April 7, 1970 MASAO MAKINO ET AL 3,504,575

METHOD OF MAKING FLUTED DRILL AND THE LIKE

Filed Aug. 21, 1967 2 Sheets-Sheet 1

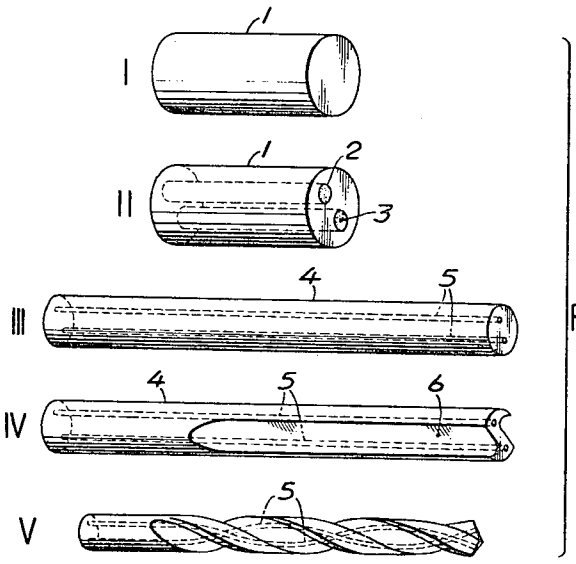

FIG. 1

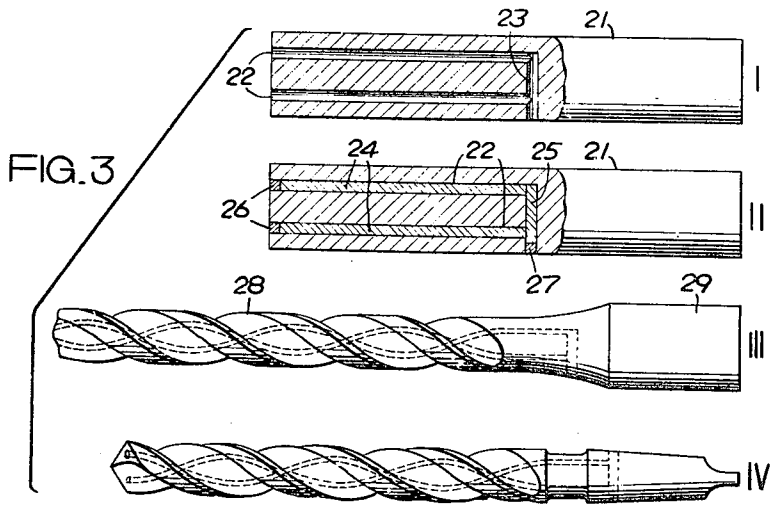

FIG. 3

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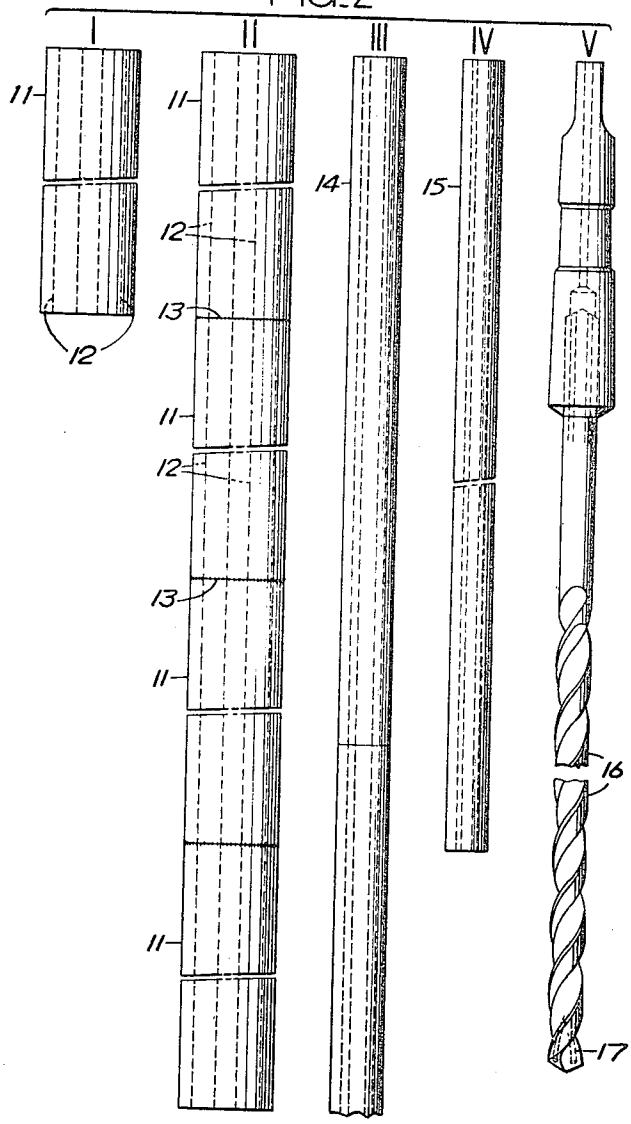
Filed Aug. 21, 1967 2 Sheets-Sheet 2

FIG. 2



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United States Patent Office

3,504,575

Patented Apr. 7, 1970

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METHOD OF MAKING FLUTED DRILL AND THE LIKE

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Filed Aug. 21, 1967, Ser. No. 661,976
Claims priority, application Japan, Oct. 3, 1966, 41/65,260
Int. Cl. B21k 5/02
U.S. Cl. 76—108 3 Claims

ABSTRACT OF THE DISCLOSURE

A method of making drills and the like having oil passages therein comprising boring holes, which are several times as large in diameter in cross-section as the oil passages in the intended drill or the like, in a thick stock material which is several times as large in cross-section as the intended drill or the like at required places, heating the stock material, forging or rolling the same by any method for forming them into an elongated intermediate stock material corresponding in diameter to the intended drill or the like, and finishing it by any method to provide a drill or the like having oil passages therein.

This invention relates to a novel method of making drills having in the interior thereof narrow oil passages extending in the direction of the edges. The invention is not limited to drills but also applicable to the manufacture of reamers and taps, these being herein generically referred to as drills and the like.

Such a drill has generally two very narrow oil passages leading from the front end to the shank, and these oil passages pass through the interior of the drill helically along the helical edges (refer, for example, to U.S. Patent No. 3,073,189). It is, therefore, generally impossible to bore oil passages after manufacture of the drills, it being usual to bore them linearly in the drill stock material prior to the twisting step. In general, such drills with oil passages are produced in such a way that two narrow holes (usually 1.5–3.0 mm. in diameter) of the same diameter as that of the oil passages in the final product are linearly bored in a cylindrical steel stock material of substantially the same size as the intended drill diameter and the stock is then subjected to fluting operation and finally twisted. However, boring a very narrow hole such as oil passage in a steel stock of considerable length (usually 250–400 mm.) is no easy task and the efficiency of manufacture is very low. Of course, narrow holes themselves do not require any high accuracy in dimensions, since they have only to allow oil to pass therethrough. However, offset boring conditions such as, for example, two narrow holes being contacted with each other or deviated toward the outer peripheral surface or flutes of the drill are undersirable. Therefore, this boring operation on steel stocks requires relatively high skill and carefulness. In fact, the conventional methods have involved a considerable amount of waste articles.

The invention aims to rationalize the manufacture of drills and the like having narrow elongated oil passages difficult to bore by the usual methods, by providing a method entirely different from the conventional techniques, and it is characterized by using as a stock a steel material such as a round bar billet or ingot thicker than the intend final product, boring large holes in said thick stock, heating and subjecting it to extrusion, forging or rolling by any suitable machines including presses, hammers, swagers and rolls for stretching it to a desired diameter, followed by the conventional processes for finishing it into a drill or the like.

Further, according to the invention, the large holes bored in the thick stock material may be filled with a heat-resistant powder or granular medium or low melting point material and then sealed so that the holes can be advantageously prevented from being excessively distorted in the subsequent stretching operation.

Further, according to the invention two or more thick stocks having large holes bored therein may be welded in series to provide an intermediate stock, thus making it possible to make a number of drills and the like by stretching said intermediate stock.

These and other objects and features of the invention will appear from the following description with reference to the accompanying drawings, in which:

FIGS. 1–3 are flow sheets showing the sequence of steps for embodying the present method.

Referring to the drawings, a square or round billet **1** which is several times as long as the intended drill is prepared (FIG. 1, I). Holes **2** which are several times as large in diameter as the oil passages in the intended drill are bored in this billet axially thereof at suitable places (FIG. 1, II). The boring may be very easily effected with the ordinary degree of technique by using a usual boring or drilling machine without requiring any special technique and carefulness. If necessary, a heat-resistant powder or granular medium **3** such as hard carbon and alumina is stuffed in said large holes **2** with a suitable degree of stuffing hardness (FIG. 1, II) and the opposed ends of the holes are then suitably sealed. The billet is then heated to a working temperature and either forged by a press, hammer or swager or rolled, thereby decreasing the diameter and increasing the length to provide an elongated intermediate stock material **4** corresponding in diameter to the intended drill (FIG. 1, III). In this forging or rolling operation, the large holes **2** in said thick stock material **1** are squeezed while retaining the medium **3** stuffed therein, so that they are transformed into narrow holes **5** (FIG. 1, III). These holes have the same narrowness or diameter as the oil passages in the intended drill. In this case, if the stuffing medium **3** is employed, the support action thereof will prevent the large holes **2** from being excessively distorted when they are transformed into narrow holes **5**. Then, the seals are removed (or the stock material is slightly cut or turned at the opposed ends thereof) to take out the medium **3**. Thereafter, required flutes **6** are formed in the intermediate stock material **4** on the opposed sides (FIG. 1, IV) and the material is finished as by twisting by the known method to provide the final product (FIG. 1, V).

FIG. 2 shows another mode of embodying the invention, where a short billet **11** which is several times as thick as the intended drill is prepared and holes **12** which are several times as large in diameter as the intended oil passages are bored therein at suitable places, thereby providing a stock material (FIG. 2, I). Then, a number of such stock materials are fused at **13** in series as by electric resistance welding to provide an intermediate stock material (FIG. 2, II) which is long enough to produce a number of final drills therefrom, the welds **13** being subjected to boring so that the holes **12** may penetrate throughout the length. Thereafter, the intermediate stock material is subjected to stretching or drawing several times at ordinary temperature for decreasing the diameter and increasing the length, thereby providing an elongated secondary intermediate stock material (FIG. 2, III). Thereafter, twisting operation may be applied thereto to form it into a desired drill (FIG. 2, III–V).

As fully described above, according to the method of the invention large holes previously bored in a stock material having a diameter several times as large as that of a final drill or similar product are finally transformed into narrow holes, so that there is no need of

boring narrow holes of the same diameter as the oil passages as in the conventional methods. Moreover, boring such large holes in short stock materials is very easy in view of machining technique involved. Further, as there is no danger of causing offset as in boring of narrow holes, two oil passages in a final drill or similar product have maintained the distance therebetween, without deviation toward the outer periphery, thus effectively contributing to the passage of oil.

EXAMPLE 1

A round steel bar **21** which is 21 mm. in diameter and 232 mm. in length is prepared and two round holes **22** with a diameter of 5 mm. are bored therein with a drill from one end for a length of 140 mm., the terminal ends of the holes being communicatively interconnected by a transverse hole **23** (FIG. 3, I). Then copper wires **24** and **25** are inserted in the round holes **22** and transverse hole **23** and the ends of these holes are sealed by plugs **26** and **27** (FIG. 3, II). The portion of the round steel bar in which the holes exist is dipped in a salt bath and heated to about 1,000° C., whereupon said portion is passed in a twist die for extrusion, thereby providing an intermediate product having a diameter of 16 mm., about 220 mm. long edge portion **28** and about 130 mm. long shank portion **29** (FIG. 3, III). Subsequently, it is hardened at about 1220° C., whereupon the copper wires are melted to flow out. Finally, it undergoes the usual turning and grinding operations whereby it is finished into a drill (FIG. 3, IV).

EXAMPLE 2

A round steel bar **11** which is 18 mm. in diameter and 230 mm. in length is prepared and two round holes **12** with a diameter of 5.5 mm. are bored therein with a drill throughout the length thereof with a spacing of 8 mm. between the holes (FIG. 2, I). Then, a suitable number of such bored round steel bars **11** are joined in series by welding **13** and the joined portions being bored to break through the round holes **12** (FIG. 2, II). It is then annealed and drawn. The drawing operation is effected at a temperature of 200–300° C., using a lubricant oil, in several steps, followed by an intermediate annealing and it is finally worked into a long-sized round steel bar **14** having a diameter of 10.5 mm. (FIG. 2, III). Then, this long-sized round bar is cut ito lengths of 300 mm., each being subjected to drawing operation to provide a long-sized round steel bar having a diameter of 8.0 mm. Then, this long-sized round steel bar is cut into lengths of 500 mm. to provide the final stock materials **15** (FIG. 2, IV), whereupon they undergo the usual operations including inverse lead cutting, twisting, fluting, hardening, tempering and heading, whereby they are finished into tapered drills **16** having oil passages **17** (FIG. 2, V).

While particular embodiments have been shown and described herein, it is to be understood that the invention is not limited thereto but shall cover and include any and all modifications which fall within the scope of the invention as hereinafter claimed.

What is claimed is:

1. A method of making drills and the like having oil passages therein comprising boring holes, which are several times as large in diameter in cross-section as the oil passages in the intended drill or the like, in a thick stock material which is several times as large in cross-section as the intended drill or the like at required places, heating the stock material, forging or rolling the same by any method for forming them into an elongated intermediate stock material corresponding in diameter to the intended drill or the like, and finishing it by any method to provide a drill or the like having oil passages therein.

2. A method as claimed in claim **1** wherein a heat-resistant powder or granular medium or low melting point metal is stuffed in the large holes in the thick stock material and the holes are then sealed, said medium or metal being removed later.

3. A method as claimed in claim **1** wherein a number of thick stock materials having large holes bored therein are lengthwise joined by welding.

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BERNARD STICKNEY, Primary Examiner

U.S. Cl. X.R.

72—464