June 5, 1951 M. HORSKY ET AL 2,555,746

DRILL

Filed Dec. 28, 1945 2 Sheets-Sheet 1

Fig. 1.

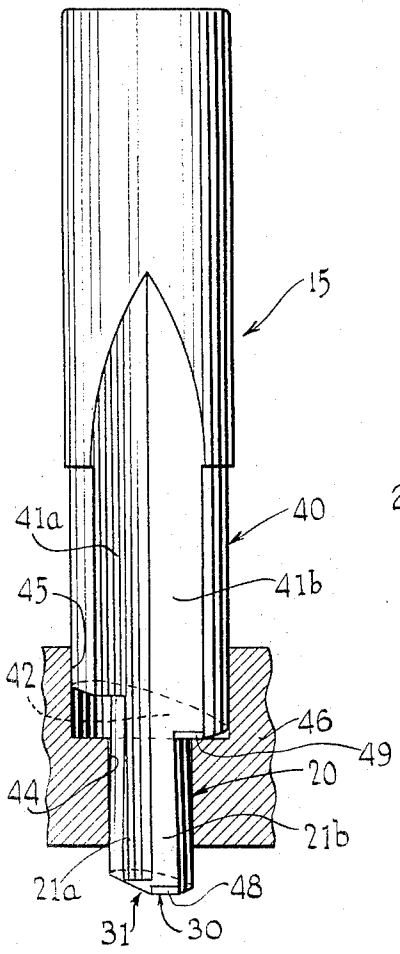


Fig. 3.

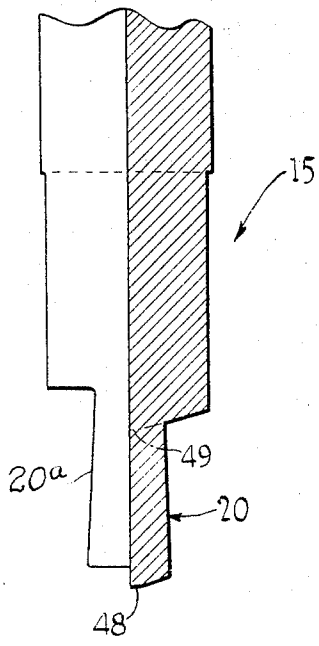


Fig. 4.

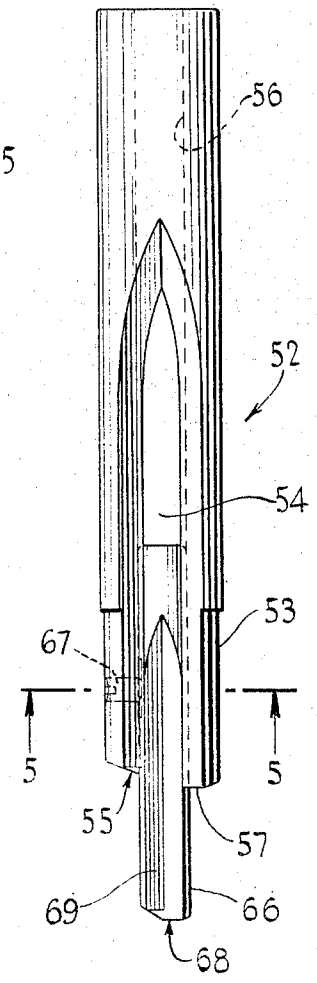


Fig. 5.

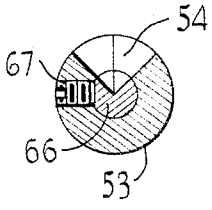


Fig. 2.

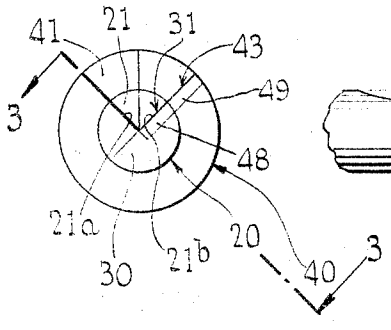
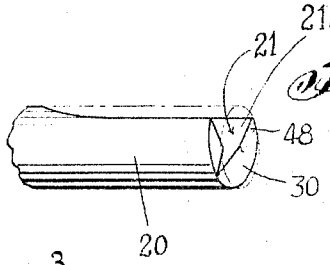


Fig. 2a.



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June 5, 1951 M. HORSKY ET AL 2,555,746

DRILL

Filed Dec. 28, 1945 2 Sheets-Sheet 2

Fig. 6.

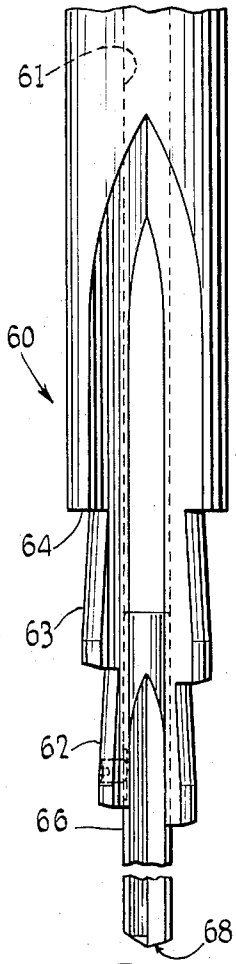


Fig. 7.

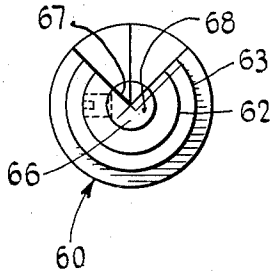


Fig. 10.

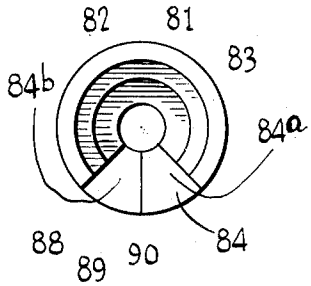


Fig. 9.

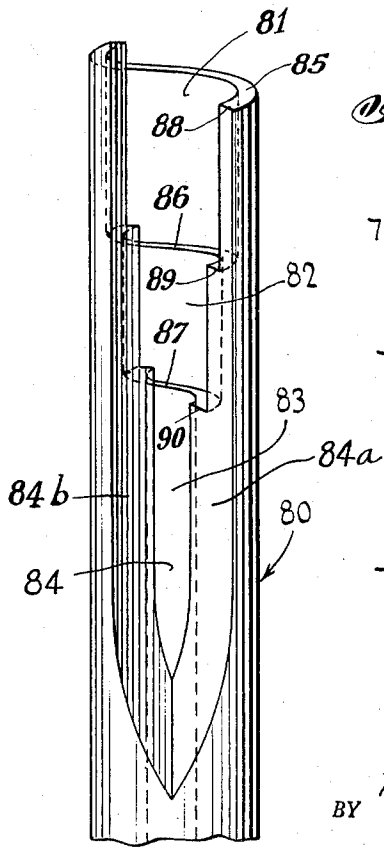


Fig. 8.

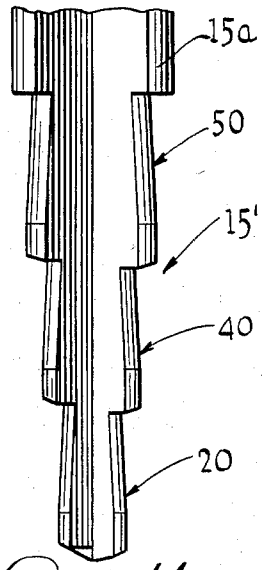


Fig. 11.

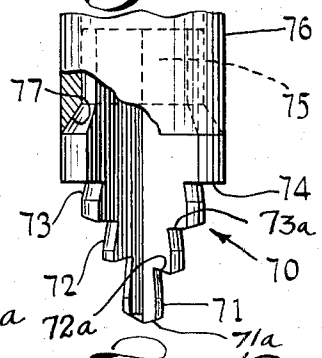
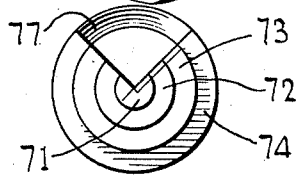


Fig. 12.



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Patented June 5, 1951 2,555,746

UNITED STATES PATENT OFFICE

2,555,746

DRILL

Milo Horsky and Rudi W. Mandl,
Long Island City, N. Y.

Application December 28, 1945, Serial No. 637,565

4 Claims. (Cl. 77—67)

1

Our invention relates generally to drills. More particularly our invention is concerned with an improved design for drills having a single cutting edge.

One of the objects of our invention is to provide a single cutting edge drill of the character described which shall be so constructed and arranged as to be particularly suitable for use in drilling soft metals, such as, for example, brass, aluminum or magnesium without leaving a faulty rake, while at the same time being capable of satisfactory use for all other drillable materials.

Another object of our invention is to provide a single edge drill of the character described by means of which a stepped-diameter hole may be drilled at one operation and in which the portions of the hole which are of different diameters may also vary in length, thus effecting a great saving of time in drilling operations, and at the same time making it possible to do precision drilling with all holes of uniform diameter and depth.

A further object of our invention is to provide a drill of the class described, having a single cutting edge which may be adapted for use as a reverse drill to turn down the diameter of the working piece to a predetermined size or to a set of different sized diameters.

Still another object of our invention is to provide a drill of the character described which shall be so constructed as to reduce drill breakage to a minimum by preventing jumping at the end of the operation, especially when drilling through thin material.

Other objects of our invention will hereinafter be pointed out or will become apparent from the description of the invention to follow.

In the accompanying drawings,

Fig. 1 is a front elevational view of a drill constructed and arranged in accordance with our invention;

Fig. 2 is a bottom plan view thereof;

Fig. 2*a* is a perspective view of a portion of the drill shown in Fig. 1 to reveal the helical contour of the bottom thereof;

Fig. 3 is a vertical sectional view of a portion of the drill taken substantially along the line 3—3 of Fig. 2;

Fig. 4 is a view, similar to Fig. 1, but illustrating a modified form of our invention;

Fig. 5 is a cross-sectional view, taken substantially along the line 5—5 of Fig. 4;

Fig. 6 is a view similar to Fig. 4, but illustrating a further modification of our invention;

Fig. 7 is a bottom plan view thereof;

Fig. 8 is a view similar to Fig. 1, but illustrating another modification of our invention;

Fig. 9 is a front elevational view of a drill arranged in reverse form with respect to the drill illustrated in Fig. 6;

Fig. 10 is a top plan view thereof;

2

Fig. 11 is a front elevational view of a drill illustrating still another modification of our invention; and

Fig. 12 is a bottom plan view thereof.

Referring now in detail to the drawings and more particularly to Figs. 1, 2, 2*a*, 3 and 8 thereof, we have shown an improved type of drill constructed and arranged in accordance with our invention and comprising a cylindrical bar 15 of any well known material suitable for making drills. The cylinder 15 is provided with an effective cylindrical drilling portion 20 of predetermined length having a triangular shaped segment 21 of the cylinder removed forming the two sides 21*a* and 21*b* with the apex substantially coinciding with the axis of the drilling cylinder 20. The segment 21 extends upwardly from the lower end surface of the drill and lengthwise thereof for a suitable distance and is designed to furnish an egress for the drilling chips. We have found that satisfactory results are obtained when the apex angle of the segment formed between the sides 21*a* and 21*b* lies within the range of from approximately 30 degrees to less than 180 degrees. The preferred angle, however, is approximately 90 degrees. The segment 21 may be provided by milling or by any other suitable process.

Since the drills illustrated in Figs. 1, 2 and 3 and 8 are designed for rotation in a clockwise direction, as viewed in the drawings, the radial edge 31 of the side 21*b* formed by the cylinder 20 and the segment 21 serves as the cutting edge of the drill.

In accordance with our invention, it is noted that the bottom end of the drilling portion 20 is made in the form of a helical surface 30 so as to provide a rake, the angle of which shall be less than 90 degrees with respect to the sides 21*a* and 21*b* or the segment 21.

In order to prevent binding of the drill, a portion 20*a* of the diameter of the drilling cylinder 20 away from the cutting edge 31 may be tapered down, as shown.

In actual practice the angle of the rake formed as above noted need be only a few degrees and the slant should preferably be equal in length to the unit of the angle so that if the lengthwise surface is ground to sharpen the drill the length of the drilling cylinder will remain unaltered.

It is noted that while we have described our invention for an improved type of drill as applied to a single drilling cylinder 20, it is noted that any desired combination of multiple drilling cylinders may be provided in which all the said drilling cylinders, which are of successively larger diameters, have a common axis, namely the longitudinal axis of the drill. Thus, for example, in Figs. 1, 2, and 3 we have shown a drill unit 15 having two drilling cylinders 20 and 40, the cylinder 40 being larger in diameter than the cyl-

inder 20 and being similar in construction and function thereto. The said cylinder 40 comprises a cut out triangular segment 41 formed by the sides 41a and 41b and having its apex forming a continuation of the apex of the segment 21, the side 41b terminating in the cutting edge 43.

The bottom annular surface 42 of the cylinder 40 is of helical formation, similar to the helical surface 30 of the cylinder 20.

As shown in Fig. 1, when this multiple cylinder drill is used it will form a hole of stepped construction comprising the hole portions 44 and 45 in the block of material 46.

In Fig. 8 of the drawings we have shown our multiple drill is provided with three drilling cylinders 20, 40 and 50, each successively larger in diameter and all three cylinders having a common axis. The drill cylinder 50 is similar in purpose, function and construction to that of the herein described drilling cylinders 20 and 40. An enlarged diameter portion 15a of the cylinder at the upward termination of the drill cylinder serves as a stop.

While in the drawings we have illustrated the drills 15 and 15' to be of one piece unitary construction, it is noted that the drills may also be made with the drilling portions as individual units adapted to be nestably received one within the other to form the drills shown in either Fig. 1 or Fig. 8.

If desired the drills of our invention may be made of relatively inexpensive material in which case the cutting edge areas may be tipped with the better grade steel or alloy as shown by the numerals 48 and 49 in Figs. 1 and 2 of the drawings.

In Figs. 4 to 7 we have shown the drill of our invention as adapted for use with a pilot.

In Figs. 4 and 5 there is shown a drill 52 having a single drilling cylinder 53 provided with a cut-out segment 54, and a helical bottom surface 55 similar in design and function to the segment 21 and helical surface 30 shown in the Fig. 1 form of invention. In this form of invention we provide the drill 52 with an axial bore 56 of predetermined diameter through which a suitable coolant of any kind well known to the art, may be brought to the cutting edge 57 by any well known means for supplying the coolant, such as, for example, through a tube from a source.

Similarly it is noted that in Figs. 6 and 7 we have illustrated the drill 60 of our invention, having an axial bore 61 similar to the axial bore 56 of the drill 52, but in this form, the drill 60 is provided with two drilling cylinders 62 and 63 terminating at its upper end in a stop shoulder portion 64, similar to the drilling cylinders 40 and 50, and the stop 15a of the Fig. 8 forms of invention hereinbefore described.

In the forms of our invention illustrated in Figs. 4 to 7 the axial bores 56 and 61 may be utilized for mounting therein a pilot drill 66. The pilot drill 66 may be of any suitable length and may be maintained in place by a headless set screw 67, as shown.

To provide a clear path for the egress of the drilling chips from the pilot 66, the said pilot drill is preferable of similar construction to that of the drilling cylinders 53, 62 or 63. In other words, the pilot drill 66 is provided with a lengthwise cut-out segment 69, and helical bottom surface 68, similar to the segment 21 and bottom edge 30 of the Fig. 1 form of invention except that the cutting edge 68 is inclined at a greater

angle so that the pilot drill may more readily be centered.

Whenever it is desired to drill a hole of greater depth than the length of the average drill, a drill 70, as shown in Figs. 11 and 12, constructed and arranged in accordance with the construction of the drills 50 or 60 hereinbefore described may be employed. The said drill 70 is provided with multiple drilling cylinders 71, 72 and 73 and a stop portion 74, similar in purpose and function to the hereinbefore described drills 15, 52 or 60, except that there is provided at the top end a reduced shank portion 75 adapted to be functionally received in a tube 76 of any desired length and at least equal in diameter to that of the diameter of the drill 70. The edge 77 of the tube 76, adjacent the drill 70 may be tapered off substantially to a point, as shown in Fig. 11 so as not to block the free passage of the drilling chips. It is noted that the shank portion 75 is provided with a cut out lengthwise segment forming a continuation of the cut-out segment of the drill 70.

It is noted that the cutting edge 72a of the drill segment 72 is tapered downwardly from the inner end instead of upwardly as the cutting edge 71a of the drill segment 71 or straight, as the cutting edge 73a of the drill segment 73. All of these forms of slanting or straight cutting edges have been found to be effective and may be employed in the other forms of drills illustrated in the drawings.

In Figs. 9 and 10 we have shown a modified form of our invention which is in reality the reverse of the drill constructions shown in Figs. 1 to 8 and is adapted for turning down the diameter of the working piece to a smaller diameter or to a set of different diameters in a single operation. As noted in Figs. 9 and 10 the drill 80 is formed from a cylindrical rod having a series of adjacently disposed successively smaller holes 81, 82 and 83 drilled axially from one end of the rod 80 inwardly and for predetermined depths. A V-shaped segment 84 is cut out of the rod 80 formed by the sides 84a and 84b and with the apex substantially coinciding with the longitudinal axis of the drill 80. It is noted that the drill is provided with a series of annuli 85, 86 and 87, successively smaller in diameter. The intersection of the topmost annulus 85 with the side 84a of the segment 84 forms a first cutting edge 88 for turning down the work to the diameter of that of the opening 81 and for the depth of said opening. The intersection of the annulus 86 with the side wall 84a of segment 84 forms a second cutting edge 89 for turning down the work to the diameter of that of the opening 82. The intersection of the annulus 87 with the side wall 84a of the segment 84 forms a third cutting edge 90 for turning down the work for the predetermined depth.

The said annular surfaces 85, 86 and 87 are made of helical formation, similar to that of the helical surfaces 30 and 57 hereinbefore described.

It is noted that by the use of our drill as shown in Figs. 9 and 10 as above described, a cylindrical rod may be turned down to form a blank for the drill illustrated in Figs. 6 and 7.

It will thus be seen that there is provided a device in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment above

set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having described our invention, what we claim and desire to secure by Letters Patent is:

1. A drill of the character described comprising a cylindrical bar having an effective cylindrical drilling portion of determined length and diameter, a V-shaped groove in said drilling portion, said groove having flat sides running lengthwise thereof, the line of intersection of said two sides substantially coinciding with the longitudinal axis of said drilling portion, the apex angle between the planes of said flat sides being approximately between thirty degrees and approximately one hundred eighty degrees, one of said flat sides terminating at the bottom thereof at a point lower than the other flat side, the surface of the bottom edge of said drilling portion transversely interconnecting said terminating edges of said flat sides being substantially helical in contour, an axial hole through said cylindrical bar for feeding a coolant to said drill, the diameter of said hole being less than the diameter of said drilling portion, a pilot drill, and means for removably maintaining said pilot drill in said hole with the effective drilling part thereof extending below said drilling portion.

2. A drill according to claim 1 in which the angle between the said flat sides ranges from approximately 30 degrees to less than 180 degrees, in which the upper end of said cylindrical bar is provided with a reduced shank portion, a tubular member receiving said reduced shank portion therein, and in which the said reduced shank portion is provided with a V-shaped groove corresponding to and in alignment with the V-shaped groove in said drilling portion.

3. A single cutting edge drill of the character described comprising a cylindrical bar having a plurality of effective drilling portions, starting from the lowermost drilling portion, each drilling portion being of larger diameter than the next adjacent one, all of said drilling portions having a common longitudinal axis, a V-shaped groove in said cylindrical bar running lengthwise thereof and extending through all of said drilling portions, said groove comprising two flat sides, the longitudinal line of intersection of said two flat sides substantially coinciding with said common longitudinal axis, each drilling portion having a portion of each of said flat sides terminating in a transverse lower edge, the said terminating edges of one flat side of all the drilling portions being lower than the corresponding terminating edges of the other flat side, the surface of the bottom edge of each drilling portion interconnecting its pair of terminating edges being substantially helical in contour to provide a rake, the angle of which is less than 90 degrees with respect to the planes of said flat sides, an axial hole through said cylindrical bar for feeding a coolant, the diameter of said hole being less than the diameter of said lowermost drilling portion, a pilot drill, and means for removably maintaining said pilot drill in said hole with the effective drilling part thereof extending below said lowermost drilling portion.

4. A drill according to claim 3 characterized further in that said pilot drill comprises a second cylindrical bar having an effective drilling portion and a shank portion, a V-shaped groove in said last named drilling portion of the same contour and in alignment with said V-shaped groove extending through all of said drilling portions of said first cylindrical bar.

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