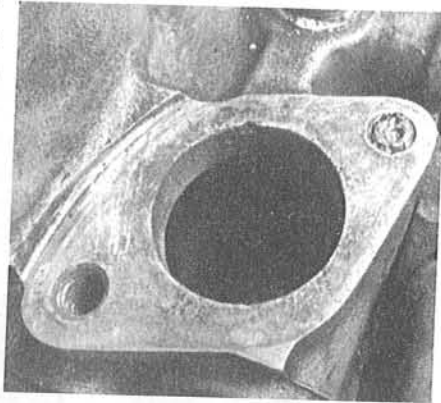


# Removing Broken or Damaged Fasteners

By Brian Wickham

Anybody who works on old cars or equipment has had a fastener strip out or break off in a component. I hope to give insight on removing these given many different scenarios. In starting out I will cover basic removal tools that most people have access to. To complete this article, I will get into more advanced techniques that a machine shop would use to save your component.



when you start using left hand drills. The key with these is to be sure you are drilling perpendicular to the hole and on center as much as possible. You want the drill to grab and spin out the fastener, not cut, so low rpm is also necessary. It is of great advantage to use a drill press or Bridgeport mill as they hold the bit perpendicular and you can exert more force on the drills in order to make them grab rather than cut. If you cannot use these machines, a magnet-base drill (pictured below) is your next best bet, followed by a regular hand drill. Since most hobbyist will use hand drills, I will go this route.

Step one is to create a flat surface, if the broken screw is jagged..

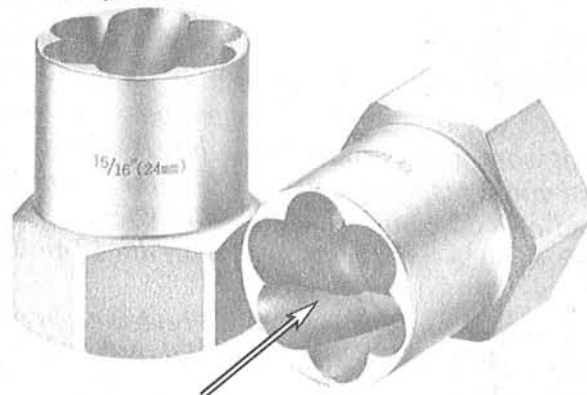
Step two is to use a prick punch to create an indentation in the center of the fastener. It needs to be as accurate as possible. A milling machine is the best for this, but as I said before we will focus on a hand drill.



Step three is to create a small hole using a center drill where you prick punched the screw.

Now you are ready to left-hand drill, The previous steps will help the drill bit not 'walk' and stay located in the dimple created by the

*Below: a hex nut removal tool has counter-clockwise splines which dig into the damaged bolt head. These tools are size specific.*



The first scenario I want to cover is a rounded off hex bolt as it is one of the easiest to remove; you have many options for tools<sup>1</sup>. Encountering this situation, the first method I would try is a little heat, penetrating oil, and Vise Grips<sup>®</sup>. I have had little luck with the Vise Grips<sup>®</sup>, I would swap them for a hex nut remover tool. This tool has splines that helix in the counter-clockwise direction to dig in when attempting to remove the bolt.

These tools come in individual sizes or in a set from many manufacturers and at varying prices. I have found them invaluable in my career as a machinist.

What if the previous method does not work, or breaks the screw clean off? This is

prick punch. Using low rpm, exert moderate pressure on the drill at low rpm. If you are lucky, the screw will back out. Heat and penetrating oil during this time will not hurt either. They also make hand drill guides to help the user keep the drill perpendicular to the work piece.



A drill guide will help keep a hand drill perpendicular to the work piece.

What if the drill is cutting and not backing out the screw? You have now entered the 'Easy-Out' realm. Continue to drill through the screw leaving a decent amount of material in the fastener so the easy out can bite and not damage the internal threads of the component. Select an 'Easy-Out' that seats well into the hole and using a flat tap wrench, slowly attempt to back out the fastener. As always heat and penetrating oil will help. It is very important that you do not break off a drill or easy out as you are in trouble if you only



Above: a conventional style 'Easy-Out'.



Right: a stubby type 'Easy-Out'.

have basic hand tools. There are many different types of 'Easy-Out' sets from different manufacturers. I prefer the short ones made by Snap-On as they grip well and are not prone to breaking. (Editor's note: 'Easy-Out' is a brand name. Bolt remover tools, similar to the standard or stubby 'Easy-Out' are available at most large hardware stores, auto parts stores, or home building centers or numerous on-line sources.)

If the easy out does not work, you will have to drill out the fastener to the tap drill size, and use a tap to clean out the material left in the components' hole. This is a risky situation as you can easily cut into the component and damage the threads forcing you to plug and re-cut or use a threaded insert like Time-Serts® or Helicoils®. (Instructions for the proper use of Time-Serts® and HeliCoils® follows.)



This should cover the introduction to removing broken fasteners. In a future article I will go into detail using equipment most machine shops use to remove very damaged or stuck fasteners.

S.K.

1. Editor's note: If the hex head is not too badly rounded off, less aggressive methods very well might work. For example, a slightly rounded hex head might respond to using a 6-point socket instead of a 12-point. The six point socket offers more surface 'grabbing' area than the 12-point.

Another tool, one which we reviewed in our August 2014 issue, is the one-size-fits-all Go-2

**Socket.** This is an unique variation on the many bolt removers. It consists of a socket with a tapered opening, and a lock-down screw which jams the rounded bolt head into a wedge, Check the website:

[www.go2socket.com](http://www.go2socket.com) for details and ordering.



## REPAIRING STRIPPED THREADS Chemical or Heli-coil or Time-Serts?

*Skinned Knuckles*, November 2006

A stripped thread-hole must be repaired to provide correct holding power for the bolt. A number of chemical products are on the market that will 'replace' threads in a stripped hole, but they normally will not provide the strength to be able to torque the bolt to specification.



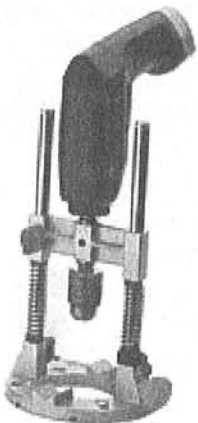
For the most secure and permanent fix, a



new metal thread has to be inserted into the stripped hole. Heli-Coils® are formed screw thread coils of stainless steel wire with a diamond shaped cross section. When properly installed, they

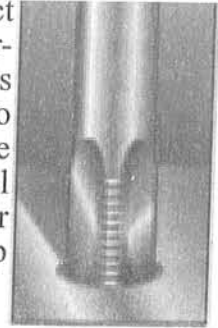
provide permanent screw threads that accommodate any standard bolt or screw.

Installation is easy, but it must be precise. Since Heli-Coils® are available in a wide range of sizes and threads both U.S. and metric, and even in sizes to repair stripped spark-plug holes, obtaining the correct size is simple. The damaged thread is drilled out, the new over-sized hole is tapped and the Heli-Coil® inserted. Really, it takes little more than that.



But having said that, there is a major warning: the hole **MUST** be drilled and tapped straight, and **NOT** at an angle. It must be perfectly perpendicular to the surface or you have ruined the repair.

The Heli-Coil® package will specify the correct size drill (and the exact size must be used) and the correct tap size. The Heli-Coil® kits (available at most better auto supply stores, larger hardware stores or certainly at industrial supply stores) include a number of Heli-Coils®, the correct tap and an installation tool.

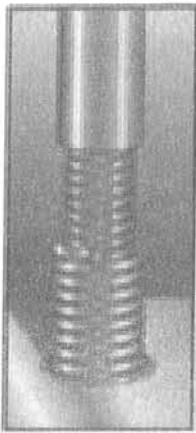


Assuming that you do not have a full machine shop, it is imperative that you use a drill jig or drill press to assure that the hole is 90 degrees to the surface. It is further recommended that you use a drill stop to prevent drilling too deeply into the part, and possibly causing additional damage. Finally, cleanliness is crucial. The metal chips that are created in drilling and tapping can get into all kinds of places where you don't want them. Each and every scrap of metal created must be cleaned up and removed from the engine. A vacuum and a small magnet are a big help.

Set up the drilling jig, and using the correct size drill bit, (another warning - a dull or resharpened drill bit may not drill an accurate hole. If the job is important to you, start with a brand new, quality drill bit.) drill to the desired depth. For repairing spark-plug holes, no drilling is required. The special piloted tap will remove the damaged threads and cut new ones in a single operation.

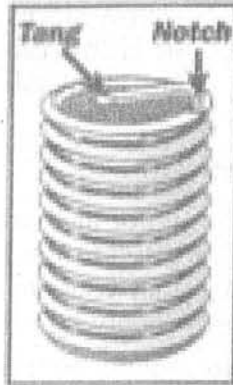
Use the Heli-Coil® tap supplied with the repair kit to tap the hole. When tapping a hole, do it by hand, never with a power drill (unless you have the proper tapping equipment and experience). Use a tapping fluid or WD-40 as a lubricant. **TAP SLOWLY!** Never turn the tap more than one full revolution without backing it out, cleaning the threads and removing the scrap metal from the working area and hole. The tap too, must be kept perpendicular to the surface. Tilting the tap, or applying any sideways pressure is almost sure to break it; then you have a major removal job on your hands. It will have to be removed with special tools and diamond-tipped drills. Not an easy job for the home mechanic.





Once the hole is tapped to the correct depth to accommodate the insert, install the Heli-Coil® itself using the special tool included in the kit. Screw the Heli-Coil® in so that the top of the coil is about half a thread below the top of the tapped hole.

The installation of the Heli-Coil® is facilitated by a tang that has to be removed. For small (under 1/2") coils, a square-tipped punch can be used. For larger sizes a needle-nosed plier



will do the job. A new type of Heli-Coil® is now available that does not use the traditional insertion tang. It too requires a special installation tool.

Like any other job that you are doing for the first time, read the instructions on the package carefully and follow them. With a Heli-Coil® properly installed, you will be able to torque the bolt to spec with no problem.

Several variations of the Heli-coil® principle - that is putting a replacement metal thread into a stripped hole - are available. You can normally find these at large industrial hardware stores or in industrial hardware catalogs like McMaster-Carr (on line at [www.mcmaster.com](http://www.mcmaster.com)). Search for 'thread repair'.

## Another 'Stripped Thread' Repair product - Time-Sert®

*Skinned Knuckles, April 2007*

We're not knocking Heli-Coils. They are a great product and those of us that have used them are grateful for the repair job that they provided. But here is an alternative product, and one which addresses some of the shortcomings that we may have experienced with Heli-Coils.

Heli-Coils are essential stainless steel 'springs' wound of a diamond-shaped wire. They fit into an oversized tapped hole, the installation tang is broken off, and when the bolt is torqued, the outside edges of the wire dig into the wall keeping them in place.

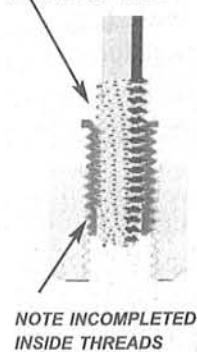
Time-Serts® are solid inserts that also fit into an oversized tapped hole, but, unlike Heli-Coils, Time-Serts® have a lip at the top to keep them from going too far into the hole. This, immediately, is a big advantage with an open hole. There is no chance that the insert will go all the way through. And, unlike the Heli-Coils, the last few inside threads of the Time-Serts® are not completely cut. The installation tool is a special tap; it

INSTALLATION TOOL ROLLS THE BOTTOM THREADS AND LOCKS INSERT INTO HOLE.

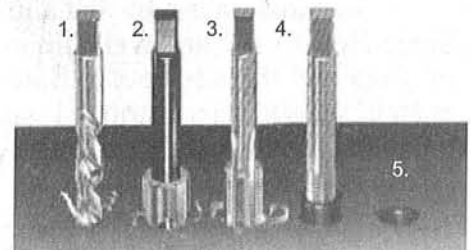


spreads the bottom of the insert locking it into the hole and bottoms the insert into the countersunk hole for the lip so that it is a flush installation. Time-Serts® (like Heli-Coils) come with an installation kit for each size tap. The installation kit consists of a drill bit, a flat-bottomed countersink bit (hand-operated with a regular tapping wrench), a tap to fit the outside threads of the insert and the special installation tap which rolls the balance of the inside threads, sets the insert and completes the installation.

Time-Serts® HAVE A LIP AT THE TOP EDGE



NOTE INCOMPLETED INSIDE THREADS



1. The hole is drilled to a specified size with the bit incorporated in the kit. 2. The hole is countersunk. 3. The oversized hole is tapped to size. 4. The special installer/tap sets the insert in place. 5. The completed installation is flush with the surface.

Time-Serts® are available in SAE coarse and fine threads and metric sizes, too. Time-Serts® are manufactured by the Time Fastener Company. They are sold through distributors and major industrial hardware stores. Check the Time Fastener website: [www.timesert.com](http://www.timesert.com) for a list of distributors or contact the Time Fastener Co. at 5301-G Longley Lane, Reno, NV 89511

S.K.