Nov. 17, 1959 J. D. ROBINSON 2,912,890

STUD REMOVERS

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Fig. 1.

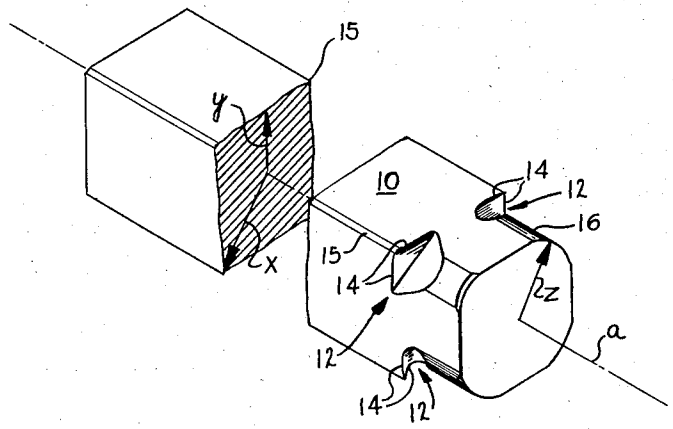


Fig. 2.

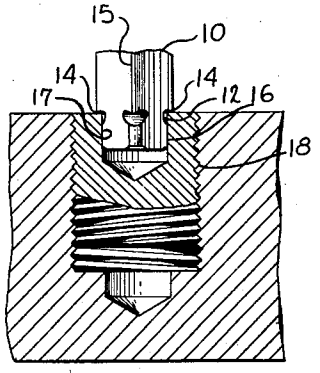
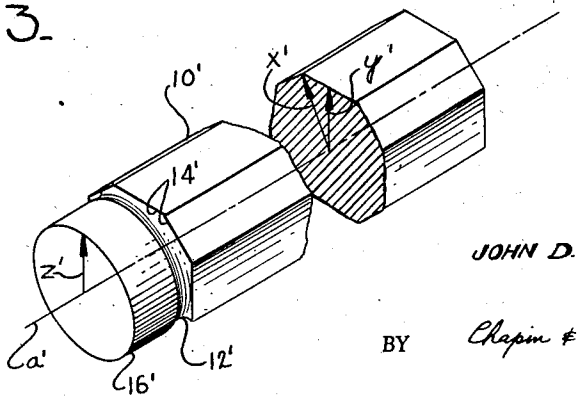


Fig. 3.



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STUD REMOVERS

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The present invention relates to improvements in stud removers as are used in removing threaded studs which have broken so that wrenches or screwdrivers cannot be used in conventional fashion.

Many different devices of the present type have been devised in the past with most if not all of these prior devices based on the same general principles of operation. That is, a hole is drilled centrally of the broken stud and the stud remover is then forced into this hole in a manner which enables a torque to be applied to the broken stud and thereby provide for its removal.

The improved stud remover of the present invention will also respond to this same general description, however, in accordance with the objects of the invention, the present stud remover overcomes most, if not all of the shortcomings of the prior art. Two predominant features will be found in the ease and efficiency with which this novel stud remover may be used and of equal importance the simplicity and economy of its manufacture.

While the patent art shows a large number of different stud removers, it is worth noting that only one of these is in widespread use today. This type of remover is formed with a tapered, spiral fluted end which is driven into the hole above referred to which is drilled in the broken stud. Over and above the relatively high expense of this type of stud remover, a fair amount of skill is required in its use. The tapered end thereof must, most generally, be driven into the broken stud by the use of a hammer. Any off-center blows of the hammer tend to "break" the tapered grooves being formed by the spiral flutes in the stud to be removed and thus lessen the torque which can be applied in removing the broken stud. Another factor to be considered is that for removing studs having right hand threads, the spiralled flutes must be formed in left-handed fashion and would not be suitable for removing broken studs having left hand threads. The stud remover of the present invention overcomes these limitations in a manner which is described in detail hereinafter.

Yet another feature that will be apparent from the following specification is the simple and economical method for making stud removers which is provided in accordance with other objects of the invention.

The above and other related objects and features of the invention will be apparent from a reading of the following description of the disclosure found in the accompanying drawing and the novelty thereof pointed out in the appended claims.

In the drawing:

Fig. 1 is a perspective view, not drawn to any particular scale, of a stud remover of the present invention;

Fig. 2 is a section, on a relatively smaller scale, illustrating the manner of using the stud remover of Fig. 1; and

Fig. 3 is a perspective view of an alternate form of stud remover embodying the present invention.

The stud remover seen in Fig. 1, comprises an upper portion 10 which is preferably of a length sufficient for

a firm finger grip say in the order of 2 to 5 inches, though a longer or shorter length could be tolerated. The upper portion 10 has a generally square cross section, the corners of which are undercut by a groove 12 which forms shearing edges 14 at the lower end of each corner of the upper portion 10. In order to avoid any undue stress concentrations, each corner is flatted at 15 particularly at the lower ends thereof where the shearing edges are formed.

For convenience, reference will be made to the longitudinal axis of the stud remover indicated at *a*. The distance *x* from the axis *a* to any corner is the major radius of the cross section and the distance *y* from the axis *a* to the midpoint between corners is the minor radius of the cross section.

With these terms of reference in mind it will be seen that an integrally formed pilot 16 is formed at the lowermost end of the stud remover about a radius *z* extending from axis *a*. Preferably the groove 12 extends below the radius *z* to provide chip clearance for purposes which later appear.

In use, a hole 17 is drilled in a broken stud 18 (Fig. 2) of a diameter approximating or slightly greater than that of the pilot 16 so that the pilot may be inserted therein. The shearing edges 14 are forced into the stud, preferably by striking the upper end of the portion 10 with a hammer. The edges 14 shear or broach grooves in the stud 18 with no outward displacement of stud material which might make removal of the stud more difficult. It will be seen that the groove 12 provides clearance for chips resulting from this broaching operation.

When the grooves of sufficient length have been formed in the stud 18, usually ¼ inch or more, a wrench may be applied to the upper portion 10 and the broken stud 18 readily turned out of its threaded hole. Thereafter the stud may be tapped with a hammer to disengage it from the stud remover.

It will be apparent that with the corner of the portion 10 being parallel to the axis *a*, studs with either right or left hand threads may be removed with equal ease. This feature is also of advantage in enabling studs to be oscillated as they are being removed to break them free from burrs or the like which may result from the manner in which the stud is broken.

The above-described stud remover is extremely simple to manufacture, it being necessary merely to sever a piece of the desired length from a bar of commercially available square stock. The piece of square stock may then be inserted in a rotating chuck and the groove 12 and pilot 16 formed by lathe tools, or a grinding wheel. When used the flats 15 may be formed as by grinding either before or after the above operations. Preferably the heat treating or hardening of the stud remover is done in such a manner that the above describes all the machining necessary. This stud remover may be formed by grinding operations performed on a length of hardened material such as a square tool bit of high carbon steel. Alternatively, it may be formed by machining a length of soft or tempered steel which may be subsequently heat-treated for desired hardness according to known techniques which are designed for minimum distortion.

It is further preferable that the shearing edges 14 and marginal portions adjacent thereto be extremely hard while the remainder of the upper portion 10 possesses the primary characteristic of toughness to withstand the hammer blows that are needed in forcing the remover into a broken stud as well as the torque applied in removing the stud. This combination of characteristics may be obtained either by a skin hardening process such as carburizing or by a selective heat treating process employing dielectric heating elements.

From Figs. 1 and 2 and the above description, it will be apparent that the depth of grooves cut in the stud **18** is essentially dependent on the difference between the major radius x and the pilot radius z. It is also apparent that the pilot radius z should never be substantially less than the minor radius y. For a square section .250 inch on a side as illustrated, with flats **15** being .005 inch wide, radius x is .171 inch, radius y is .125 inch and radius z is .165 inch. Thus for ordinary soft steel screws the preferred ratio of radius z to radius x is approximately .964.

Stud removers can be fabricated according to the present invention from lengths of stock having cross sections of other regular polygons. Thus, for example, a triangular cross section may be preferred for smaller stud removers.

On the other hand a stud remover of hexagonal cross section as seen in Fig. 3 may advantageously embody the present invention. Like reference characters, primed, are used in designating the various portions of the stud remover in Fig. 3 since they correspond to the showing of Fig. 1. It will be seen that the pilot radius z' is the same length as the minor radius y'. The greater included angle between adjacent sides of the corners minimizes the need for the flats **15** seen in Fig. 1 and they have accordingly been eliminated. The ratio between radius x' and radius z' has been decreased to .866 in view of this greater included angle which would cause a greater tendency of the remover to displace stud material outwardly when a torque is applied to a broken stud for removal in the manner taught above.

The method of forming and using the remover seen in Fig. 3 may follow the various teachings detailed above with respect to Fig. 1.

While it is the preferred practice of the present invention to form stud removers from stock having a regular polygonal cross section, all aspects of the invention are not so limited and advantageously may be found in using any stock having longitudinally extending corners parallel to a central axis thereof.

Having thus described the invention, what I claim as novel and desire to secure by Letters Patent of the United States is:

1. A stud remover comprising an upper portion having longitudinal corners parallel to a central axis, said corners being undercut to form shearing edges at the lower end of each corner and an integrally formed pilot beneath said corners formed on a radius from said central axis less than the major radius to said corners and at least as great as the minor radius from said axis to the nearest outer surface of said upper portion.

2. A stud remover comprising an upper portion having longitudinal corners parallel to a central axis and a given cross section throughout its length to receive a wrench or the like, said corners being undercut to form shearing edges at the lower end of each corner and an integrally formed pilot beneath said corners formed on a radius from said central axis less than the major radius to said corners and at least as great as the minor radius of said axis to the nearest outer surface of said outer portion.

3. A stud remover comprising an upper portion having a regular polygonal cross section throughout its length and providing corners parallel to a central axis, a peripheral groove undercutting said corners to form shearing edges at the lower end of each corner and an integrally formed pilot beneath said corners formed on a radius from its central axis and at least as great as the minor radius from said axis to the midpoint between adjacent corners.

4. A stud remover as in claim 3 wherein the shearing edges are relatively hard and wherein the remainder of the upper portion is relatively tough to resist impact and torsional stresses.

5. A stud remover comprising an upper portion having a square cross section providing longitudinal corners parallel to a central axis, a peripheral groove undercutting said corners to form shearing edges at the lower end of each corner and an integrally formed pilot at the lowermost end of said remover formed on a radius from said central axis less than the major radius to said corners and at least as great as the minor radius of said axis to the midpoint between adjacent corners.

6. A stud remover as in claim 5 wherein the ratio of the pilot radius to the major radius approximates .964.

7. A stud remover as in claim 5 wherein the corners of said upper portion are flatted to a width approximating .005 inch.

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