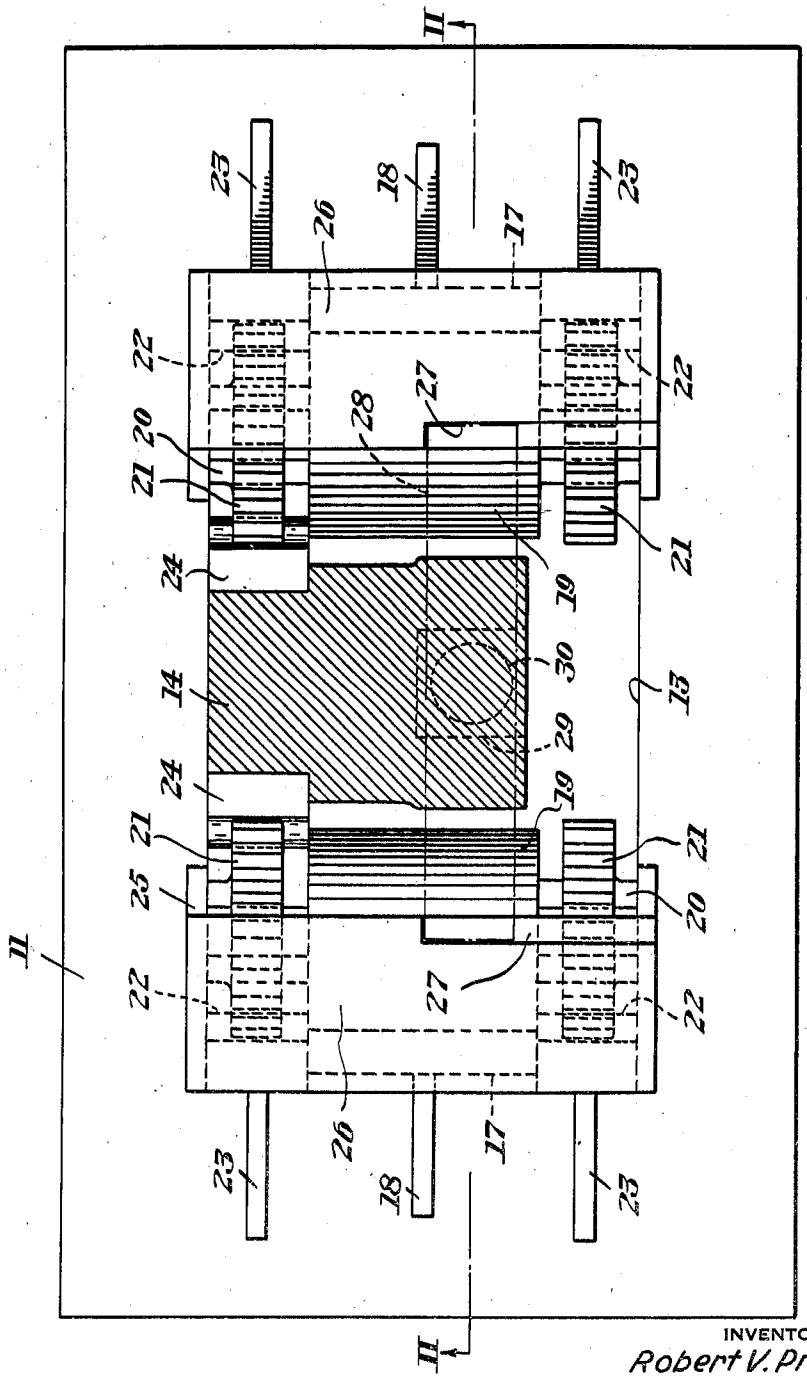
Feb. 29, 1944. R. V. PROCTOR 2,343,083

APPARATUS FOR SHAPING METAL

Original Filed Jan. 11, 1941 2 Sheets-Sheet 1

Fig. 1.



INVENTOR

Robert V. Proctor

by his attorneys

Stebbins and Blenko

Feb. 29, 1944. R. V. PROCTOR 2,343,083

APPARATUS FOR SHAPING METAL

Original Filed Jan. 11, 1941 2 Sheets-Sheet 2

Fig. 2.

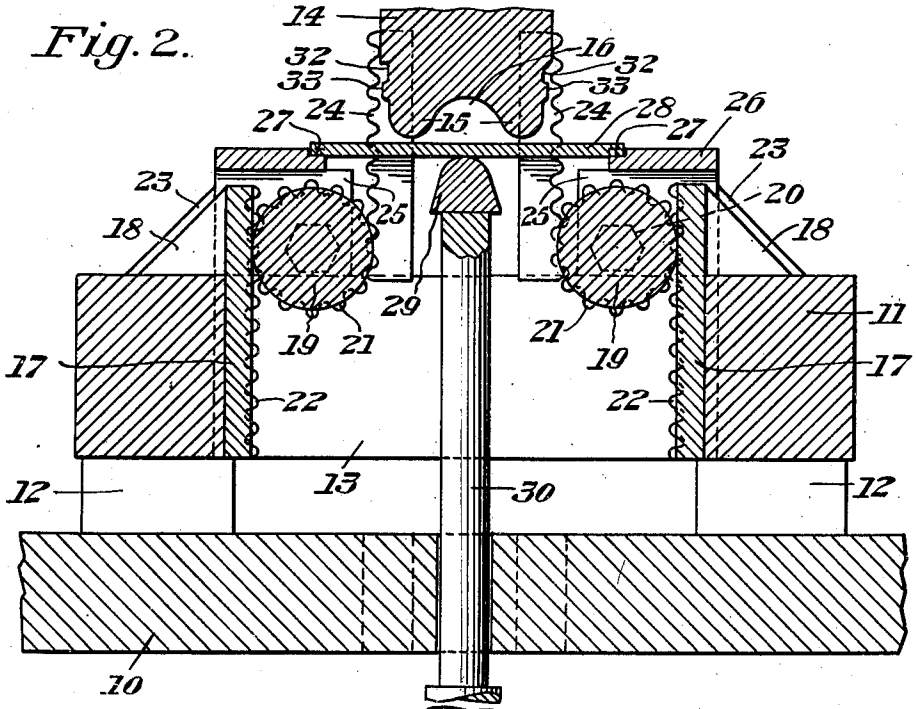
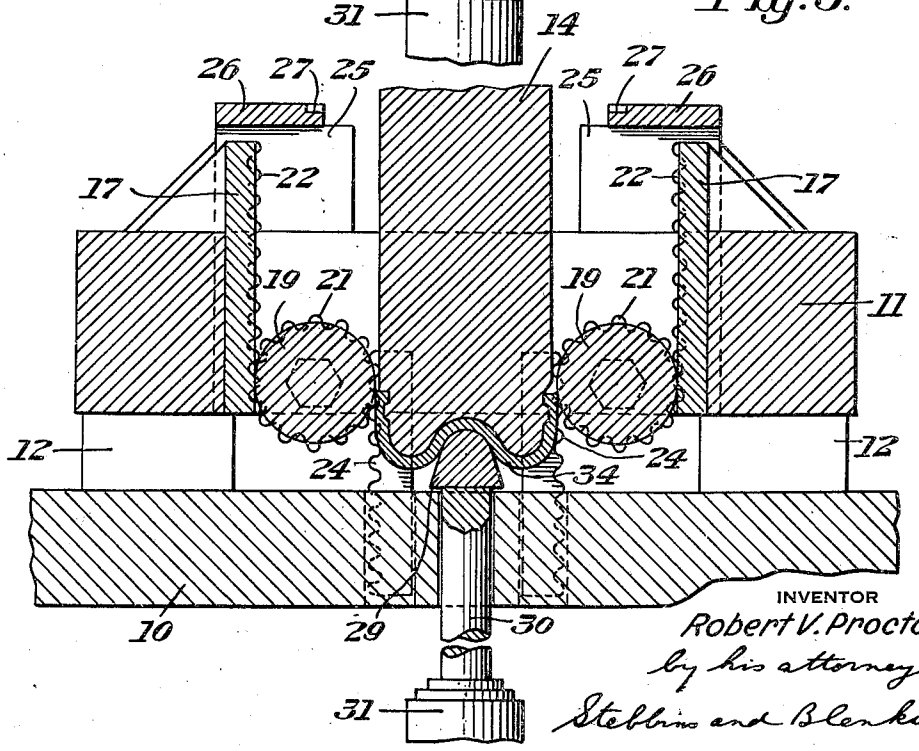


Fig. 3.



INVENTOR
Robert V. Proctor
by his attorneys
Stebbins and Blenko

Patented Feb. 29, 1944 2,343,083

UNITED STATES PATENT OFFICE

2,343,083

APPARATUS FOR SHAPING METAL

Robert V. Proctor, Youngstown, Ohio, assignor to The Commercial Shearing and Stamping Company, Youngstown, Ohio, a corporation of Ohio

Original application January 11, 1941, Serial No. 374,057. Divided and this application February 12, 1942, Serial No. 430,639

3 Claims. (Cl. 29—34)

This invention relates to the forging of metal bars and, in particular, to an apparatus for converting lengths of flat bar stock into completely finished articles, such as U-shaped rail anchors, in a single operation.

This is a division from my application Serial No. 374,057, filed January 11, 1941, for Method and apparatus for shaping metal.

The manufacture of certain articles used in large numbers, such as U-shaped rail anchors, cannot be satisfactorily carried out by conventional devices such as cold-bending apparatus, ordinary machine tools, etc., because of the character of the material, i. e., alloy spring steel having a substantial manganese content and a high hardness. Hot forging of such articles by ordinary shaping dies is open to serious objections. Difficulty is encountered in finishing the articles accurately to dimensions and the presence of scale is also troublesome. Forging a heated bar between dies, to shape a rail anchor, furthermore, scratches the surface of the articles and causes excessive wear of the dies.

I have invented a novel apparatus for producing generally U-shaped articles from flat stock of such composition that it has to be shaped while heated to a temperature suitable for forging, whereby the aforementioned difficulties are overcome and the finished article may be turned out to accurate dimensions and without any marring of the surface, in a single operation. In a preferred embodiment of the invention, I employ a pair of spaced rolls and a punch reciprocable therebetween. An anvil cooperating with the punch effects a preliminary shaping of the stock after which descent of the punch, in cooperation with the rolls, effects the bending of the ends and finally the die-shaping of the latter. In one form of the invention the rolls travel downwardly in timed relation with the movement of the punch and are supported by hardened steel backing plates mounted in a die-block. Further details of the construction and operation of the apparatus and the advantages thereof will become apparent during the following complete description and explanation, and the novel features will be specifically pointed out in the appended claims. In the drawings,

Figure 1 is a plan view of the die-block and rolls with the punch shown in section on a horizontal plane;

Figure 2 is a partial sectional view taken substantially along the plane of line II—II of Figure 1, showing the punch, anvil and rolls in their starting or upper positions; and

Figure 3 is a view similar to Figure 2 showing the positions of the parts at the completion of a working stroke.

Referring in detail to the drawings, the bolster-plate of a forging press is indicated at 10. A die-block 11 is supported on the bolster-plate by blocks 12. The block 11 has an opening 13 therethrough adapted to receive a punch 14. The punch 14 has spaced rounded projections 15 at the lower end thereof between which is a re-entrant portion or recess 16.

Backing plates 17 preferably of tool steel are disposed in opposite ends of the opening 13 and are braced by gusset plates 18. Rolls 19 are adapted to bear against the plates 17 as they move vertically within the opening 13 with the punch 14. The necks of the rolls indicated at 20 are non-circular, e. g., hexagonal, and are provided with pinions 21. Racks 22 are positioned in the opening 13 adjacent the necks of the rolls 19 and mesh with the pinions 21. The racks are braced by gusset plates 23.

The punch 14 is provided with racks 24 meshing with the pinions 21 at the rear or upper ends of the rolls 19, as shown in Figure 1.

Side plates 25 extend upwardly from both sides of the opening 13 adjacent each end thereof and support bridge plates 26 extending across the opening adjacent each end. The plates 25 have their adjacent edges recessed as at 27 and are thereby adapted to support a piece of flat bar stock 28 in position for engagement by the punch 14.

An anvil 29 is mounted for reciprocation coaxially of the punch 14. The anvil may conveniently be carried on the piston 30 of a hydraulic hoist 31. In any event, the function of the anvil is to oppose the initial downward movement of the punch with sufficient force to deform the mid-portion of the work-piece 28 upwardly into the reverse-curved recess 16 of the punch. As shown in the drawings, the piston of the hoist extends through a suitable hole in the bolster-plate 10.

To explain the operation of the apparatus of my invention, it will be assumed that the parts are in the positions illustrated in Figure 2 and that the work-piece 28 has been heated in a suitable furnace to the proper temperature for hot shaping as by forging and rolling. The forging press with which the mechanism shown is associated is then operated to drive the punch 14 downwardly. As previously indicated, the initial result is to shape the mid-portion of the piece 28 between the anvil 29 and the recess 16 of the punch thereby forming a hump intermediate the ends of the anchor. The punch thus acts as a moving die.

The downward movement of the punch 14 is accompanied by similar movement of the rolls 19. The latter roll on the backing plates 17 without slippage because, as shown in Figures 2 and 3, the pitch circles of the pinions 21 have the same diameter as the bodies of the rolls 19. Since the pinions roll on the racks 22 by reason of the

downward thrust of the racks 24, the axes of the rolls 19 descend at a rate one-half the speed of the punch 14.

After slight downward movement of the punch 14, the ends of the piece 28 slip off the recessed edges of the bridging plates 26 and, as the punch forces the piece 28 downwardly against the upward pressure exerted by the anvil 29, the ends of the work-piece engage the bodies of the rolls 19. On continued movement of the punch, the ends of the work-piece are bent upwardly around the rounded projections 15, through an angle of about 90° into substantial parallelism.

In addition to the recess 16 in its bottom, the punch has die recesses 32 and projections 33 which become effective to shape the ends of the work-piece as the descent of the punch continues. It will be apparent that, since the rolls travel downwardly at a speed one-half that of the punch, there is rolling engagement without slippage between the bodies of the rolls and the ends of the work-piece. As the die recesses and projections 32 and 33 come opposite the bodies of the rolls 19, a progressive shaping of the ends of the work-piece is effected by the cooperation of the rolls and die portions of the punch. This shaping is accompanied by slight extrusion of the ends, so that the operation may correctly be termed a true die rolling.

Figure 3 illustrates the condition of the work-piece as the parts approach their final positions. The anvil 29 cooperating with the recess 16 in the punch has displaced the mid-portion of the work-piece upwardly to form a hump or bearing portion of a rail anchor adapted to engage the bottom of the rail flange centrally. The ends of the work-piece have been bent into such position that, when sprung over the edges of the rail flange, they will have a firm frictional engagement therewith. The die projections 33 on the punch, furthermore, have formed flange-receiving slots on the inner faces of the finished article, such as the rail anchor indicated at 34.

The anvil 29 is larger at its bottom than the piston 30 and the hole in the bolster plate through which the latter slides. The engagement of the anvil with the bolster plate therefore arrests downward movement of the anvil and punch. A heavy sizing blow is thus applied to the article by the momentum of the punch as the anvil strikes the bolster plate. After the punch has exerted this sizing blow, the press is operated to raise the punch and with it the rolls 19. The anvil 29 preferably remains in its lowermost position until the finished anchor has been removed by a suitable ejector traveling horizontally and parallel to the axes of the rolls 19. After the finished anchor has been thus ejected, the anvil 29 is raised to the position shown in Figure 2, another heated piece of stock, such as that shown at 28, is placed in position and the operation repeated.

It will be apparent from the foregoing description and explanation that the invention is characterized by numerous advantages and novel features especially adapted for the manufacture of rail anchors, although it may be used as well for the forging of other articles involving the shaping and bending of bar stock. The possibility of finishing articles such as rail anchors accurately to dimensions by the process and apparatus of my invention has already been mentioned. The several bending and shaping operations are combined into a single continuous procedure which can be completed in a very short space of time, thereby making possible the production of articles such as rail anchors in large numbers and at low cost. A forging press of relatively moderate capacity is sufficient to perform the operations described since the thrust required to bend the ends of the bar by the action of the rolls is small compared to the force that would be required to swage these portions in a fixed die. As already explained, the metal being shaped has only rolling engagement with the shaping surfaces of the punch and rolls, thereby avoiding scratching of the surfaces of the article. The extrusion of the ends of the work-piece prevents widening of the ends of the article adjacent the flange-receiving slots and permits some economy in material since a shorter blank may be used than would otherwise be necessary. Difficulty with scale is avoided because there are no surfaces on which scale can accumulate. The cost of the apparatus necessary for operating in accordance with my method is much less than that of ordinary forging dies and the cost of maintenance is correspondingly reduced.

While I have illustrated and described only a preferred embodiment of the invention, it will be understood that changes in the structure disclosed may be made without departing from the spirit of the invention. As already stated, the invention is adaptable to the manufacture of articles other than rail anchors. Special shapes may be produced by varying the contour of the backing plates or the rolls themselves and matrix grooves may be formed in the latter to provide raised portions on the exterior of the finished article. The bending rolls, furthermore, might be stationary instead of movable and provided with suitable backing rolls if desired.

I claim:

1. Apparatus for making a rail anchor having spaced, substantially parallel sides with flange-receiving slots on their adjacent faces and an intermediate connecting portion with a re-entrant hump adapted to engage the bottom of a rail flange, said apparatus comprising a die-block having a polygonal opening therethrough, a pair of parallel rolls disposed in spaced relation in said opening and confined therein against endwise movement but free for sidewise movement therein, a punch reciprocable through said opening between said rolls, a displaceable anvil cooperating with said punch to deform the intermediate portion of a straight bar into said hump, said punch cooperating with said rolls simultaneously to bend the ends of said bar through about 90° into substantial parallelism as the punch advances between the rolls, pinions on said rolls and racks on said block and punch meshing therewith whereby the advance of the punch rotates the rolls and moves them sidewise into said opening, and die recesses in the sides of said punch, said rolls being adapted to shape the slots in the anchor ends by die-rolling the ends of the bar against the sides of the punch as the forward end of the punch passes beyond the rolls.

2. The apparatus defined by claim 1 characterized by backing plates seated against the sides of said opening and supporting said rolls as they move sidewise.

3. The apparatus defined by claim 1 characterized by said anvil having a rounded working surface and said punch having spaced rounded projections and an inwardly curving recess for cooperation with said punch to form said hump.

ROBERT V. PROCTOR.