Oct. 13, 1936. W. L. CLOUSE 2,057,418

BOLT MAKING MACHINE

Filed Feb. 18, 1935

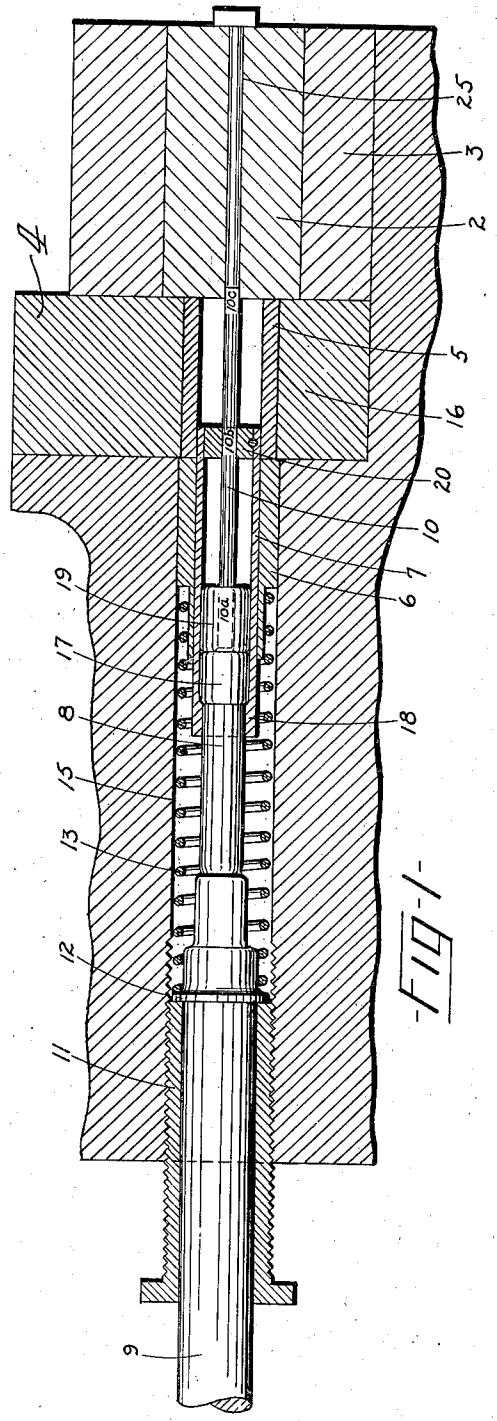


Fig-1-

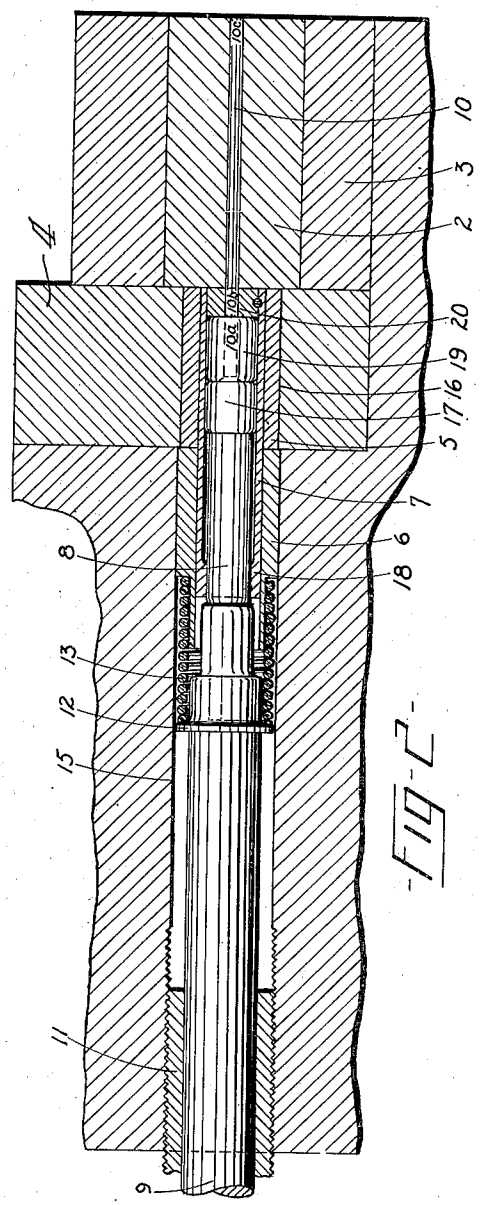


Fig-2-

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Patented Oct. 13, 1936 2,057,418

UNITED STATES PATENT OFFICE

2,057,418

BOLT MAKING MACHINE

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Application February 18, 1935, Serial No. 6,991

17 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 knockout mechanisms 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 "knockout pin" or rod. This ejecting member is subjected to considerable thrust axially, especially during the upsetting operation, when the end of the pin forms the bottom of the die, and at the statrt of the ejecting operation when the pin must free the upset blank from the die, and such thrust naturally tends to bend the portion of the pin that is unsupported laterally. Since the pins are generally made of hardened steel, they can stand very little bending without breaking, and as a consequence pins with an unsupported portion of substantial length are subject to frequent breakage.

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 ordinarily 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.

Where the bolt to be formed is relatively short, solid dies have been commonly used, since the stroke of the knockout is correspondingly short and the length of the pin which is unsupported laterally is determined by the length of the stroke. With these short bolts lateral stresses imposed on the knockout 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 knockout pin proportionately increases. Accordingly, it has been customary in the past to use open dies for long work.

In machines provided with a transfer mechanism to move the blank from one die to another it is essential that the blank be completely ejected from the die into the transfer fingers prior to the transferring movement of the fingers. When the ejector pin is restored to its retracted position by springs the retracting movement may be sufficiently rapid to create a vacuum in the bore of the die with the result that the blank in the transfer fingers at the die entrance may be drawn back into the die. The slightest re-entrance of the blank will prevent its transfer and disrupt the entire sequence of blank working and transferring and necessitate a shut-down of the machine for adjustments or repairs.

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

A further object is the provision of a knockout assembly having relatively heavy and light aligned knockout members wherein the heavy members are rapidly retracted by spring means and the light members are more slowly retracted by movement of a blank into the die.

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

Figure 1 is a central longitudinal sectional view of the knockout assembly showing the plunger and knockout pin in retracted position ready to receive the thrust of a bolt blank during the working operation of the latter.

Figure 2 is a view similar to Figure 1 showing the knockout pin in its advanced or knockout position.

Referring to the drawing which illustrates a preferred embodiment of the invention, the bed frame of a bolt machine is indicated generally as 1 and carried on the face of the bed frame adjacent the header slide is a die holder 3 to support the die 2 wherein the blanks are positioned during the heading or other fabricating operations. A face plate 4 is arranged between the die holder and the bed frame to receive and transmit to the bed frame the horizontal or axial pressures imparted to the die and die holder by the header slide. The bed frame 1 and the face plate 4 are provided with horizontal bores 15 and 16, respectively, in axial alignment with the bore 25 in the die. The bore 15 of the bed frame preferably is slightly larger than the bore

in the face plate and is provided with a bush 6 at one end and an abutment sleeve 11 fastened to the frame 1 at the other end. The bore 16 in the face plate is provided with a bush 5 which extends throughout the length of the bore. The bush 5 of the face plate although having a smaller outside diameter than the bush 6 of the bed frame bore has the same inside diameter as the adjacent bush 6. This arrangement of bush diameters provides an abutment for the bush 6 against the face plate 4.

The openings in the bed frame and face plate above described carry the ejector rod and knockout pin assembly. The main ejector rod 9 is supported for longitudinal movement in the sleeve 11 and is moved therein towards the die by a cam or the like in any suitable manner. Various arrangements for actuating the ejector rod in timed relation to the movement of the tools with respect to the dies are well known in the art. The rod 9 is provided with a collar 12 thereon within the bore 15. The double functions of this collar are to limit the movement of the rod 9 away from the die by abutment with the sleeve 11 and to serve as an abutment for a coil spring 13 arranged within the bore 15, the other end of which abuts the bush 6. The spring 13 normally urges the rod 9 away from the die.

The end of the rod 9 within the bore 15 is arranged to actuate the ejector pin in any convenient way, and in the illustrated embodiment engages an intermediate pin 8 which is slidably supported for longitudinal movement within a sleeve 7. The sleeve 7 is in turn slidably supported in the bushings 6 and 5 and carries therein the knockout pin 10. The intermediate pin 8 is provided with an enlarged head portion 17 which abuts an enlarged head portion 19 on the knockout pin 10. The sleeve 7 in which both knockout pins are mounted is provided at one end with a restricted internal shoulder portion 18 surrounding the intermediate knockout pin 8 and at the other end with an apertured bearing plug 20 which serves as an intermediate support for the knockout pin 10.

The knockout pin 10 as thus mounted in the bed frame is supported in its retracted position at three points, 10*a*, 10*b* and 10*c*. The support at 10*a* is effected through the head 19 of the knockout pin, the central support at 10*b* is effected through the bearing plug 20 and the support at 10*c* is effected through the disposition of the end of the knockout pin in the bore 25 of the die 2. The unsupported length of the knockout pin 10 is never greater than the distance from 10*b* to 10*c* as shown in Figure 1. During the working of a bolt blank in the die 2 by the header slide the axial pressure on the blank is transmitted through the knockout pin 10 and the intermediate knockout pin 8 to the ejector rod 9, and then to the sleeve 11 through the collar 12.

As the ejector rod 9 is actuated the rod advances towards the die and moves the intermediate knockout pin 8 before it. The movement of the intermediate knockout pin through engagement of the heads 17 and 19 moves the knockout pin 10 into the bore 25 of the die to force the bolt blank from the die. The head 19 of the pin 10 slides forwardly within the sleeve 7 until the head 19 engages the bearing plug 20. This engagement moves the sleeve 7 along with the assembly, sliding within the bushes 5 and 6. The parts in their position of maximum advance or ejecting movement are shown in Figure 2.

The spring 13 is compressed by the movement of the ejector rod 9 towards the die and after the completion of the ejecting stroke the spring effects a return movement of the rod 9. The knockout pins 10 and 8 remain in their advanced position and are moved back by the movement of the next blank into the bore of the die 2. During the return movement of the pins 8 and 10 the head 17 of the intermediate pin 10 engages the shoulder 18 of the sleeve 7 and the said sleeve is returned with the pins to the position of maximum retraction as shown in Figure 1.

The parts may be adjusted to receive shorter blanks by adjusting toward the die the member which receives the reaction of the heading pressure. In the illustrated embodiment, this is the sleeve 11 which may be adjustably mounted as disclosed in my prior application, Serial No. 717,608, filed March 27, 1934. The parts are preferably proportioned so that when the knockout pin 10 is at the limit of its retraction and the parts are adjusted to receive the longest blank for which they are designed, the support for the knockout pin provided by the plug 20 is disposed about midway between the support of the pin at the points 10*a* and 10*c*.

Although I have described one modification of my invention in detail I have done so merely for the purpose of illustration and not with the desire to be limited thereto since it is obvious that many variations in the modification described could be made by those skilled in the art without departing from the scope of my invention.

I claim:

1. In a bolt machine, a die having a die opening therein, a knockout pin mounted in axial alignment with said opening and means for reenforcing said pin against bending stresses comprising a sleeve having a portion adjacent one end supporting the pin intermediate its ends, means on that end of the pin remote from the die engaging said sleeve portion to move the sleeve toward the die and means adjacent the other end of said sleeve engaged by said last mentioned pin means to move said sleeve away from the die.

2. In a bolt machine, a die having a die opening therein, a knockout pin mounted in axial alignment with said opening and means for reenforcing said pin against bending stresses comprising a sleeve mounted for movement in a bore in axial alignment with said die opening, said pin mounted for movement in said sleeve and supported at spaced points by said sleeve in the retracted position of said pin, means associated with the sleeve engaging a member carried by said pin and moved thereby during a part of the advance of said pin and a second means associated with the other end of said sleeve engaged by said member and moved thereby during a part of the retraction of said pin.

3. In a knockout assembly, a die opening, a bore in axial alignment with said opening, a sleeve slidably mounted in said bore, a knockout pin in said sleeve, and a knockout pin actuator mounted in said sleeve arranged to advance said pin into said die opening.

4. In a bolt machine, a bed frame, a die therein having an opening, a bore in said frame, an ejector rod mounted at one end of said bore for movement therein, resilient means urging said ejector rod to a retracted position, a sleeve slidably mounted in said bore and spaced from the

end of said rod, a knockout pin projecting from one end of said sleeve and entering said die, an intermediate knockout pin projecting from the other end of said sleeve and engaging said rod, interengaging means associated with said pins and sleeve to advance same toward the die by said rod and return same to a retracted position by movement of a blank into said die.

5. In a bolt machine, a bed frame, a die therein having an opening, a bore in said frame, an ejector rod mounted at one end of said bore for movement therein, a sleeve slidably mounted in said bore and spaced from the end of said rod, a knockout pin projecting from one end of said sleeve and entering said die, an intermediate knockout pin projecting from the other end of said sleeve and engaging said rod, interengaging means associated with said pins and sleeve to advance same toward the die by said rod and return same to a retracted position by movement of a blank into said die.

6. In a bolt machine, a die having a die opening therein, a knockout pin mounted in axial alignment with said opening and means for re-enforcing said pin against bending stresses comprising a sleeve provided with apertured end closures, said apertures being unequal in diameter, said knockout pin projecting through the smaller of said apertures and extending into said die opening, an intermediate knockout pin projecting through the other of said apertures and extending in the opposite direction, head portions on said pins having diameters exceeding the diameters of said apertures whereby said sleeve is positioned by said pins.

7. In a bolt machine, a die having a die opening therein, a knockout pin mounted in axial alignment with said opening and means for re-enforcing said pin against bending stresses comprising a sleeve provided with apertured end closures, said apertures being unequal in diameter, said knockout pin projecting through the smaller of said apertures and extending into said die opening, an intermediate knockout pin projecting through the other of said apertures and extending in the opposite direction, said two knockout pins being movable longitudinally of said sleeve, interengaging means on said pins and sleeve to reposition said sleeve with respect to said pins and said die.

8. In a bolt machine, a die having a die opening therein, a knockout pin mounted in axial alignment with said opening and means for re-enforcing said pin against bending stresses comprising a sleeve provided with apertured end closures, said apertures being unequal in diameter, said knockout pin projecting through the smaller of said apertures and extending into said die opening, an intermediate knockout pin projecting through the other of said apertures and extending in the opposite direction, said two knockout pins being movable longitudinally of said sleeve, and provided with abutting head portions within said sleeve.

9. In a bolt machine, a die having a die opening therein, a knockout pin mounted in axial alignment with said opening and means for re-enforcing said pin against bending stresses comprising a sleeve provided with apertured end closures, said apertures being unequal in diameter, said knockout pin projecting through the smaller of said apertures and extending into said die opening, an intermediate knockout pin projecting through the other of said apertures and extending in the opposite direction, said two knockout pins being movable longitudinally of said sleeve, and provided with abutting head portions within said sleeve, said head portions alternately engaging said sleeve closures to move said sleeve with said pins.

10. In a bolt machine, a die having a die opening therein, a knockout pin mounted in axial alignment with said opening and means for re-enforcing said pin against bending stresses comprising a member engaging and supporting said pin at the end remote from the die and at a point intermediate the ends of said pin, said member being movable with said pin to continue the end support and movable with respect to the pin to move the intermediate support towards the end support as the pin advances into the die, said member being moved by said pin in retraction from the die to restore said intermediate support to position intermediate the ends of the pin.

11. In combination, a support, a die therein having an opening, a knockout pin arranged in a bore in said support in axial alignment with said die, said pin supported at one end in said die opening and means within said bore to support said pin at the other end and at the center, said means moved by said pin substantially half the length of the pin toward and away from the die.

12. In a bolt machine, a die having a die opening therein, a knockout pin mounted in axial alignment with said opening, a knockout rod axially aligned with said pin having a diameter greater than the diameter of the knockout pin, said pin advanced to blank ejecting position by said rod, spring means to move the rod away from the pin while the pin is in said ejecting position and means acting subsequently to said spring means to move the pin to its retracted position.

13. In a bolt machine, a die having a die opening therein, a knockout pin mounted in axial alignment with said opening and means for re-enforcing said pin against bending stresses mounted for sliding movement with respect to said die and with respect to said pin, said means being supported throughout said sliding movement, interengaging abutting surfaces on said pin and said means to effect a movement of said means toward and away from said die in response to movement of said knockout pin.

14. In a bolt machine, a bed frame, a die having a die opening therein, a bore in said bed frame in axial alignment with said die opening, a blank ejector assembly mounted in said bore, said assembly comprising means continuously supported in said bore for slidable movement therein, a knockout pin slidably supported by said means intermediate the ends of said knockout pin, and interengaging abutting surfaces on said knockout pin and means to effect a movement of said means toward and away from said die.

15. In a knockout assembly, a knockout pin, means to re-enforce said knockout pin against bending and slidably supporting said knockout pin at spaced points, interengaging abutting surfaces on said knockout pin and said means to move said member in one direction after a predetermined movement of said knockout pin, and a second group of interengaging abutting surfaces on said pin and means to move said means in an opposite direction.

16. In a bolt machine, a die having a cylindrical bore therein, a knockout assembly for ejecting blanks from said die comprising a knockout pin having one end supported in the die opening and the other end supported in a bore coaxial

therewith, a reciprocating ejector rod operatively connected to the end of said pin remote from said die to advance said pin into said die opening, spring means to retract said ejector rod subsequent to its advancing movement, said ejector rod moving with respect to said knockout pin upon retraction, and retraction of said knockout pin being subsequent to ejector rod retraction, and the retracting movement of said pin corresponding to the movement of a bolt blank into said die.

17. In a bolt machine having a die with a cylindrical bore and an ejector rod assembly to eject blanks therefrom, means to prevent the formation of a vacuum within the die opening comprising an ejector rod and a knockout pin operatively connected to each other for joint movement to advance the knockout pin into the die during bolt blank ejecting action, means to rapidly retract the ejector rod subsequent to ejecting movement and means to slowly retract the knockout pin subsequent to ejecting movement, the retracting movement of said pin corresponding to the movement of a bolt blank into said die.

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