Oct. 25, 1938. M. B. WOLF 2,134,386

DROP FORGING DIE STRUCTURE

Filed Nov. 4, 1935

Fig. 1.

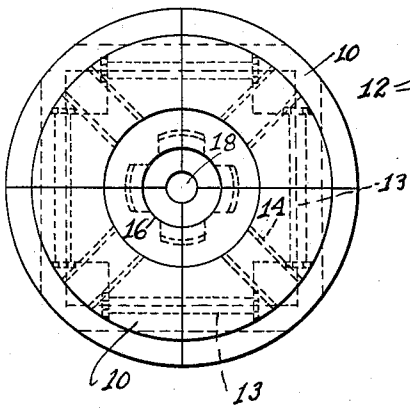


Fig. 2.

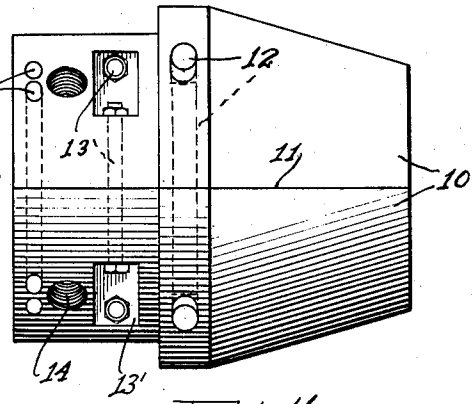


Fig. 4.

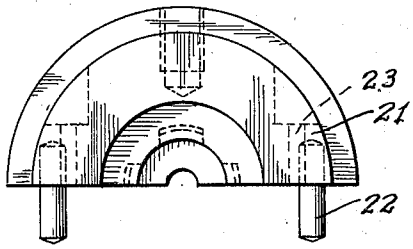


Fig. 3.

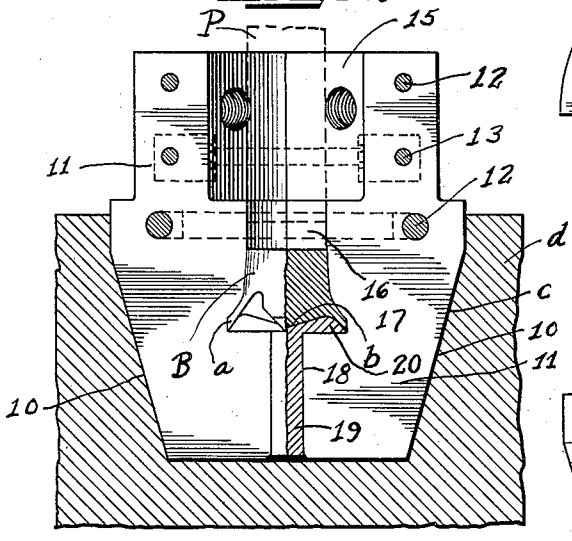


Fig. 5.

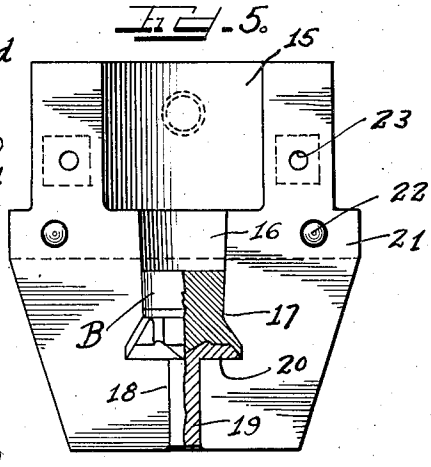


Fig. 6.

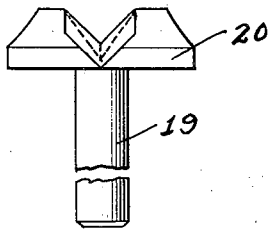
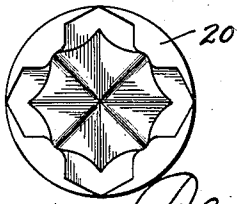


Fig. 7.



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UNITED STATES PATENT OFFICE

2,134,386

DROP FORGING DIE STRUCTURE

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Application November 4, 1935, Serial No. 48,155
In Canada September 10, 1935

1 Claim. (Cl. 76—95)

This invention relates to the drop forging of die formed articles, as for example rock drill bits, and particularly to improved die structure by means of which the forging can be more efficiently and economically accomplished.

The invention consists essentially in forming the die structure from a plurality of cooperative parts and forging the metal into the shaped recess and thereafter collapsing the die for removal of the finished article.

An important object of the invention is to form the female die structure of a plurality of sections or segments which are accurately machined to fit intimately together to form the die, with dowel and securing means for accurately holding the segments together during the forging operation so as to produce articles free from burrs and ragged edges and thereby eliminating excessive grinding and trimming which often causes articles, such as drill bits, to be of light weight and not capable of attaining and keeping efficient drilling speed.

A further object is to provide a die structure of similar symmetrical sections or segments so that in case any segment becomes damaged it may be replaced without having to throw away the entire die structure.

The various features of my invention are incorporated in the structure disclosed on the drawing, in which drawing

Figure 1 is a plan view of a die structure composed of four quarters or segments;

Figure 2 is a side elevation of the structure of Figure 1;

Figure 3 is a side elevation of two adjacent quarters of a four-quarter die, showing the interior arrangement;

Figure 4 is a plan view of one of halves of a two-part die;

Figure 5 is a side elevation of the die half showing the interior arrangement;

Figure 6 is a side elevation of a die or mold part for application in the bottom of the cavity of the die body for molding the end of an article such as a drill bit; and

Figure 7 is a plan view of the molding element of Figure 6.

The die structure is of circular horizontal cross section throughout and the structure shown in Figures 1, 2 and 3 comprises four quarters or segments 10, the inner faces 11 of the segments being accurately machined so that the segments may intimately fit together. The segments are held in accurate alignment by guide or dowel pins 12 and are drawn together and fastened by bolts 13 whose ends are kept within the circumferential surface of the die structure by being within recesses 13'. Each quarter is drilled and tapped, as indicated at 14, for receiving centering pins for adjusting the position of the female die structures in relation to the male die or forging plunger P. The interior of the die structure is machined out to receive the male die or forging plunger and to provide the mold cavity for the article to be forged. As shown the die structure has the outer bore 15 through which the male die is guided, and the inner bore 16 whose shape is determined by the shape of the article to be forged. As shown a drill bit B is the forged article and the lower end 17 of the bore 16 is therefore properly shaped for forming the sides of the bit while the upper end of the bore 16 serves as a guide for the male die or plunger which is accurately centered by means of the centering pins (not shown) threading through the openings 14, the bore 15 being larger than the bore 16.

Extending downwardly through the die structure from the molding bore 17 is the passage 18 for receiving the pin 19 extending from the die or mold member 20 which rests in the bottom of the mold space 17 and which is shaped at its top and sides to determine the shape of the end of the article to be molded, in this case the drill bit B which bit is shown as comprising a substantially cylindrical body with side cutting teeth *a* and inner cross teeth *b*.

The dowel pins 12 will hold the segments accurately aligned and the bolts 13 will secure these segments together and the structure can then be placed in a lathe or other suitable machine for machining off the outer surface of the structure and the inner bores 15, 16, and the circumferential surface of the mold cavity 17. The lower end of the structure may be frusto-conical as shown and may be seated in a correspondingly formed pocket *c* provided in a supporting base *d* so that under impact of the male die or plunger the segments will be prevented from separating radially. Where the die or mold member 20 cannot be dropped into the segments after assembly thereof, it is inserted during assembly of these segments and will then be held accurately in centered position at the bottom of the mold cavity 17 by its supporting pin 19. A steel ingot of predetermined shape and size is now placed in the cavity 17, and, after the male die has been accurately aligned in the bore 15 and the upper end of the bore 16 by means of the centering pins engaging in the passages 14, the forging blows

are applied to the male die and the metal of the ingot is forced downwardly to fill the mold cavity 17 for molding of the bit B. After completion of the molding operation the die structure is disassembled and the finished bit removed therefrom, and owing to the accuracy of construction and the accurate alignment of the die members during the forging operation, the bit will be free from burrs and ragged edges and will be ready for use.

In the modified arrangement illustrated by Figures 4 and 5, the die structure is formed of halves 21 accurately aligned and held together by dowels 22 and bolts extended through bolt holes 23 and the interior of the structure is shaped like that of the structure in Figures 1, 2 and 3, the lower end of the bore 16 forming the molding cavity 17 for the article to be forged, in this case also a drill bit B, the end of the bit being shaped by the die member 20 centered by the pin 19 engaging in the hole 18.

Although the drawing illustrates the molding of a four-pointed bit, it is evident that a two, six or eight point bit can be forged with equal success and that the structure can be efficiently used for the forging of other articles. In the manufacture of six-point or greater type bits a very decided advantage arises in that the die structure can be disassembled and the finished bit readily removed, which cannot be accomplished successfully with prior types of dies.

I have shown a practical and efficient embodiment of the various features of my invention, but I do not desire to be limited to the exact construction, arrangement and operation shown and described, as changes and modifications may readily be made without departing from the scope and spirit of the invention.

I claim as follows:

In the drop forging of drill bits, a female die element of circular cross section throughout its extent and composed of interchangeable quarter segments, bolts extending in a common plane transversely through adjacent sections at points outside of the axis of said element for securing said elements together in accurate alignment, said segments having recesses for the ends of the bolts for keeping said ends within the circumferential surface of said element, and a plunger for entering the die cavity for forging an ingot of metal placed therein to form the desired article.

MARTIN BENJAMIN WOLF.