

BIT FOR REMOVING DAMAGED SCREWS



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FIELD OF THE INVENTION

This invention relates to a cylindrical bit for removing damaged screws by backing them out. More specifically, this invention relates to such a bit adapted for use in a power drill running in a counter-clockwise direction.

BACKGROUND OF THE INVENTION

In US patents 4,406,917, 4,777,850, 5,031,487, and 5,251,516 assigned to my assignee, there are disclosed various bits and other devices for removing broken bolts. US Patent 5,251,516, for instance, involves chucking a bit in a power drill and running the drill anti-clockwise and making a small hole in the broken end of the bolt. A reverse threaded device is then snugly inserted in the drill chuck and the bit is moved into the hole. The threads on the reverse threaded device catch the edges of the hole and spin the broken bolt out of the hole.

There has been a need for a device to remove screws, the heads of which have been damaged by rounding out the Philips screw cross recess or shearing off the side of the slot of a regular screw. Also, a screw remover has been needed for a screw in which the screw head has been covered by paint so that the recess or slot is no longer pronounced enough to get a good purchase on it by a screwdriver.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention, there is provided a bit for removing a threaded fastener having an axis, a threaded section and a head section, the head section being formed with a generally radial end surface having a damaged cross slot having sloping sidewall portions defining a first angle, the bit comprising:

a cylindrical extraction bit having an axis and a tip end formed with a point, the tip end having a pair of diametrically opposed longitudinal recesses, each bordered by a longitudinal surface facing in a counter-clockwise direction and having a scraping edge, the scraping edges lying in a first plane including the axis of the bit and defining a second angle;

the bit being arranged for use with a threaded fastener having a first angle sharper than said second angle and which is dimensioned such that, with the extraction bit axis



aligned with the axis of the fastener and the tip end inserted in the cross slot, the scraping edges engage the end surface of the fastener at the margin of the slot.

According to a second aspect of the present invention, there is provided, in combination, the bit of the first aspect and a threaded fastener having an axis, a threaded section and a head section, the head section being formed with a generally radial end surface, a damaged slot in the radial end face, the scraping edges of the bit engaging the radial end face of the fastener with the point generally disposed on the axis of the threaded fastener.

According to a third aspect of the present invention, there is provided, for removing damaged screws, a bit having an axis and a tip end formed with a point and a rear end formed in hexagonal cross-section adapted for installation in a chuck of a power drill drivable in the counter-clockwise direction, the tip end having a plurality of longitudinal recesses uniformly disposed about the tip end, each bordered by a scraping surface facing in a counter-clockwise direction, the scraping surface formed with a distal straight scraping edge, the scraping edges of the recesses each being disposed at a scraping edge acute angle to the axis less than about 70° , and a support portion behind each scraping edge, the support portions each defined by a relief surface curving away from the scraping edge down to a rearward edge bordering one of the longitudinal recesses being disposed at a more acute angle to the axis than the scraping edge acute angle.

According to a fourth aspect of the present invention, there is provided a method for unscrewing threaded fasteners installed in an object and having a head with a deformed end surface, the method comprising the steps of:

inserting a bit of the first or third aspects into the deformed end surface of the head of a threaded fastener, to engage the scraping edges of the bit against the end surface;

forcefully pressing the tip end with the scraping edges against the end surface of the fastener; and

driving the bit in the counter-clockwise direction.

According to a fifth aspect of the present invention, there is provided a method for unscrewing threaded fasteners installed in an object and having a head with a deformed end surface, the method comprising the steps of:

a. providing a power drill rotating in the counter-clockwise direction,

b. providing a cylindrical bit installed in the drill and having an axis and a tip end formed with a point, the tip end having a pair of diametrically opposed recesses, each bordered by a longitudinal scraping surface facing in a counter-clockwise direction and having a scraping edge lying in a plane including the axis, the scraping edges each being at a first acute angle to the axis, a support portion behind each scraping edge, the support portions each defined by a relief surface curving away from the scraping edge down to a rearward edge bordering one of the longitudinal recesses, each rearward edge lying in a second plane including the axis and being disposed at a second more acute angle to the axis than the first acute angle and

c. forcefully pressing the tip end with the scraping edges against the end surface of the fastener.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and features of the invention will be clear to those skilled in the art from a review of the following specification and drawings, all of which present a non-limiting form of the invention. In the drawings:

Fig. 1 is an elevational view partly in section of a bit embodying the invention installed in a power drill chuck and engaging a screw in the process being removed;

Fig. 2 is an enlarged sectional view through the bit scraping surfaces showing the engagement of the bit with the screw head;

Fig. 3 is a plan view, greatly enlarged, of a damaged screw and showing in broken lines the outline of the bit, and showing in a solid line a projection of the working edge of the bit;

Fig. 4 is a fragmentary perspective view of the tip of the bit;

Fig. 5 is a series of side views taken 90° apart around the periphery of the bit;

Fig. 6 is a perspective view similar to Fig. 4 of a second embodiment of the invention; and

Fig. 7 is a series of views similar to Fig. 5, but of the Fig. 6 embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS

A cylindrical bit is shown in elevation in Fig. 1 and generally designated 10. It is shown held in a chuck C by its hexagonal stem 12. The tip 14 is shown engaging the damaged head of a Philips screw S which is screwed into a block of wood W in the example shown, although it could be a self-tapping metal screw in a metal object.

The tip 14 of the bit comprises two longitudinal recesses 18 (Fig. 4) bounded by on one side a longitudinal scraping surface 20 facing in the counter-clockwise direction and having a scraping edge 22 which is preferably a straight line extending from the periphery 24 of the bit to the axis 26.

From the scraping surface 20 a transition surface 28 curves and meets the periphery 24 in the Fig. 4 embodiment. Generally perpendicular to the surfaces 20 and 28 is a longitudinal boundary surface 30 which faces clockwise and which has a rearward edge 32 which also is a straight line from periphery 24 to axis 26 of the bit. Next, there is a generally quarter-conical relief surface 34.

The slant of the edge 32 is somewhat greater than the slant of the edge 22. This accentuates the edge 22 and assures that the surface 34 does not merely ride in the metal of the screw, keeping the edge 22 from performing its digging function. As an example, the edge 32 is made at an angle in a range of about 40 to 50°, preferably 45°, to the axis, while the edge

22 is about 70° to the axis. The surface 34 gradually curves from edge 32 up to 22. The metal defined by surface 34 serves to back up and support the scraping surface 20.

The scraping edge 22a of the second sector is in the same plane as the first, and the two scraping edges are in the same plane and intersect at the axis of the bit in a point 36. Parts of the second sector (Fig. 5) are designated by the same reference numeral as the first, with an "a" added.

The angle A (Fig. 2) between the edges 22 is preferably about 140° . This angle is less sharp than the angle at the bottom of the cross slot of the Philips recess (Fig. 2). As a result, the edges 22 of the bit engage the portions of the top of the screw at points P well out from the axis and have good purchase and leverage on the screw well out from its axis to break it away from its firm engagement with the wood and put it into rotation with the bit and back it out.

The point 36, having the angle of about 140° when engaging the vestiges of a standard screw slot serves as a centering means. As in Figs. 2 and 3, it is the portions of the screw well out from the center which the edges 22 engage and effectively scrape (note the scrapings in Fig. 3 ahead of the edges) and rotate the screw out of its hole.

Second Embodiment

A second embodiment of the invention is shown in Figs. 6 and 7. Because it represents the simplest way to manufacture the product, it is the preferred or "best mode" form of the invention.

To each element of the Figs. 6, 7 embodiment the same reference number has been applied as the like element in the previous embodiment, augmented by 100.

The Figs. 6 and 7 embodiment comprise the cylindrical bit 124 having an axis and a tip end which comes to a point 136. At diametrically opposite positions the tip end is formed with recesses 118. The recesses each are defined by a planar counter-clockwise-facing scraping surface 120, 120a having a scraping edge 122, 122a.

As shown in the views comprising Fig. 7, the surface 120, 120a is backed by a support portion defined by an upward rounded surface 134, 134a which drops down to a rearward edge 132, 132a at a sharper incline than the scraping edge 122, 122a. The recesses 118, 118a are also defined by a downwardly curved surface 130, 130a extending down from the rearward edges 132, 132a. The surfaces 120 and 120a are in the same plane which includes the axis of the bit and the scraping edges 122, 122a are at angles of about 70°. The rearward edges 132, 132a are also in the same plane as the axis.

The use of the second embodiment of the invention is the same as the use of the first embodiment. The bit is rotated counter-clockwise in a power drill. The scraping edges 122 and 122a are brought into engagement with the deformed fastener head as shown for example in Fig. 2 with contact made in positions well outward from the axis of the fastener. This assures a firm purchase of the fastener by the scraping surfaces and results in a "digging" into the top face of the fastener, developing a line of upwardly plowed metal as roughly indicated in Fig. 3.

The bit of the invention may be used to remove screws from wood or metal, or to remove bolts with damaged heads from the threaded element in which they are installed. In short, it can be used to remove any threaded fastener having a deformed head from the object into which it is threaded.

Further variations in the invention are possible. For instance, the bit may be formed with three recesses and three scraping surfaces instead of the two diametrically opposed recesses and two scraping surfaces as described. Thus, while the invention has been shown in limited embodiments, it is not so limited but is of a scope defined by the following claim language which may be broadened by an extension of the right to exclude others from making, using or selling the invention as is appropriate under the doctrine of equivalents.

WHAT IS CLAIMED:

1. A bit for removing a threaded fastener having an axis, a threaded section and a head section, the head section being formed with a generally radial end surface having a damaged cross slot having sloping sidewall portions defining a first angle, the bit comprising:

a cylindrical extraction bit having an axis and a tip end formed with a point, the tip end having a pair of diametrically opposed longitudinal recesses, each bordered by a longitudinal surface facing in a counter-clockwise direction and having a scraping edge, the scraping edges lying in a first plane including the axis of the bit and defining a second angle;

the bit being arranged for use with a threaded fastener having a first angle sharper than said second angle and which is dimensioned such that, with the extraction bit axis aligned with the axis of the fastener and the tip end inserted in the cross slot, the scraping edges engage the end surface of the fastener at the margin of the slot.

2. The bit as claimed in claim 1 including a support portion behind each scraping edge, the support portions each defined by a relief surface curving away from the scraping edge down to a rearward edge bordering one of the longitudinal recesses, the rearward edges both lying in a second plane including the axis and being disposed at a third angle sharper than the second angle.

3. In combination, the bit as claimed in claim 1 and a threaded fastener having an axis, a threaded section and a head section, the head section being formed with a generally radial end surface, a damaged slot in the radial end face, the scraping edges of the bit engaging the radial end face of the fastener with the point generally disposed on the axis of the threaded fastener.

4. A bit as claimed in claim 1, wherein there are two diametrically opposite longitudinal recesses and the scraping edges of the two recesses lie in the same longitudinal plane, which plane includes the axis of the extraction bit.

5. A bit as claimed in claim 1, wherein the scraping edges of the bit are adapted to engage the radial end face of the fastener with the point generally disposed on the axis of the threaded fastener.

6. A bit as claimed in claim 1 or 2, wherein the second angle is about 70° to the axis of the extraction bit.

7. For removing damaged screws, a bit having an axis and a tip end formed with a point and a rear end formed in hexagonal cross-section adapted for installation in a chuck of a power drill drivable in the counter-clockwise direction, the tip end having a plurality of longitudinal recesses uniformly disposed about the tip end, each bordered by a scraping surface facing in a counter-clockwise direction, the scraping surface formed with a distal straight scraping edge, the scraping edges of the recesses each being disposed at a scraping edge acute angle to the axis less than about 70° , and a support portion behind each scraping edge, the support portions each defined by a relief surface curving away from the scraping edge down to a rearward edge bordering one of the longitudinal recesses being disposed at a more acute angle to the axis than the scraping edge acute angle.

8. A bit according to claim 7, wherein the bit is cylindrical.

9. A bit according to claim 7, wherein the scraping surface is longitudinal.

10. A bit according to claim 7, wherein each scraping edge is in a plane including the axis.

11. A bit according to claim 7, wherein the scraping edge acute angle is about 70° to the axis.

12. A bit according to claim 7, wherein each rearward edge is in a plane including the axis.

13. A method for unscrewing threaded fasteners installed in an object and having a head with a deformed end surface, the method comprising the steps of:

inserting a bit as defined in any one of claims 1, 2 and 4 to 12 into the deformed end surface of the head of a threaded fastener, to engage the scraping edges of the bit against the end surface;

forcefully pressing the tip end with the scraping edges against the end surface of the fastener; and

driving the bit in the counter-clockwise direction.

14. A method for unscrewing threaded fasteners installed in an object and having a head with a deformed end surface, the method comprising the steps of:

- a. providing a power drill rotating in the counter-clockwise direction;
- b. providing a cylindrical bit installed in the drill and having an axis and a tip end formed with a point, the tip end having a pair of diametrically opposed recesses, each bordered by a longitudinal scraping surface facing in a counter-clockwise direction and having a scraping edge lying in a plane including the axis, the scraping edges each being at a first acute angle to the axis, a support portion behind each scraping edge, the support portions each defined by a relief surface curving away from the scraping edge down to a rearward edge bordering one of the longitudinal recesses, each rearward edge lying in a second plane including the axis and being disposed at a second more acute angle to the axis than the first acute angle; and
- c. forcefully pressing the tip end with the scraping edges against the end surface of the fastener.

15. A method as claimed in claim 14, wherein the first acute angle is less than about 70°.

16. A method as claimed in claim 15, wherein the first acute angle is about 70°.