane for action on the blank, and which, at the same time, provides a double-swage action machine in which the swaging actions are, to all intents and effects, continuous with each other and on a single continuous working stroke of the punches, whereby de-

sirable and important advantages are gained, as above described.

It is obvious that the described stationary die with its axial feeding bore may be replaced by a type of die into which the blank is fed from in front or from the side without in any way altering the construction, arrangement and cooperation of the described parts forming my invention.

What I claim is:—

1. In a heading apparatus of the character described, a head-forming matrix, a press-slide movable toward and from the matrix, a hollow die member carried by the press-slide and adapted on a preliminary forward movement of the press-slide to receive and enclose an end portion of the stock projecting beyond the matrix and to abut against said matrix and to be limited in further forward movement thereby, a second die member connected to and positively movable with the press-slide, said second die member having a plunger portion movable in the hollow die member on a further forward movement of the press-slide to displace said projecting end portion of the stock from the hollow die and preliminarily upset the same in the matrix, the degree of forward movement of said second die on such preliminary upsetting motion being such as to bring the front ends of the two die members into coacting relation to form a unitary die surface for a unitary final upsetting action of both die members on the preliminary upset portion of the stock, means for yieldingly backing the hollow die member and yieldingly coupling said die members to permit said second die member to have forward movement independent of the hollow die member for its stock-end displacing and preliminary upsetting action, and means for positively coupling said die members for a joint forward final upsetting motion on the completion of said preliminary upsetting movement of the second die member.

2. In a heading apparatus of the character described, a press-slide, a hollow die member for enclosing the end of the stock to be upset, said die member being guided for limited longitudinal movement in said press-slide, a stationary head-forming matrix serving as a stop for limiting the forward movement of said hollow die member in the forward movement of the press-slide, a second die member for pressing said stock-end out of said hollow die member into said matrix, said second die member being guided in said hollow die member and engaged with the press-slide for positive motion therewith, a spring for yieldingly coupling said die members and permitting forward movement of the second die member independent of the hollow die member when the forward movement of the latter is arrested, and a shoulder on said second die member for positively coupling said second die member and said hollow die member, said die members, after being positively coupled, conjointly forming a final upsetting die.

3. In a heading apparatus of the character described, a head-forming matrix, a press-slide, a hollow die member for enclosing the end of the stock to be upset, said die member being slidably mounted in said press-slide and adapted to abut against the matrix on a preliminary portion of the forward movement of the press-slide so as to laterally close the matrix and to be limited in its forward movement thereby, a second die member for pressing said stock-end out of said hollow die member into said head-forming matrix and preliminarily upsetting the same therein, said second die member being guided in said hollow die member and engaging said press-slide for positive movement thereby, resilient means for coupling said die members in the direction of their forward stroke, said resilient means permitting the press-slide and second die member to move forward after the hollow die member abuts against the matrix until the said second die member forces the projecting stock-end into the matrix and then permitting the hollow die member to recede under pressure from such preliminarily upset stock-end to such a position that the distance between the bottom of the head-forming matrix and the front face of said die member is greater than the finished height of the head to be formed, and a shoulder on said second die member adapted to abut against the rear end of said hollow die member for positively coupling said die members for a final unitary forward motion when the preliminary upsetting of the stock end is completed, the length of that portion of said punch which lies in front of said shoulder being such that the front faces of said die members, when such positive coupling takes place, coact to form together a finishing die surface to flatten out and complete the formation of the head.

4. In a heading machine, a matrix, a press-slide movable toward and from the matrix, inner and outer coaxially movable dies carried by the slide, one die being slidably mounted in the press-slide and operative on a predetermined forward movement of said press-slide to enclose a portion of a stock blank projecting beyond the matrix and to laterally close the open side of the matrix, and the other die being operative on such movement of the press-slide to engage the enclosed portion of the blank and on a further forward movement of the press-slide to force said enclosed portion of the blank into the matrix for a first upsetting action thereby so as to form an inchoate head upon the blank and simultane-

ously bring the die faces of the two dies into position to form a unitary die surface, and said dies being movable in unison on a continued forward movement of the press-slide and at the completion of the said inchoate head forming action to cause their die faces to compress and flatten out the inchoate head in the matrix into finished head form, and coupling means for controlling and cooperatively connecting said dies for such working actions on each forward single stroke motion of the press-slide.

In testimony whereof I affix my signature.

JOSEPH KUHNE.