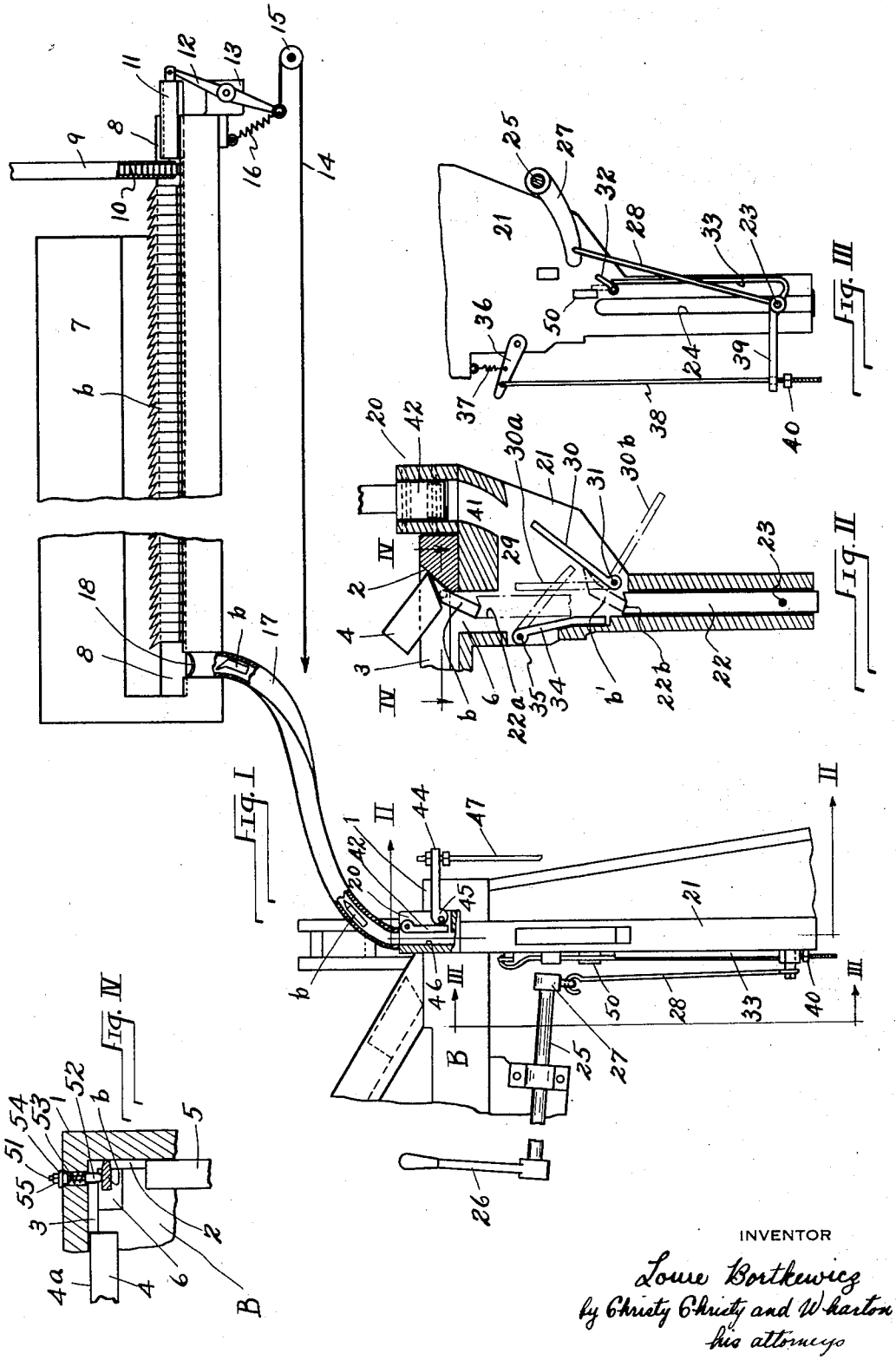
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BIT FORGING APPARATUS

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BIT-FORGING APPARATUS

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2 Claims. (Cl. 76—5)

My invention relates to the forging of cutter bits, particularly cutter bits of the type employed in the coal-cutting machines used in the mining of coal. In general the problem of properly forging such bits has been overcome by the forging machine illustrated and described in Letters Patent No. 1,818,601, granted to me August 11, 1931, and in my co-pending application Serial No. 455,005, filed May 23rd, 1930, now Patent No. 1,857,011, granted May 3rd, 1932. Such forging machine comprises an anvil having two plane faces extending angularly to one another from the line of intersection or meeting of the faces; a spring-operated forging die is organized with each face of the anvil, and feeding mechanism is adapted to present a preheated bit-blank to the anvil. The forging dies are reciprocated alternately against the two faces of the anvil, and the heated blank is provided with the desired forged point.

I am now concerned with auxiliary apparatus for use in conjunction with the anvil and forging dies, to the end that the cold bit-blanks may be introduced to the apparatus at one end and may emerge from the other end of the apparatus in the form of completely forged cutter bits. That is to say, I provide apparatus and method for doing the following things in preparing the bit-blanks for forging, and in manipulating the bit-blanks before, during, and after forging:

1. Feeding the bit-blanks, one after another, from a supply hopper into a heating furnace.

2. Heating the bit-blanks fed into the furnace to forging temperature.

3. Introducing the heated bit-blanks to the mechanism which feeds them to the anvil.

4. Presenting each blank to the anvil and supporting it against one of the two forging faces of the anvil and yieldingly supporting it at an interval from the other forging face of the anvil while the forging dies operate.

5. And ejecting the forged articles from the apparatus.

In the accompanying drawing Fig. I is a view, partly in side elevation and partly in vertical section, of forging apparatus embodying the invention, the forging machine proper being fragmentarily illustrated. Fig. II is a view in vertical section of the feeding mechanism of the forging machine, the view being taken on the plane II—II of Fig. I. Fig. III is a view in elevation of such feeding mechanism, as it appears on the plane III—III of Fig. I. And Fig. IV is a fragmentary view of the anvil, illustrating in cross-section (on the plane IV—IV of Fig. II) an important element of the structure.

Considering first the forging machine, I have disclosed in my above noted Letters Patent that the machine comprises a frame supporting an anvil. The anvil includes two forging faces which extend angularly to one another from a common line of intersection, and extend at an angle from the horizontal,—the angles at which the forging faces lie with respect to the horizontal, and with respect to each other, being determined in accordance with the shape of the point to be forged on the cutter.

Co-operating with the anvil are two movable dies, one die being associated with each of the forging faces of the anvil. The dies of the machine are alternately reciprocated to and from forging position against the respective anvil faces; the means for reciprocating the dies include springs which are successively energized and released, to activate the dies in the manner described. As mentioned, the structure of the forging machine per se is fully disclosed in my patents, above noted, and inasmuch as the particular co-operation between the die-operating mechanism and the dies is not primarliy of the essence of this invention, I illustrate the forging machine fragmentarily in the accompanying drawing, showing only the structure requiring present consideration.

The reference numeral 1 is applied to the anvil, which includes two forging faces 2 and 3, extending angularly to one another and angularly from the horizontal. The two forging dies 4 and 5 are reciprocative to and from forging position upon the anvil; the forging die 5 co-operates with face 3, and the die 4 co-operates with face 2 (cf. Fig. IV). An opening 6 extends through the bed B of the machine, and through this opening a heated bit-blank is fed and supported against the anvil, while the forging dies 4 and 5 are alternately reciprocated.

A heated bit-blank is fed through the opening 6 and held in such position against the "cornered" anvil that the alternately reciprocating dies forge the desired point upon it (cf. the bit-blank *b*, Fig. II). Then the pointed bit is released, falling through opening 6 and out of the machine.

I provide a heating furnace 7 which includes a way 8 upon which a series of bit-blanks *b* may be supported. So much of the bit-blanks as are to be heated to forging temperature extend upwardly from the way 8, and, in accordance with well-known continuous heating furnace practice, combustion means (not shown) are provided for heating the bit-blanks. A supply hopper 9 is organized without the furnace, and in the hopper

a column 10 of bit-blanks is stored. The lowest bit-blank of the column rests upon the way 8, and the side walls of hopper 9 clear the way 8 by an interval slightly greater than the thickness of a bit-blank, but less than the thickness of two bit-blanks. A feeding bar 11 is slidable upon the face of way 8; a lever 12 is pivotally mounted upon a bracket 13; one end of the lever is articulated with the feeding bar 11, and the other end of the lever is connected to a flexible line 14, trained upon a pulley 15. A spring 16 is so organized as normally to maintain the parts in their illustrated positions. The line 14 extends from the furnace to a point where it is accessible to the operator of the forging machine. Upon pulling the line 14 the lever 12 is rotated counter-clockwise and the feeding bar 11 is moved right-to-left along the way 8, thrusting the lowermost bit-blank from beneath the column 10 and effecting the advance of the series of bit-blanks upon the way 8, through an interval at least equal to the width of such bit-blank. The bit-blank at the left-hand end of the series on way 8 is thus shifted to a position over the open end 18 of a chute or passage 17, and accordingly the bit-blank falls into the passage. Of course, such blank has during its advance through the furnace been heated to forging temperature.) Release of the line 14 permits the feeding bar 11, under the influence of spring 16, to return to its illustrated position, whereupon the column 10 of bit-blanks in the hopper 9 drops through the interval vacated by the last-advanced bit-blank, and the parts are ready for another feeding operation. Thus it will be perceived that I have provided means, subject to the control of the forging machine operator, for supplying heated bit-blanks to the passage 17. While I have shown simply a pull line 14 as the means for operating the feeding bar 11, it will be understood a more specialized linkage can be readily provided.

The bit-blanks *b* to be forged or pointed are usually of the form illustrated in Fig. I; that is, the form of the bit-blanks *b* is such that when they are arranged in series the tip of one overlies the next succeeding bit-blank. I have found that the bit-blanks must be placed on the way 8 with their tips pointing toward the end of the furnace at which they enter the passage 17, otherwise the bit-blanks will not fall freely into the passage. That is to say, if the tips of the bit-blanks were directed to the right in Fig. I, the end bit-blank would tend to hang on the adjacent blank, when shifted to "release" position over mouth 18. Thus it is desirable to so arrange the bit-blanks that their tips are directed in the manner shown in Fig. I. However, in so obviating the disadvantage of bit-blanks sticking or hanging over the mouth 18, I find that the bit-blanks upon falling into the passage 17 are not pointing in the correct position for entrance to the forging machine; the blanks must be turned upon their axes through an angle of 90°. This difficulty is solved by providing a tortuous or twisting passage; that is, the passage or chute 17 is so formed that, as the bit-blank *b* moves through it under gravity, the bit-blank is turned through an angle of 90°, before entering the feeding mechanism of the forging machine.

The feeding mechanism of the forging machine includes a blank-straightening device 20. As described in Letters Patent No. 1,857,011, above noted, the blank straightening device comprises a die 42 pivotally secured to the wall of the feeding mechanism. A pivotally supported arm 44, having an eccentric head 45 bearing laterally against the distal end of the die 42, is effective upon oscillation to swing the die 42 to and fro, so that the die co-operates with the opposite wall 46 of the feeding device, to straighten bit-blanks leaving the passage 17. A rod 47 is vertically reciprocated by the moving parts of the forging machine, to effect oscillation of arm 44.

Upon moving under gravity through the straightening device 20, the heated and straightened bit-blank enters the feeding mechanism proper. The feeding mchanism comprises a frame 21 in which a plunger 22 is vertically reciprocative. A pin 23 extends from the plunger and through a slot 24 in the wall of frame 21; a rotatable shaft 25 is supported on the bed B of the forging machine, and a handle 26 conveniently is provided on the shaft to admit of its manual rotation; an arm 27 is secured to the shaft 25, and a rod 28 interconnects the pin 23 and said arm 27. It will be observed that clockwise (Fig. III) rotation of shaft 25 will effect a raising of the plunger 22, and counter-clockwise rotation will effect a lowering of the plunger.

The frame 21 is internally recessed at 29, and in this recess a guide bar 30 (Fig. II) is located; the guide bar is integrated with a pin 31 which extends through the side wall of the frame, and to the projecting end of such pin an arm 32 is secured (Fig. III).

An operating stem 33 is secured at its lower end to the pin 23 of the plunger; the upper end of the stem (33) normally bears against the arm 32, maintaining the arm 32 and the guide bar 30 with which it is integrated in the full line positions, respectively shown in Figs. III and II.

An ejector guide 34 is integrated with a pin 35 (Fig. II); the pin 35 projects through the wall of frame 21, and has an arm 36 secured to it (Fig. III). A tension spring 37 is organized with the arm 36, tending to maintain it in its illustrated position (Fig. III). A rod 38 is attached to the arm 36, and extends downward, projecting with sliding fit through a bar 39 which is rigidly secured to the pin 23. A nut 40 is adjustable on the rod 38, below the bar 39, and, as will presently appear, the nut serves to limit relative movement between the bar (39) and the rod (38).

The feeding mechanism parts are in the position illustrated in Figs. II and III when the heated bit-blank is admitted to the straightening device 20. Upon passing through the straightening device, the bit-blank falls down passage 41 (Fig. II) and is guided along bar 30 (full line position) to the head of plunger 22 (cf. dotted lines *b'*). Then the operator pulls the lever 26 forward, turning arm 27 clockwise, and elevating the plunger 22. As the plunger 22 starts upward, the stem 33 moves with it. The tip of the stem 33, in moving upward, effects the swinging of the arm 32 to a position against stop 50 (Fig. III), and in consequence the guide bar 30 is shifted to the dotted line position 30*a* (Fig. II). Accordingly, a vertical passage is provided for the bit-blank *b'* while the plunger 22 moves it upward. The plunger is shifted upward to the dotted line position 22*a* (Fig. II), in which position the bit-blank is supported upon the anvil. It should be noted that the top of the plunger is formed with an angular or slanting face 22*b*, by reason of which the bit-blank is tilted to lie against the face 2 of the anvil. The alternately reciprocating dies 4 and 5 forge a point upon the tip of the blank against the anvil.

When the bit-blank has been pointed, the hand lever 26 is thrust back, swinging the arm 27 back to its illustrated position in Fig. III. Accordingly, the completed bit lowers into the recess 29 again. The back swing of the lever 26 is continued past its normal or initial position, so that the counter clockwise rotation of the arm 27 is effective to lower the plunger 22 below its blank-receiving position. As a result, the tip of stem 33 moves away from the arm 32, and the guide bar 30 drops to its dotted line position 30*b* (Fig. II). This so-called additional lowering of the plunger 22 carries the bar 39 downward, engaging nut 40, and forcing arm 36 to turn against the resistance of spring 37. So, the ejector guide 34 is swung outward (Fig. II), kicking the forged bit from the top of plunger 22, whereupon the bit slides down the guide bar (30*b*) and is ejected from the machine.

During the operation of the reciprocating dies 4, 5 upon the bit-blank, I support the bit-blank in contact with the forging face 2 (by means of plunger 22) but I do not permit the bit-blank to lie freely against the forging face 3. I have found that the forging dies (Fig. IV) tend to form fins upon the point of the bit-blank; that is, during operation of the forging dies, the metal along the inner edges of the blank is pressed into the intervals, however slight the intervals may be, between the forging faces of the anvil and the adjacent lateral faces of the forging dies. More specifically, if one side of the bit-blank lies snug against the face 3 of the anvil, and the die 4 is impelled against the bit-blank, there is a tendency for the metal along the edge of that side of the blank to wedge between the face 3 of the anvil and the side face 4*a* of the die, thereby producing or forming a fin upon the blank. There is a similar tendency for a fin to be produced on the diagonally-opposite edge of the blank, by the action of the die 5. The discovery I have made to obviate this objection comprises a yielding lateral support for the bit-blank. Such yielding support comprises a stem 51, extending through the wall of the anvil. The stem 51 is provided with a head 52, projecting from the face 3 of the anvil; a compression spring 53 is organized on stem 51, between the head 52 and a fitting 54. The fitting 54 is secured in the anvil; a nut 55 is secured to the stem outwardly of the fitting 54, and the stem is slidable in the fitting 54 against the restraint of spring 53. So, a yielding support is provided to hold (yieldingly) the bit-blank *b* from close contact with the face 3 of the anvil, while the forging die 4 strikes it. In so holding the bit-blank an interval from the face 3 of the anvil when the die 4 strikes, the metal of the blank is maintained an interval from the region of contact between the face 3 of the anvil and the face 4*a* of the die. Accordingly, it is impossible for the metal of the blank to enter between the said faces of the anvil and die in such manner as to form a fin. The stem 51, of course, yields or recedes when the die 5 strikes the bit-blank, and the bit-blank is pressed or forged against the face 3, substantially as though the yielding support (51) were not present. My experience has shown that the yielding member 52 co-operates with the rapidly oscillating dies 4, 5, to maintain the bit-blank being forged in a constant state of agitation or "chattering", so that the blank does not rest snugly against either of the faces of the anvil, except when one or the other of the dies 4, 5 strikes it and moves it into forging engagement with one or the other of the respective forging faces 2, 3. While a yielding support (52) on one face of the "cornered" anvil has proven sufficient to overcome the objections referred to, I contemplate that such a support may be organized with each forging face of the anvil. I may add that the bit-blank maintains its forging temperature longer when the yielding support is employed. That is to say, the yielding support positions the bit-blank an interval from the face 3 of the anvil, so that the blank is in contact with such face only for the short periods of time that the forging die 5 acts upon it. Thus loss of heat by conduction through the anvil is minimized.

I claim as my invention:

1. In forging apparatus the combination of an anvil having two forging faces extending angularly to one another to form a corner region, two alternately reciprocating forging dies co-operating with said anvil for the shaping of a metal blank in said corner region, and a yielding support associated with said anvil for normally spacing said blank from one of said forging faces, which support yields under the influence of one of said forging dies and permits said blank to lie against the last-mentioned forging face.

2. In a bit-forging machine, the combination of an anvil having two forging faces extending angularly to one another and forming a corner region in which the tip of a blank is adapted to lie, a forging die organized with each forging face, said forging dies being alternately reciprocable to and from forging position against said forging faces, and adapted to hammer the tip of said blank into bit form, and means organized with said anvil to support said blank yieldingly at an interval from one of said forging faces, said means being adapted to yield under the impact of one of said forging dies, whereby momentary contact of the blank against such forging face is permitted.

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