Feb. 9, 1943. G. E. BOYCE 2,310,675

METHOD OF FORGING AND REFINISHING DETACHABLE BITS AND THE LIKE AND APPARATUS THEREFOR

Filed Jan. 28, 1942 2 Sheets-Sheet 1

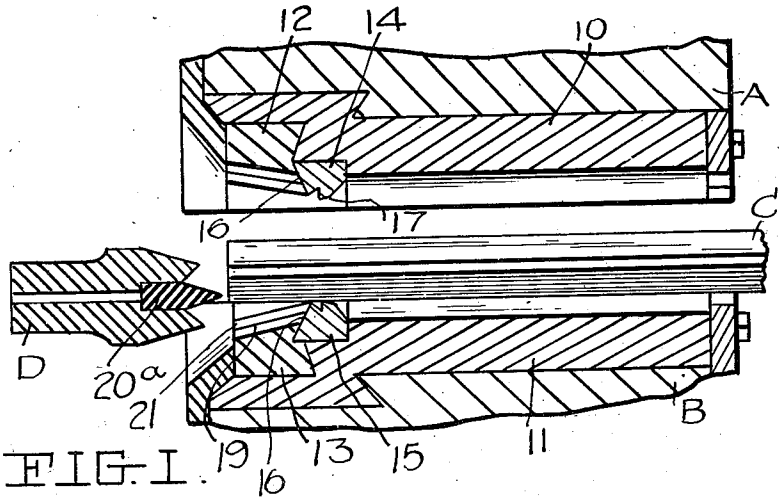


FIG. 1.

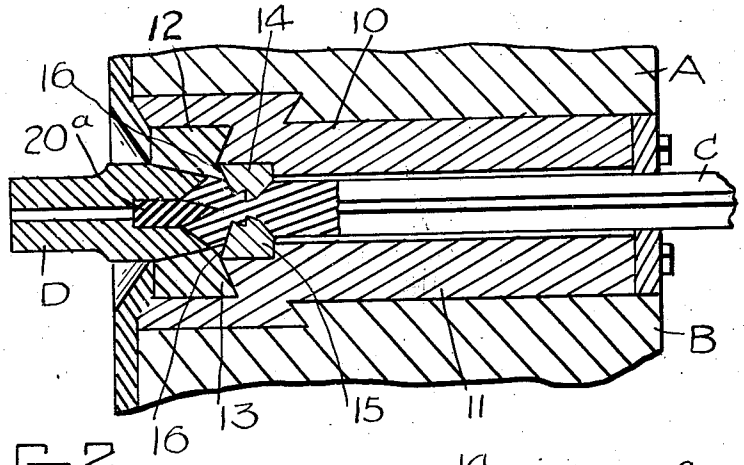


FIG. 2.

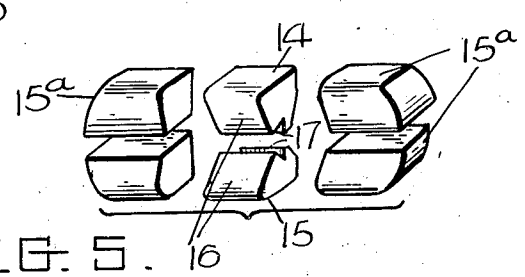


FIG. 5.

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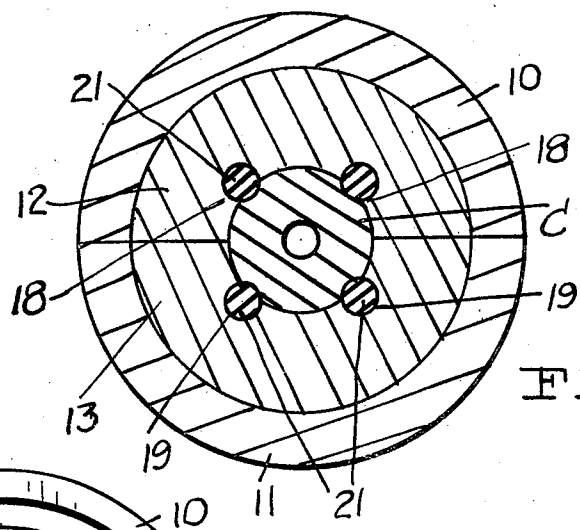


FIG 4

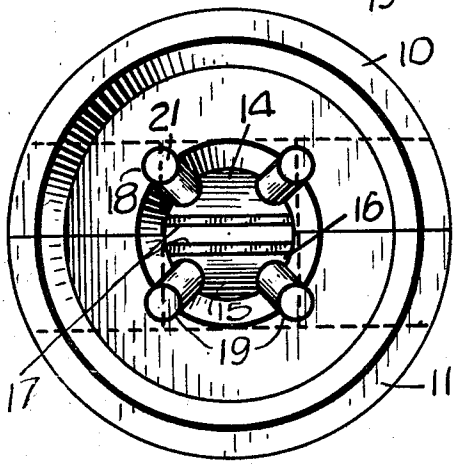


FIG. 3.

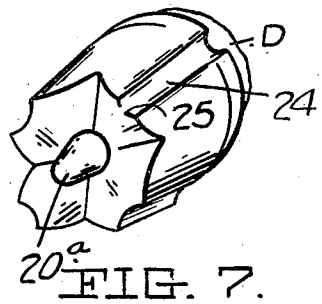


FIG. 7.

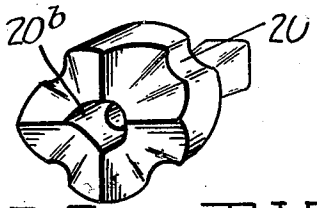


FIG. 8.

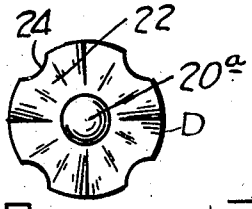


FIG 9

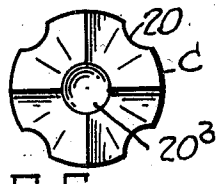


FIG. 6.

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METHOD OF FORGING AND REFINISHING DETACHABLE BITS AND THE LIKE AND APPARATUS THEREFOR

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Application January 28, 1942, Serial No. 428,606
In Canada July 22, 1941

8 Claims. (Cl. 76—108)

This invention relates to a method of forging and refinishing detachable bits and the like and apparatus therefor.

In the manufacture and/or reconditioning of detachable drill bits according to usual methods, it has been necessary to subject the article being formed or reconditioned to swaging and gauging operations previous to dollying in order to form and/or maintain the sludge grooves. Otherwise, if the bit is merely dollied, hot metal must flow into and obliterate existing sludge grooves in the case of a bit being reconditioned, or in the case of the forming of a new bit no sludge grooves would be formed. Moreover, when employing existing apparatus which invariably provides liberal clearances between the coacting dolly and clamping die, undersize bits both in respect to length and diameter would result if the swaging and gauging operations were omitted. Such operations naturally increase the amount of processing actually necessary and require skilled workmen which in the aggregate increase the cost of the article formed as well as reduce the speed at which bits may be produced.

It is an object of the present invention to devise a method and apparatus through which detachable drill bits and other die formed cutters having a fluted or grooved cross-section may be produced in a simple manner by a simple percussive forging operation without requiring several operations as is usual practice.

A further object of the invention is to provide a method and apparatus of this kind through which detachable bits and other die formed cutters may be readily resharpened and reconditioned.

A further object of the invention is to provide a method and means for easily fluting or channeling the sides of such bits or cutters employing specially inserted and hardened groove forming means in the forming die.

A still further object of the invention is to provide a construction through which detachable bits, cutters and the like may be formed with a minimum of waste.

With these and other objects in view the method generally embodies the clamping of drill stock in a die, inserting in said die a series of forming members projecting into the die cavity and subjecting the clamped steel to a percussive forging operation to form the cutting end and simultaneously subjecting the clamped stock to the pressure contact of the hardened forming members to form the bit or cutter simultaneously with sludge grooves along its sides.

The preferred form of apparatus includes a two-piece annular clamping forming die having a series of hardened forming members or metal pins inserted in the walls of the die at spaced apart intervals and projecting into the die along the walls to form in the finished article fluting or grooves. The apparatus includes a percussively operated dolly operating upon the metal of the die cavity to form a completely finished bit or cutter, in combination with the forming pins and the die, in one general and complete operation. The apparatus is also, of course, adapted for the reconditioning of articles of the character referred to.

The invention will be clearly understood by reference to the following detailed specification taken in conjunction with the accompanying drawings.

In the drawings:

Fig. 1 is a fragmentary longitudinal section taken through the apparatus showing the parts of the forming and clamping dies separated and ready for operation with drill steel stock in position and also illustrating the dolly designed to contact the drill steel percussively.

Fig. 2 is a similar view to Fig. 1, but showing parts of the apparatus brought together to clamp the drill steel and cut into it to form the detachable drill bit with the dolly in position to form the bit in conjunction with the die.

Fig. 3 is an enlarged end elevation of the closed die looking into the die cavity showing the position of the forming pins or inserts.

Fig. 4 is a transverse section taken through the closed die when engaging drill steel stock.

Fig. 5 is a perspective illustration of the inserts for the die for forming a dove-tailed end on a detachable bit.

Fig. 6 is a perspective view of a bit formed by the method and apparatus.

Fig. 7 is a perspective view of the dolly head.

Fig. 8 is an end elevation of the bit, and

Fig. 9 is an end elevation of the dolly.

The method and apparatus will first be described in relation to the fabrication of a detachable bit having a dove-tailed tongue.

Referring to the drawings, A indicates the ram of a conventional drill steel sharpener and B indicates the die block of such an apparatus which carries the upper and lower parts 10 and 11 of a forming and clamping die which carry die inserts 12 and 13 respectively and cutter inserts 14 and 15 respectively. The inserts 12 and 13 form the main die cavity, the base for

which is formed by the leading surface 16 of the cutter inserts 14 and 15.

The inserts 14 and 15 are of known kind for forming a dove-tailed tongue of a detachable bit and include the cutting edges 17 designed to bite into the drill stock to form the end of the dove-tailed tongue substantially as shown in Fig. 2. These inserts are also shown in Fig. 5 with which are also shown flanking inserts 15a which are positioned in the die on each side of inserts 14 and 15. The inserts 14 and 15 and flanking inserts 15a are retained in position by means of inwardly projected angularly directed extensions of a clamping face plate as clearly shown in Figs. 1 and 2.

The inserts 12 and 13 are recessed at two spaced apart points respectively indicated at 18 and 19 to receive forming members designed to project into the die cavity to groove the side walls of the detachable bit to form the sludge grooves 20 of the bit. These forming members may take the form of cylindrical pins 21 which, as indicated in Figs. 3 and 4, extend into the recess to an extent greater than a semi-circle so that they are thus retained against any lateral movement. The pins 21 are made from hardened steel and in conjunction with the percussive dollying action function with the die cavity to form the detachable bit quickly and efficiently.

According to the method, a piece of heated drill steel stock C is positioned on the lower portion of the forming and clamping die with one end projecting a sufficient distance over the cavity of the lower die insert 13 such that sufficient metal will be present in the die cavity to form a finished bit of predetermined dimensions. To this end the dolly D is positioned at the mouth of the die cavity with its pin 20a projecting at the edge of the cavity forming a stop for the end of the drill steel stock such as to assure with each operation that a corresponding amount of drill steel stock is projected into the die cavity. The ram A is then moved downwardly, as shown in Fig. 2, and clamps the stock, the cutters 17 of the inserts 14 and 15 preliminarily forming the rearward outline of the detachable bit, and providing a base for the forging operation whereupon the dolly D is projected through the die cavity into percussive contact with the end of the stock held therein.

The dolly is formed with forming wedge-shaped ridges 22 and intermediate wedge-shaped valleys 23 so as to form the final cutting edges on the detachable bit. The sides of the head of the dolly are grooved as at 24 in such a manner that the grooves coincide with and will ride over the pins 21 or other forming members held in the die inserts 12 and 13 and projecting into the die cavity. Moreover, all the dimensions of the coacting surfaces of the dolly and forming die are such that detachable bits of a predetermined uniform size are formed. The dolly enters the forming die to a point where the external surface of its tapered nose and the walls of the forming die exactly fit and at this point the diameter of the die cavity and the diameter of the dolly correspond to the required finished diameter of the cutting edges of the detachable bit so that in one complete forging a detachable bit is produced finished to the actual size required and this is accomplished without previous swaging or gauging operations or subsequent grinding or milling operations. It is then only necessary to break off the formed detachable bit from the bar stock along the thin web of material connecting it with the bar and to drill the water hole through the bit. The projecting pin of the dolly countersinks the bit as at 20b and forms a pilot hole for the final drilling operation to form the water hole in the bit.

In the forging operation the dolly percussively contacting with the end of the clamped metal forces the metal to spread which, with the projecting ribs formed by the members 21 extending along the die cavity, is readily accomplished as the hardened pins have a tendency to cause the metal to spread into the shape of the die cavity more readily.

The provision of inserts 12 and 13 constitute an advance in the art in addition to use of the hardened forming pins 21 in that it is a simple matter to maintain the contour of the die cavity in proper condition so as to produce a detachable bit of predetermined dimensions and efficient structure. In the case of wash-outs in the die surface, the inserts 12 and 13 may be removed and the pins 21 readily removed from the inserts whereupon such inserts may be easily reconditioned. Moreover, by using a second set of inserts the operations may be continued without substantial interruption while the worn inserts are being reconditioned, the pins 21 being removed from one set and immediately inserted in the other for use.

While it is possible to form the die with protruding integral ribs projecting into the die cavity, such a construction is difficult to make and is consequently very expensive. The formation of the recesses in the walls of the die and the insertion of specially hardened groove forming members or pins projecting into the die cavity not only constitutes a particular feature of the construction from the point of view of expense and ease of construction, but since these groove forming members are subjected to somewhat rigorous treatment it will be obvious that the specially hardened members will withstand wear to a great extent in addition to producing a smooth and positive groove structure on the article being formed. On the other hand, they are readily replaceable.

In addition to the advantages outlined as a result of the improved method and the consequent elimination of swaging and gauging operations, the article produced is of improved texture and shape, free from forging cracks and folds and very large inclusions of slag. Moreover, it is stronger and more uniform in shape since it is automatically formed from accurately designed dies and formed entirely by the operations of the machine so that it does not require special skill in forging. Furthermore, the article is of improved shape with regard to the passage of sludge and chips since the sludge grooves produced are smooth and rounded and the exact shape and size of them may be predetermined and controlled automatically in the manufacture of the die, and eliminating the necessity of considerable skill on the part of the operator and resultant non-uniform constructions in some cases.

Detachable bits may be reconditioned in a similar manner, the only difference being that in place of the cutter inserts 14 and 15, another conventional type of non-cutting dove-tailed forming inserts are used.

While the method and apparatus has been described in relation to the fabrication of detachable bits having a dove-tailed tongue, it is obvious, of course, that other forms of bit can be fab-

ricated and reconditioned and that the method may, through suitable apparatus, be applied to the construction of other die formed cutters having a fluted or grooved cross-section.

What I claim as my invention is:

1. Apparatus for forming or reconditioning detachable drill bits and the like comprising in combination, a clamping die, a plurality of coacting sections forming an open-mouthed die cavity having side walls and a base, a plurality of circumferentially spaced apart rib-like members extending along the walls of the cavity substantially from its mouth to its base and protruding thereinto, and a dolly having a forming nose to engage hot metal in the cavity, said dolly having a plurality of axially extending circumferentially spaced apart grooves in its outer surface corresponding in number to the rib-like members and adapted to straddle the latter when said dolly has projected into the cavity to act upon the hot metal contained therein.

2. Apparatus as claimed in claim 1 in which the rib-like members are formed by a plurality of pins, said die being formed with recesses intersecting the cavity to receive said pins.

3. Apparatus as claimed in claim 1 in which the rib-like members are formed by cylindrical pins, said die being formed with a plurality of substantially circular recesses intersecting the die cavity to receive said pins, the latter protruding into the die cavity to a degree less than the extent of half their circumference.

4. Apparatus for forming or reconditioning detachable drill bits and the like comprising in combination, a clamping die having a plurality of coacting sections, each of said sections carrying an insert to form, when said sections are moved together, an open-mouthed die cavity, a second pair of inserts connected one at each section rearwardly of the die cavity and forming a base therefor, a plurality of circumferentially spaced apart rib-like members extending along the walls of the cavity substantially from its mouth to its base and protruding thereinto, and a dolly having a forming nose to engage hot metal in the cavity, said dolly having a plurality of axially extending circumferentially spaced apart grooves in its outer surface corresponding in number to the rib-like members and adapted to straddle the latter when said dolly has projected into the cavity to act upon the hot metal contained therein.

5. Apparatus for forming or reconditioning detachable drill bits and the like comprising a clamping die formed from two coacting relatively movable sections designed to grip heated drill steel stock, said sections forming a die cavity, the walls of said cavity having spaced apart recesses extending in the axial direction of the cavity and intersecting the latter, and groove forming members inserted in said recesses and protruding into the die cavity.

6. Apparatus for forming or reconditioning detachable drill bits and the like comprising a clamping die formed from two coacting relatively movable sections designed to clamp heated drill steel stock, said sections forming a die cavity having side walls formed from inserts secured in the die sections, said inserts having spaced apart recesses extending in the axial direction of the cavity and intersecting the latter, and groove forming members inserted in said recesses and protruding into the die cavity.

7. Apparatus for forming or reconditioning detachable drill bits and the like comprising in combination, a clamping die having a plurality of coacting sections forming an open-mouthed die cavity, the latter having side walls and a base, said walls being formed with a plurality of circumferentially spaced apart recesses extending in the axial direction of the cavity from its mouth to its base and intersecting the cavity throughout its length, a plurality of groove forming members inserted in said recesses and protruding into the die cavity along the length of its walls, and a dolly having a forming nose to engage hot metal clamped in the cavity, said dolly having a plurality of axially extending circumferentially spaced apart grooves in its outer surface corresponding in number to the groove forming members and adapted to straddle the latter when said dolly is projected into the cavity to act upon and deform the hot metal in the cavity.

8. In apparatus for forming detachable drill bits and the like, a plurality of coacting sections forming therebetween a die cavity, the defining side walls of said cavity being intersected by a plurality of recesses extending in the axial direction of the cavity designed to receive pin-like members and cause them to protrude into the cavity.

GEORGE EDMUND BOYCE.