March 7, 1933. H. C. ELLISON 1,900,049

U-BOLT AND METHOD OF MAKING THE SAME

Filed March 19, 1930 4 Sheets-Sheet 1

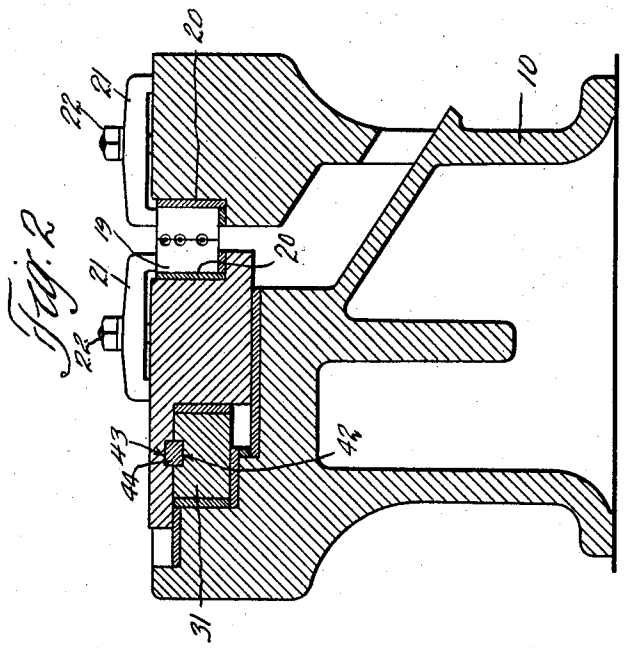


Fig. 2

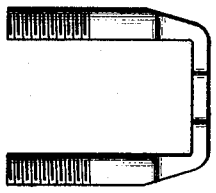


Fig. 3

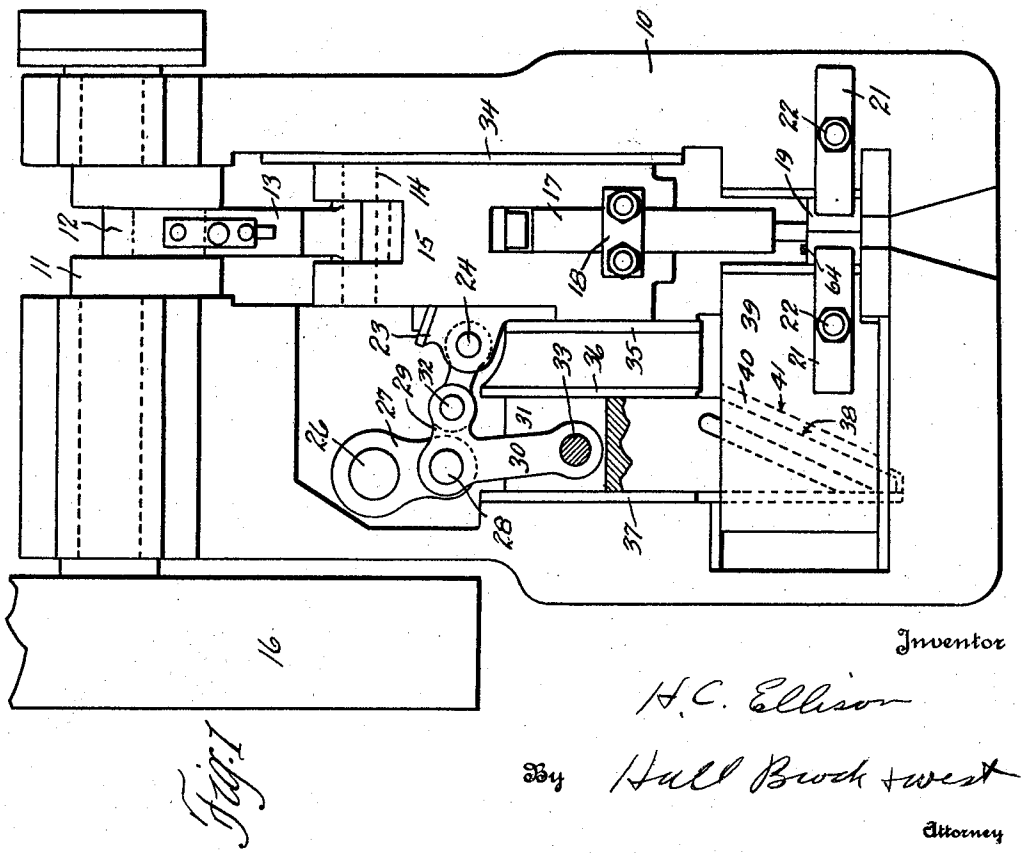


Fig. 1

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U-BOLT AND METHOD OF MAKING THE SAME

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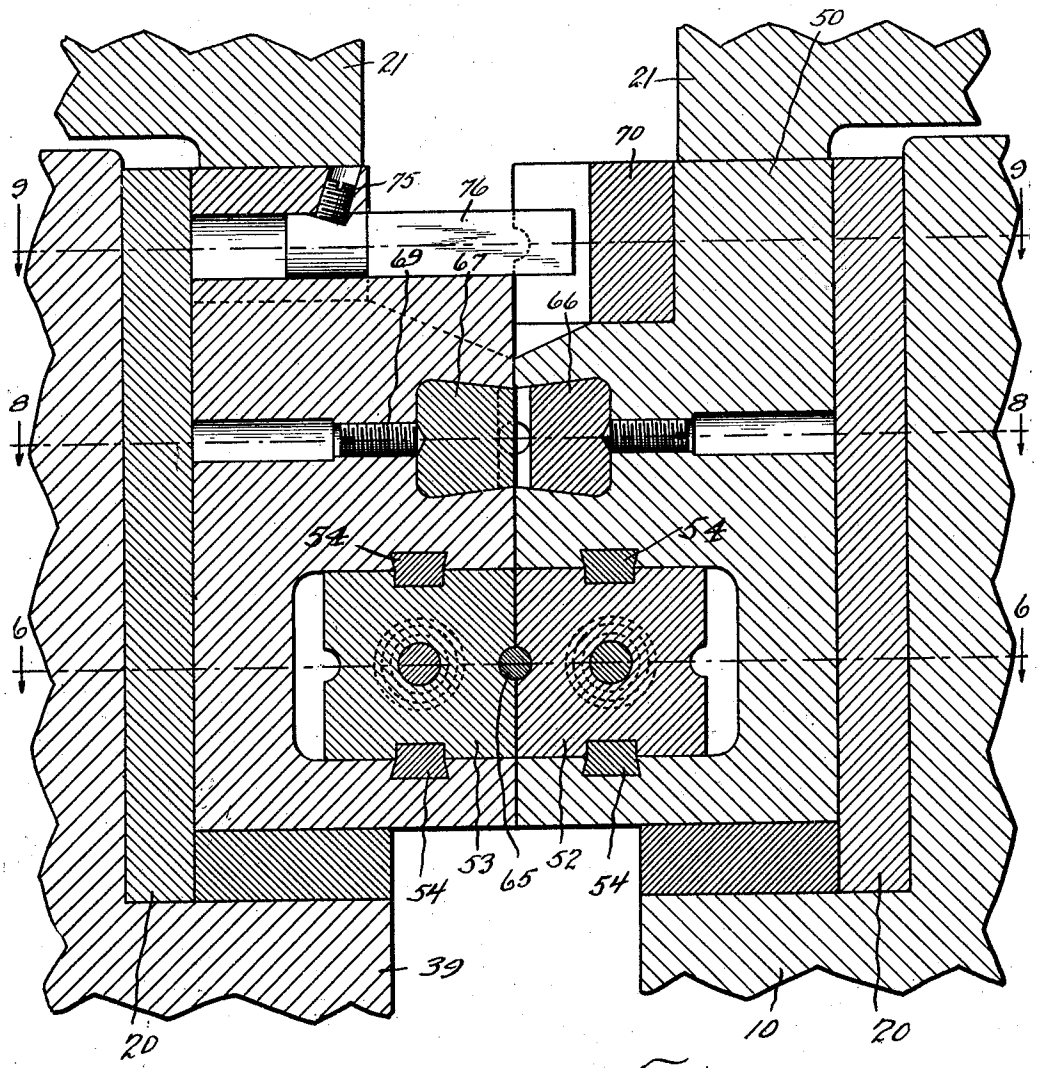


Fig. 5

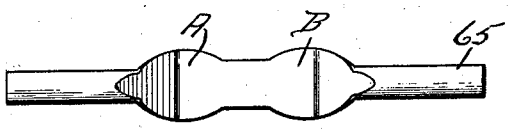


Fig. 4

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U-BOLT AND METHOD OF MAKING THE SAME

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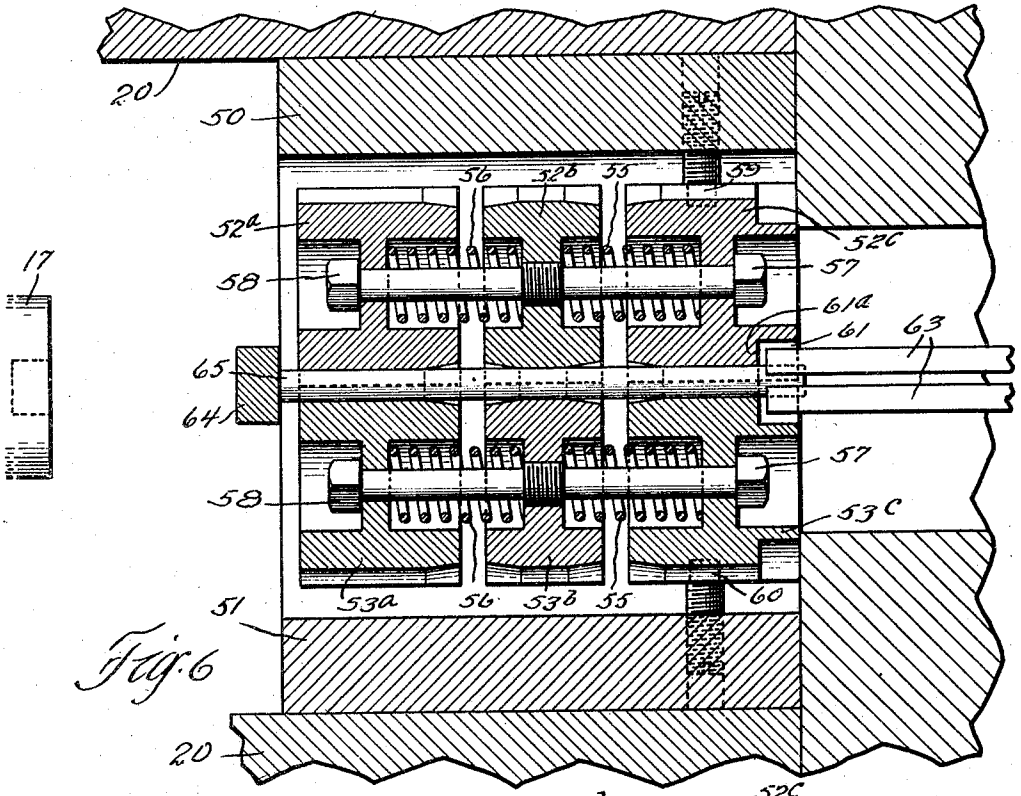


Fig. 6

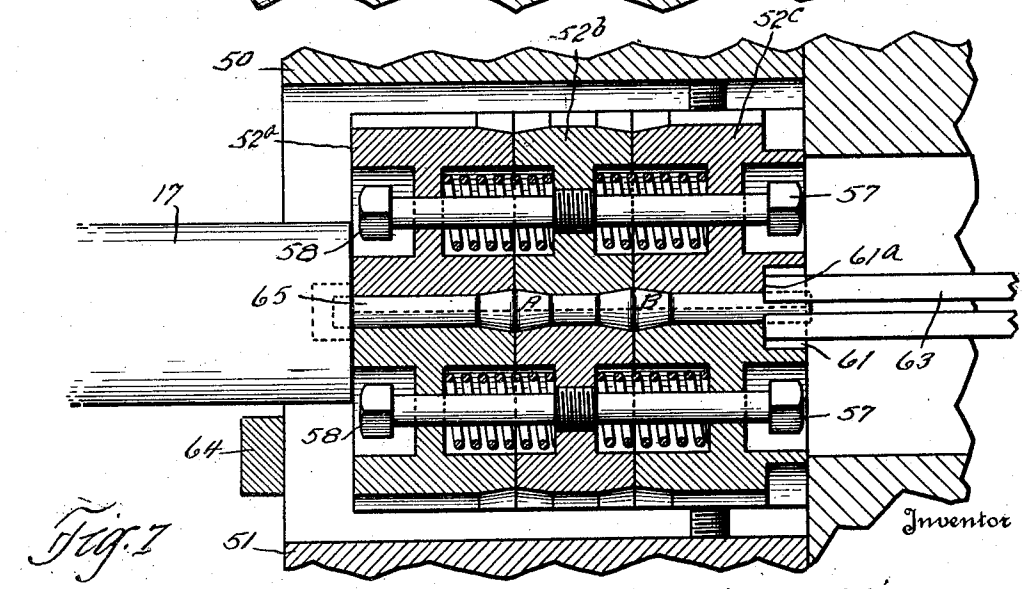


Fig. 7

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U-BOLT AND METHOD OF MAKING THE SAME

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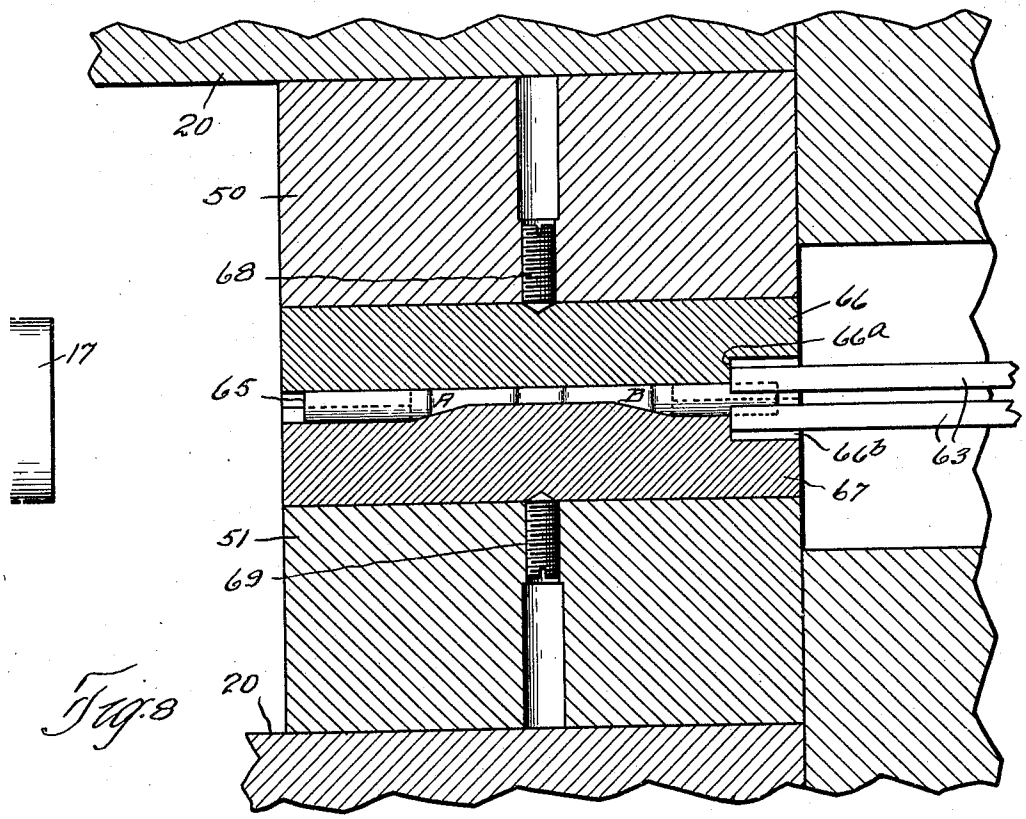


Fig. 8

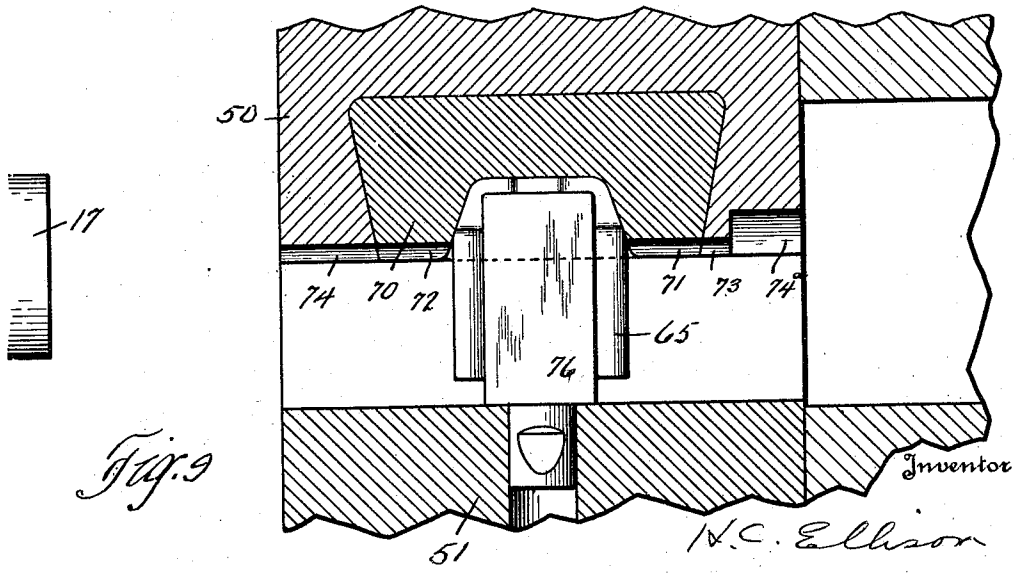


Fig. 9

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Patented Mar. 7, 1933 1,900,049

UNITED STATES PATENT OFFICE

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U-BOLT AND METHOD OF MAKING THE SAME

Application filed March 19, 1930. Serial No. 437,007.

This invention relates to U-bolts such as are used in large quantities for fastening the springs of automobiles to the axles, and to a process of making them.

Heretofore two distinct types of U-bolt have been in general use, namely, a drop forged U-bolt and a U-bolt made from plain round steel. The first type—a drop forged bolt—was better in some respects but was far more expensive to manufacture. In the second type a line contact only was obtained between the U-bolt and the spring. In order to obtain a better contact between the U-bolt and the spring, the stock was first flattened intermediate its ends and then bent into a U, thus forming a bolt having a flat bight portion and cylindrical legs. In both these forms the corners were the weakest part of the bolt, due to the sharp angular bends between the bight portion and the legs. Thus, in order to have sufficient metal at the corners to give the requisite strength, it was necessary to have far more metal—and strength—in the bight portion and legs than was needed.

The principal object of this invention is to produce a U-bolt from plain round stock having a greater cross sectional area at the corners than elsewhere, thereby to give it the requisite strength at the corners without its having unneeded strength—and metal—in the bight portion and legs.

Another object of the invention is to improve manufacturing efficiency in the production of U-bolts of the particularly superior design disclosed herein.

A further object of the invention is to provide a process which will enable the performance of a plurality of operations on the stock from which the U-bolt is to be made with only one heating of such stock.

In the drawings Fig. 1 is a schematic plan view of an improved bolt making machine for carrying out my improved process; Fig. 2 is a schematic vertical section therethrough; Fig. 3 is an elevation of my improved U-bolt; Fig. 4 is a plan view of the U-bolt of Fig. 3 before the same has been bent to U shape and threaded; Fig. 5 is a vertical section in detail through the dies employed in carrying out the steps of the process; Fig. 6 is a horizontal section taken on line 6—6 of Fig. 5; Fig. 7 is a horizontal section corresponding to that of Fig. 6 but showing the dies in closed position; Fig. 8 is a horizontal section on line 8—8 of Fig. 5 and Fig. 9 is a horizontal section on line 9—9 of Fig. 5.

In the drawings the numeral 10 indicates a base upon which are carried the dies and actuating mechanism of a machine employed in carrying out my improved process. Mounted on said base in suitable bearings is a crank shaft 11 having a crank portion 12. Suitably journaled on the crank portion 12 is a connecting rod 13 which is pivotally connected as at 14 to a cross head 15. A suitable pulley 16 is provided for the purpose of driving the cross head 15. A suitable plunger 17 is removably secured to the cross head 15 by means of any suitable clamping device 18 and adapted to cooperate with a set of sliding dies, indicated generally by the numeral 19, in a manner hereinafter to be described. The dies 19 are received in rabbeted portions of the base of the frame, suitably protected against wear by wear plates 20 and held clamped in such rabbeted portions by clamps 21, secured by suitable bolts 22. Attached in any suitable manner to the cross head 15 is a member 23 to which is pivotally mounted at 24 a link 25. Pivotally mounted on the frame at 26 is a link 27 to which is pivotally connected at 28 a bell crank having arms 29 and 30 extending from the pivot point 28 and connected to the link 25 and a slide 31 at 32 and 33 respectively. The cross head 15 works between suitable guide plates 34 and 35, while the slide 31 works between similar guide plates 36 and 37. The slide 31 has an angular face 38 which cooperates with a die clamping slide 39 which may also be termed a movable die since one-half of the dies 19 is fixedly carried thereby. A suitable wear plate 40 is positioned between the wedging face 38 of the slide 31 and the wedging face 41 of the movable die 39. The slide 31 is provided with a suitable slot 42 which cooperates with a similar slot 43 in the movable die 39 to receive a key 44 which serves to retract the movable die 39 when the slide 31 is retracted.

Suitable guides and wear plates are provided to receive the movable die 39.

From the foregoing, it will be observed that upon the beginning of the operative cycle due to the rotation of the pulley 16, the movable die 39 will be forced rapidly into clamping engagement with the fixed die and due to the toggle action of the cooperating toggles formed by the bell crank lever and links 25 and 27 which cooperate therewith, a dwell will be produced holding the dies in clamped position before, during, and after the operative stroke of the plunger 17.

The set of dies hereinbefore referred to generally by the numeral 19 are shown in detail in Figs. 5 to 9 inclusive. In these dies, I provide a pair of main blocks 50 and 51 surrounded by suitable wear plates and held in rabbeted portions in the main frame 10 and movable die 39 respectively, being clamped as already mentioned by the clamps 21 to prevent upward movement out of the frame. In the lower portion of the blocks 50 and 51 are a pair of sliding die blocks 52 and 53 constrained against any motion except longitudinal by the blocks 50 and 51 and the keys 54 which connect them with the blocks 50 and 51 as best seen in Fig. 5. These blocks 52 and 53 are not continuous but made up in sections 52^a, 52^b, 52^c and 53^a, 53^b and 53^c. Of these sections 52^c and 53^c are held in fixed relation to the blocks 50 and 51 respectively, while the other sections are movable longitudinally of said blocks. The slidable sections are tensionally constrained to operate by reason of coil springs 55 and 56 between the sections 52^b and 52^c and the sections 52^a and 52^b, respectively. The construction of the complementary half of these dies involving sections 53^a, 53^b and 53^c are identical and need not be described. Each of the sections 52^a, 52^b and 52^c and 53^a, 53^b and 53^c are drilled and countersunk whereby bolts 57 and 58 may extend through sections 52^a, 52^c and 53^a, 53^c respectively, and be threaded in sections 52^b and 53^b passing through the central opening of the springs 55 and 56 respectively. The sections 52^c and 53^c are held in fixed position with respect to the blocks 50 and 51 by means of set screws 59 and 60 respectively. Each of the sections 52^c and 53^c has a semi-circular counterbored portion 61, 62 provided for the purpose of receiving the nose of a pair of tongs 63 as hereinafter set forth. A stock gauge 64 cooperates with the dies to position the bolt forming stock 65 with respect to the dies. This stock gauge is carried by the frame 10 and moves into gauging position and remains there until the punch 17 approaches the movable dies and it moves out of the path of the punch. The mechanism for accomplishing this motion of the stock gauge is conventional and it is believed unnecessary to go into the same any more fully.

Also carried by the blocks 50 and 51 above the sliding dies just described is a pair of longitudinally fixed dies 66 and 67. These dies are held firmly in position by means of set screws 68 and 69. The shape of these dies as shown best in Fig. 8 is such as to flatten the stock to the shape shown in Fig. 4.

Above the dies 66 and 67 is a set of bending dies consisting of a block 70 carried in the block 50 and having grooves 71 and 72 in its edges which form extensions of grooves 73 and 74 in the block 50, the groove 73 communicating with enlarged drilled portions 74^a, 74 which is adapted to receive the tongs 63. Carried by the block 51 and held in position therein by means of set screw 75, is a die member 76 which is adapted to cooperate with the die member 70 to perform the bending operation.

Suitable controls such as electric or compressed air or any other suitable type will be provided whereby the operator may conveniently cause the crank shaft 11 to be set in motion or stopped at will.

An especially important feature of this machine is the positioning of the three types of dies just described, one above the other.

Operation

When the pulley 16 is rotated, a reciprocating motion is imparted to the cross head 15 from which motion is transmitted to the dies 19 in two ways. The slide 31, driven by the toggle mechanism from the member 23 causes reciprocating motion of the slide or movable die 39 in a direction at right angles thereto. Due to the toggle effect, a dwell is produced in the motion of the movable die 39 when the same is moved into gripping relation with the fixed die carried by the base 10 whereby the movable and fixed dies will grip the stock therebetween before, during and after the plunger 17 has operated to squeeze the sliding die sections 52^a, 52^b and 53^a, 53^b into close contact with each other and the sections 52^c and 53^c. This motion occurs once for each revolution of the crank shaft, and the stock gauge 64 is moved into alignment with the stock receiving portions of the dies before the plunger 17 is moved into operative relation thereto and said stock gauge is moved out of the path of the plunger 17 before the same can move into contact therewith. The above cycle is repeated each time the pulley 16 rotates irrespective of whether any stock is present between the dies to be operated upon or in which of the three superposed dies the stock happens to be received.

Process

My improved process, in connection with which the above described machine is employed, is designed for the production of U-bolts illustrated in Figs. 3 and 4. As will be seen, these U-bolts consist of two threaded

bolts connected by a bight portion and having an extra amount of metal at the bends or corners for the purpose of strengthening the bolt. In carrying out my process, a predetermined length of stock is heated to the desired working temperature by the use of a heating means placed comparatively close to the machine. The heated stock at proper temperature is withdrawn from the heating means by the use of a pair of tongs 63, shown schematically in the drawings. The stock is inserted in the lowermost or sliding dies, best illustrated in Figs. 6 and 7, and pushed back until it contacts the stock gauge 64. After the stock has been caused to contact the stock gauge, the tongs are pushed against the same and allowed to slide thereon until the nose of the tongs contacts the shoulders 61^a of the counterbored portion 61 of the die sections 52^c and 53^c. The crank shaft is then set into motion, whereupon the movable die 39 moves into gripping relation with the fixed die and the blocks 52 and 53 grip the stock. After the stock is gripped, the stock gauge 64 moves to one side and the plunger 17 comes into contacting engagement with the sections 52^a and 53^a, whereupon the sliding die sections are constrained to move from the position shown in Fig. 6 to that shown in Fig. 7, producing bulges A and B in the stock, which bulges are to supply the extra metal for the corners or bends of the U-bolt. This having been accomplished, the tongs are caused to retain their grip on the stock after the dies have opened and the stock is then moved upwardly (see Fig. 5) into registration with the dies 66 and 67 where it is held during the next cycle of the machine. At this stage the position of the stock is gauged by pushing the nose of the tongs against the inner surface 66^a of the counterbored portion 66^b of the dies 66, 67. During this operation the stock is formed as shown in Figs. 4 and 8, ready for the bending operation. It will be observed that the central portion of the bolt is flattened and that extra metal is introduced at the corners due to the bulges A and B formed in the first operation of the machine. When the machine has completed the second cycle, the stock will be moved upwardly into engagement with the bending die 70, 76 and its position gauged by means of the tongs as before. As shown in Fig. 9, the stock is bent to final form and the only further operation required is the necessary cooling or tempering operation and threading of the two arms of the U-bolt.

It will be evident from the foregoing that with a small amount of practice an operator will be able to put a bolt through all the steps of the process from that of a straight piece of stock to the final form shown in Fig. 9 with one heating and that very rapid production will be made possible.

While I have illustrated the preferred manner of carrying my invention into effect, it is obvious that certain changes may be made therein without departing from the invention, and I wish it understood that I am limited only in accordance with the appended claims.

Having thus described my invention, what I claim is:

1. The method of producing U-bolts comprising upsetting a bar of stock of predetermined length at two spaced points intermediate the ends thereof, thereby increasing the cross sectional area at said points, forming the bar to provide two cylindrical end portions, a flat intermediate portion and connecting portions between the cylindrical end portions and the flat intermediate portion at said points of greater cross sectional area, bending the bar at the points of greater cross sectional area to form a U so that the corners between the bight portion and the legs will be of greater cross sectional area than the bight portion or legs.

2. The method of producing U-bolts comprising upsetting a bar of stock of predetermined length at two spaced points intermediate the ends thereof, thereby increasing the cross sectional area at said points, flattening the upset portions of greater cross sectional area and the portion therebetween with no appreciable elongation, bending the bar at the points of greater cross sectional area to form a U so that the corners between the bight portion and the legs will be of greater cross sectional area than the bight portion or legs.

3. The method of producing U-bolts comprising upsetting a bar of stock of predetermined length at two spaced points intermediate the ends thereof, thereby increasing the cross sectional area at said points, flattening the upset portion of greater cross sectional area and the portion therebetween by squeezing said portions between a flat die and a frusto-pyramidal die thereby spreading the said portions laterally without elongation, bending the bar at the points of greater cross sectional area to form a U so that the corners between the bight portion and the legs will be of greater cross sectional area than the bight portion or legs.

4. The method of producing U-bolts comprising upsetting a bar of stock of predetermined length at two spaced points intermediate the ends thereof, thereby increasing the cross sectional area at said points, straightening one side of the bar and at the same time producing in the opposite side of the bar, by spreading the bar laterally without elongation, an indentation having a flat bottom parallel to the straightened side and flat sides extending upwardly and outwardly therefrom, bending the bar at the points of greater cross sectional area to form a U so that the corners between the bight portion

and the legs will be of greater cross sectional area than the bight portion or legs.

5. The method of producing U-bolts comprising upsetting a bar of stock of predetermined length at two spaced points intermediate the ends thereof, thereby increasing the cross sectional area at said points, then flattening the upset portions of greater cross sectional area and the portion therebetween, then bending the bar at the points of greater cross sectional area to provide a pair of legs and a bight portion, the upsetting, flattening and bending operations being such that the cross sectional area of the bolt at the corners thereof will be greater than the cross sectional area of the bolt elsewhere.

6. The method of producing U-bolts comprising upsetting a bar of stock of predetermined length at two spaced points intermediate the ends thereof, thereby increasing the cross sectional area at said points, forming the bar to provide two cylindrical end portions, a flat intermediate portion and connecting portions between the cylindrical end portions and the flat intermediate portion at said points of greater cross sectional area, bending the bar at the points of greater cross sectional area to form a U so that the corners between the bight portion and the legs will be of greater cross sectional area than the bight portion or legs, the upsetting, flattening and bending operations being carried out with but one heating of the stock and in such rapid sequence that the last step is performed while the stock is still at a satisfactory working temperature.

7. A U-bolt of the character described comprising a bight portion, a pair of legs extending at an angle thereto, one at each end thereof, and corners between the bight portion and legs of greater cross sectional area than the bight portion or legs, the said corners being formed by upsetting two spaced points in a bar of stock to increase the cross sectional area at these points and then bending the bar at these points of greater cross sectional area to form a U.

8. A U-bolt of the character described comprising a bight portion rectangular in cross section, a pair of cylindrical legs extending at an angle thereto, one at each end thereof, and corners between the bight portion and legs rectangular in cross section and of greater cross sectional area than the bight portion or legs, the said corners being formed by upsetting two spaced points in a bar of stock to increase the cross sectional area at these points and then bending the bar at these points of greater cross sectional area to form a U.

9. A U-bolt of the character described comprising a bight portion rectangular in cross section, a pair of legs extending at an angle thereto, one at each end thereof, and corners between the bight portion and legs rectangular in cross section, the short sides thereof being the same dimension as the short sides of the bight portion, and the long sides thereof being of greater dimension than the long sides of the bight portion, the said corners being formed by upsetting two spaced points in a bar of stock to increase the cross sectional area at these points and then bending the bar at these points of greater cross sectional area to form a U.

In testimony whereof, I hereunto affix my signature.

HARRY C. ELLISON.