June 18, 1935. W. L. CLOUSE 2,005,495

BOLT MAKING MACHINE

Filed April 18, 1934 2 Sheets-Sheet 1

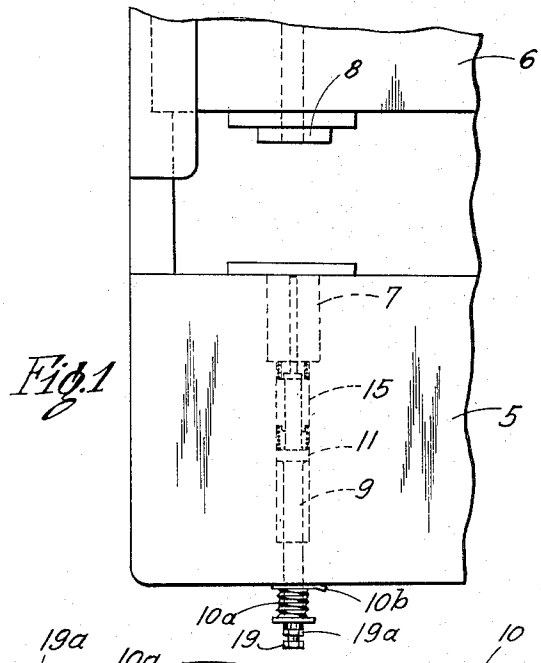


Fig. 1

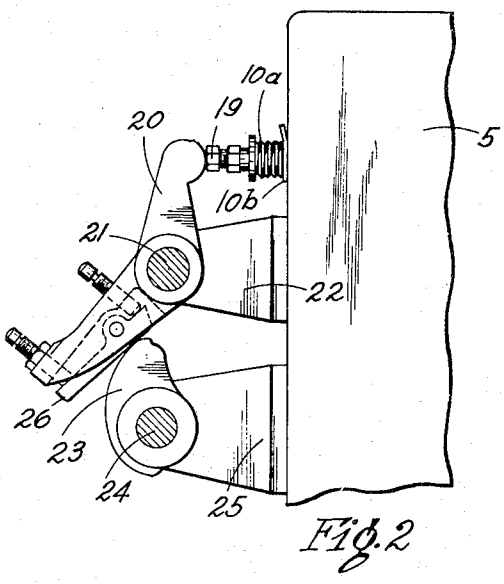


Fig. 2

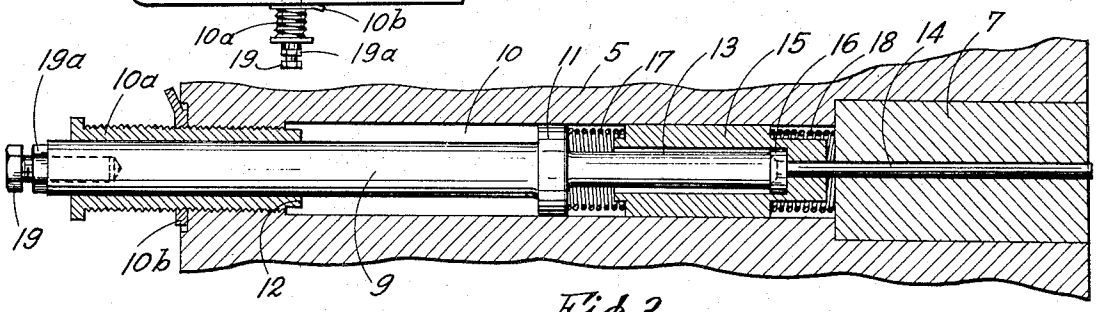


Fig. 3

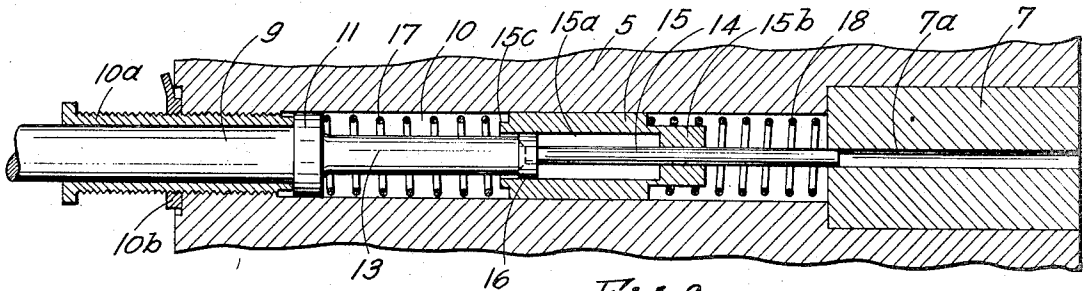


Fig. 3a

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June 18, 1935. W. L. CLOUSE 2,005,495

BOLT MAKING MACHINE

Filed April 18, 1934 2 Sheets-Sheet 2

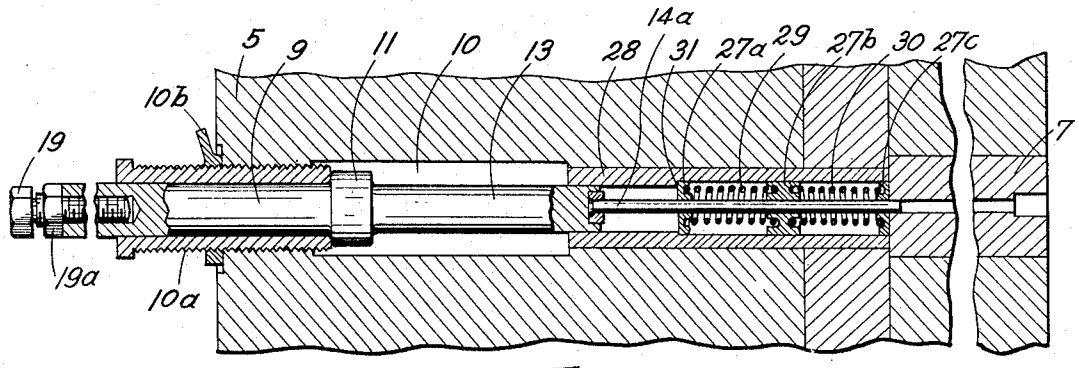


Fig. 4

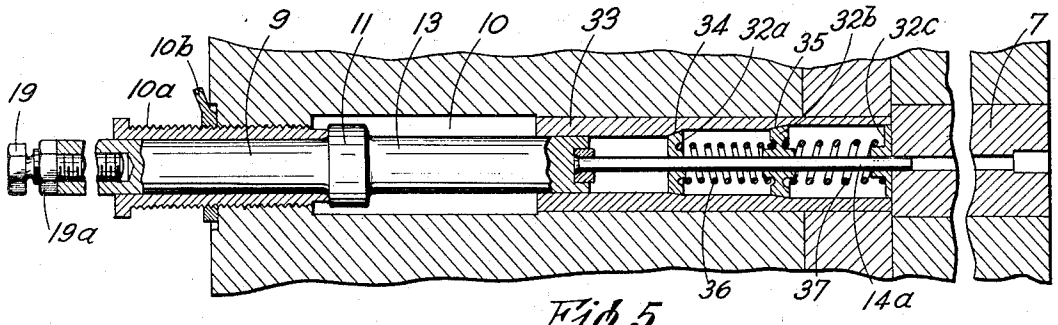


Fig. 5

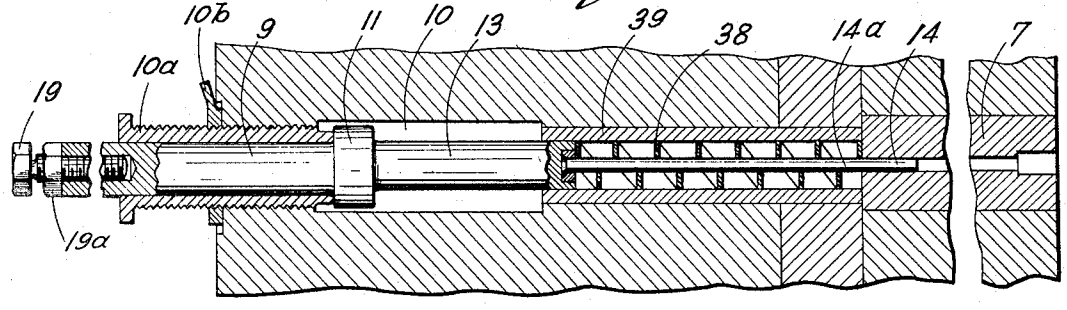


Fig. 6

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UNITED STATES PATENT OFFICE

2,005,495

BOLT MAKING MACHINE

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12 Claims. (Cl. 10—11)

This invention relates to heading machines for heading or upsetting bolts, screws and analogous articles, and is particularly concerned with blank-ejecting or knock-out mechanism for such machines.

In machines of the above type, it is highly desirable to use solid or one-piece dies, to avoid flash or fin formations at the part lines and other difficulties inherent in the use of open or divided dies, such as the added complication and expense of mechanism for operating the dies, inaccuracies in the work resulting from spreading of the dies under the upsetting or forging pressure and the like. One-piece dies, however, require the blank to be ejected from the die opening by an axially-moving member commonly termed a "knock-out pin" or rod, and this member is subjected to considerable thrust axially, especially at the start of the ejecting operation, and such thrust naturally tends to bend the pin if the latter is unsupported laterally, and since the pins are generally made of hardened steel, they can stand very little bending without breaking. Where the bolt to be formed is relatively short, solid dies are commonly used, since the stroke of the knock-out is correspondingly short and the length of the pin which is unsupported laterally is determined by the length of the stroke. As a consequence lateral stresses imposed on the knock-out pin or rod are not sufficient to bend and cause frequent breakage of the pin. However, as the length of the bolt increases, the required length of stroke of the knock-out pin proportionately increases. The pin must be small enough to enter the bore of the die and is normally driven by an ejector rod of relatively large diameter. As a consequence, when the pin is retracted it is normally unsupported through a length equal to the length of the ejecting stroke, and as this length increases the danger of breakage of the hardened pin under the thrust loads rapidly increases.

It is an object of the present invention, therefore, to provide an improved knock-out assembly for machines of the above type embodying means of a practical nature and of a highly efficient character whereby the knock-out pin is adequately reinforced against bending strains or stresses due to thrust imposed thereon during blank working operations, while at the same time the pin is accurately guided with respect to the die opening.

The foregoing and other objects and advantages will become apparent in view of the following description taken in conjunction with the drawings, wherein:

Figure 1 is a fragmentary plan view of a bolt heading machine showing a forming die and blank ejecting or knock-out mechanism of the type with which the present invention is concerned associated therewith;

Figure 2 is a fragmentary view in side elevation of the rear portion of the machine of Figure 1, showing a preferred type of actuating mechanism for the ejector or knock-out pin forming part of the knock-out assembly;

Figure 3 is an enlarged central longitudinal sectional view of a preferred type of knock-out assembly, showing the knock-out pin in its advanced or knock-out position;

Figure 3*a* is a view similar to Figure 3 showing the knock-out plunger and pin in its retracted position ready to receive the thrust of a bolt blank during the working operation of the latter;

Figures 4, 5 and 6 are views similar to Figures 3 and 3*a* of modified types of knock-out assemblies.

Referring to Figures 1 and 2, 5 indicates the frame of the machine and 6 the header slide which is mounted to reciprocate in said frame. Suitably secured in the frame 5 is a die 7 having a die opening 7*a* therein, in which the shanks of the bolt blanks are extruded, or held while the blank is headed or otherwise acted upon by a tool 8 carried by the header slide 6.

The knock-out assembly illustrated in Figures 3 and 3*a* comprises a plunger 9 of any suitable type which is mounted in a bore 10 formed in the frame 5 directly in rear of the die 7 and in axial alignment with the die opening 7*a*. As illustrated the plunger 9 is formed with an annular enlargement or abutment shoulder 11 which when the plunger 9 is in retracted position is adapted to abut a shoulder 12 formed by the end of a sleeve 10*a* which is threaded into the bore and locked in position by a nut 10*b*. Beyond the shoulder 11, the plunger 9 is formed with a reduced portion 13 arranged to abut at its forward end against the end of a knock-out pin 14. However, any desired arrangement for limiting the retracted position of the plunger may be employed. Mounted to have a sliding fit in the bore 10 is a reinforcing and guide bushing or analogous member 15 formed with an axial opening or bore 15*a* and reduced end portions 15*b* and 15*c*. The rear end of the knock-out pin 14 is provided with a guide or bearing collar 16 which has a sliding fit in the bore 15*a*, the latter terminating in a reduced concentric bore in the reduced end 15*b* in which the knock-out pin 14 has a sliding fit. Mounted on each side of the

bushing 15 and housed in the bore 10 are resilient positioning members in the form of compression springs 17 and 18 which serve to maintain bushing 15 in its most effective reinforcing position. These springs also act to return the knock-out plunger to its retracted position, after the blank is ejected from the die. At its rear extremity, the plunger 9 is internally bored and threaded to adjustably receive a contact screw or analogous member 19 provided with a locking nut 19a.

A preferred means of actuating the plunger 9 is shown in Figure 2 and comprises a rocker arm or pusher 20 which is rotatably mounted on a shaft 21 carried by a bracket 22. The arm or pusher 20 is rocked by a cam 23 mounted on a shaft 24 carried by a bracket 25, the shaft 24 being driven from the main crank shaft of the machine (not shown) which reciprocates the header slide 6. The one extremity of the rocker arm 18 is provided with an adjustable contact member 26.

In operation, when the shank of a bolt blank is driven into the die opening 7a of the die 7 by the tool 8 during the advancing movement of the header slide, the knock-out pin 14 takes the thrust of the shank and transmits it to the frame 5 through the shoulder 11 abutting against the shoulder 12, or through any other suitable backing means. In this position, it will be noted that the portion 15b of the reinforcing bushing 15, due to springs 17 and 18, is held approximately at the intermediate portion of the pin and adequately reinforces the latter against bending strains both while the pin is taking the upsetting thrust and at the start of the ejecting operation, while the rear extremity of the bushing laterally supports the rear extremity of the pin. Thus the pin is held against any tendency toward bending along the entire length thereof. When the header slide retracts, the rocker arm 20 drives the plunger 9 and knock-out pin inwardly and ejects the blank, the springs 17 and 18 being compressed and the bushing 15 moving to the position shown in Figure 3.

Figures 4, 5 and 6 show modified or alternate types of knock-out assemblies with respect to that shown in Figures 3 and 3a. Parts shown in Figures 4, 5 and 6 which are substantially similar to those shown and described in Figures 3 and 3a have been given like reference numerals.

In Figure 4 a plurality of reinforcing and guide members or bushings 27a, 27b and 27c are provided and are mounted in a sleeve bushing 28, the latter being inserted in the bore 10 and being adapted to receive the inner extremity 13 of the plunger 9. Interposed between these respective bushings are a pair of positioning compression springs 29 and 30 which maintain the reinforcing bushings at the most effective bracing position along the knock-out pin 14a when the latter takes the thrust and at the start of the ejecting action. The bushing 27a is limited in its rearward movement by an abutment shoulder 31 formed in the sleeve 28. During the ejecting stroke when the plunger 9 passes beyond this shoulder, springs 29 and 30 are compressed, and the bushings 27a and 27b are collapsed or moved together to allow the completion of the stroke. On the return stroke the springs serve to reposition the bushings in the most effective supporting position. This construction permits the guide bushing and spring assembly to remain in assembled position in sleeve 28 when the sleeve 10a and plunger 9 are withdrawn or removed for adjustment or repair.

The construction in Figure 5 is along the lines of that in Figure 4. In this instance the reinforcing bushings are indicated at 32a, 32b and 32c and the sleeve bushing at 33. In this instance, sleeve 33 is formed with spaced seats 34 and 35, which are preferably tapered, the movable bushings 32a and 32b being also tapered or frusto-conical to adjust themselves to said seats. A pair of spacing and positioning springs 36 and 37 are provided and are preferably of unequal tension, the spring 36 embodying less resistance to compression than the spring 37. When the thrust loads are imposed on the pin 14a, which occurs during the heading and at the start of the knock-out operation, the bushings 32a and 32b are in seated position so that the pin is effectively reinforced. When the plunger 9 is moved inwardly beyond seat 34, bushing 32a unseats first and then moves freely in sleeve 33, bushing 32b remaining seated until its tension is overcome by the compression built up in spring 36, whereupon it unseats and both bushings collapse together to permit completion of the stroke. Spring 37, of greater tension than spring 36, ensures return of both bushings to seated position, while on the ejecting stroke, spring 36 offers less resistance to movement of plunger 9 and permits the center bushing, which serves the most effective reinforcing function and is preferably heavier, to remain seated until the bolt blank is well out of the die. In this construction, also, the plunger may be removed without displacing the reinforcing assembly. The tapered formation of bushings 32a and 32b reduces bearing or surface contact and friction thereof in sleeve 33 to a minimum.

In Figure 6 a resilient or compressible reinforcing member is provided in the form of a spring 38, the coils of this spring being of such diameter and wall thickness as to have a sliding or bearing fit in sleeve 39 and around the pin 14a and serve the function of reinforcing bushings or like members. When the plunger 9 and pin 14a are in retracted position and at the start of the ejecting stroke, the coils of spring 38 are distributed equally along the length of pin 14a and effectively reinforce the latter against lateral thrust or stresses.

When the plunger 9 moves forward to eject a blank, the spring 38 is compressed to clear the end 13 of the plunger. During this compression the coils of the spring tend to assume a larger overall diameter which is prevented by the engagement of the spring in the sleeve 39, and this tendency results in a slight additional winding of the spring about the pin 14a. Both ends of the spring are preferably left free to permit this movement.

It will be understood that structural changes and variations in arrangement of the several parts may be adopted within the scope of the invention as defined by the appended claims. By "bolt machine" in the claims is meant any machine adapted for heading, upsetting, or otherwise working on bolts, screws and analogous headed or upset articles.

I claim:

1. In a bolt machine, a die having a die opening therein; and a knock-out assembly for said die comprising a knock-out pin, a plunger mounted in axial alignment with said pin for imparting knock-out movements to the pin with respect to the die opening, said plunger being

formed with an annular abutment shoulder, a bushing for reinforcing the pin against bending stresses mounted to have sliding movement on the pin and plunger, and positioning springs disposed at opposite ends of said bushing between the die and bushing and between said shoulder and bushing.

2. In a bolt machine, a bed frame, a die supported by said frame and having a die opening therein, said frame being formed with an elongated bore in axial alignment with said die opening, a plunger mounted to reciprocate in said latter opening and formed with an abutment shoulder, a knock-out pin connected to the forward end of said plunger in axial alignment with the die opening, a bushing for reinforcing the pin against bending stresses having an axial opening therein in which the pin and the forward extremity of said plunger have movement, and positioning springs arranged at opposite ends of said bushing and arranged to abut said die and shoulder to maintain the bushing in the most effective reinforcing position when the pin is in retracted position and at the beginning of the knock-out stroke.

3. In a bolt machine, a die having a die opening therein, a bed frame supporting said die and having an opening in axial alignment with said die opening, a plunger mounted to reciprocate in the opening formed in the frame, a knock-out pin arranged at the forward end of said plunger in axial alignment with the die opening, a plurality of bushings for reinforcing the pin against lateral stresses mounted on the pin, and springs disposed between said bushings for maintaining the latter at the most effective bracing position when the plunger and pin are in retracted position and at the beginning of the knock-out stroke.

4. In a bolt machine, a one-piece die having a die opening therein, a bed frame supporting said die and having an elongated opening in axial alignment with said die opening, a sleeve bushing disposed in said frame opening and having an abutment shoulder along the interior bore thereof, a pin, a plurality of reinforcing bushings slidably mounted on said pin with the outer bushing arranged to abut said shoulder, and springs arranged between said bushings for normally maintaining the latter in the most effective reinforcing position.

5. In a bolt machine, a one-piece die having a die opening therein, a frame supporting said die and formed with an elongated opening in axial alignment with said die opening, and a knock-out assembly disposed in said frame opening; said assembly comprising a plunger having a knock-out pin at the forward end thereof, a sleeve bushing formed with a series of spaced internal abutment shoulders, reinforcing bushings within said sleeve bushing formed with axial openings in which said pin has a sliding fit, and positioning springs arranged between said bushings to maintain the latter at the most effective reinforcing position when the pin is in retracted position at the beginning of the knock-out stroke.

6. In a bolt machine, a one-piece die having a die opening therein, a frame supporting said die and formed with an elongated opening in axial alignment with said die opening, and a knock-out assembly disposed in said frame opening; said assembly comprising a plunger having a knock-out pin at the forward end thereof, a sleeve formed with a series of spaced internal abutment shoulders, reinforcing bushings within said sleeve formed with axial openings in which said pin has a sliding fit, and positioning springs arranged between said bushings to maintain the latter at the most effective reinforcing position when the pin is in retracted position at the beginning of the knock-out stroke, one of said springs embodying less resistance to compression than the remaining spring or springs.

7. In a bolt machine, a die having a die opening therein, a frame supporting said die and having an elongated bore therein in axial alignment with said opening, and a knock-out assembly arranged in said bore, said assembly comprising a plunger, a pin at the forward end of said plunger and adapted to be moved into said die opening by said plunger, a sleeve bushing fitted into said bore and having a plurality of tapered seats formed therein, reinforcing bushings mounted to have a sliding movement on said pin and arranged to abut said seats, and springs of unequal tension arranged between said bushings for maintaining the latter at the most effective reinforcing position.

8. In a bolt machine, a die having a die opening therein, a frame supporting said die and provided with an elongated bore in axial alignment with said die opening, a knock-out pin arranged in said bore in axial alignment with the die opening, and means for reinforcing said pin against bending stresses comprising a spring fitted over said pin and having coils of a sufficient diameter and thickness to reinforce the latter against bending stresses.

9. In a bolt machine, a die having a die opening therein, a frame supporting said die and having an elongated bore in axial alignment with the die opening, a knock-out pin disposed in said bore in axial alignment with the die opening, a plunger backing up said pin, and a spring arranged around the pin and having coils of a diameter sufficient to occupy the space between the pin and the adjacent wall of the bore for reinforcing the pin against bending stresses.

10. In a bolt machine, a frame, a die having an axial bore mounted therein, said frame being formed with an opening in alignment with, and of greater diameter than, the bore of said die, an ejector pin slidable in the bore of said die and in retracted position extending into said bore, a plunger for actuating said ejector pin, means slidably bearing on the walls of said opening and on said ejector pin for laterally supporting said pin, said means being resiliently positioned intermediate the ends of the portion of said pin extending into said opening in the retracted position of said pin, and being collapsible between said plunger and said die when the plunger advances the pin into the die.

11. In a bolt machine, a frame, a die having an axial bore mounted therein, said frame being formed with an opening in alignment with, and of greater diameter than, the bore of said die, an ejector pin slidable in the bore of said die and in its retracted position extending into said bore, a plunger for actuating said ejector pin, shiftable means slidably bearing on the walls of said opening and on said ejector pin for laterally supporting said pin, said means including spring means for maintaining a lateral bearing for said pin positioned intermediate the ends of the portion thereof extending into said opening when said pin is retracted, and said

spring means being compressible between said plunger and said die to permit said plunger to enter said opening and advance the pin into the die.

12. A bolt machine comprising a bed frame having a die mounted therein, a reciprocating header slide mounted in said bed frame, a tool carried by said header slide arranged to cooperate with said die, said die provided with an opening, a knock-out pin axially aligned with said die opening and supported therein in its retracted position, means to support said knock-out pin at the end thereof remote from the die and means to support said knock-out pin intermediate its ends, said last named means movable with respect to the pin and with respect to the die.

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