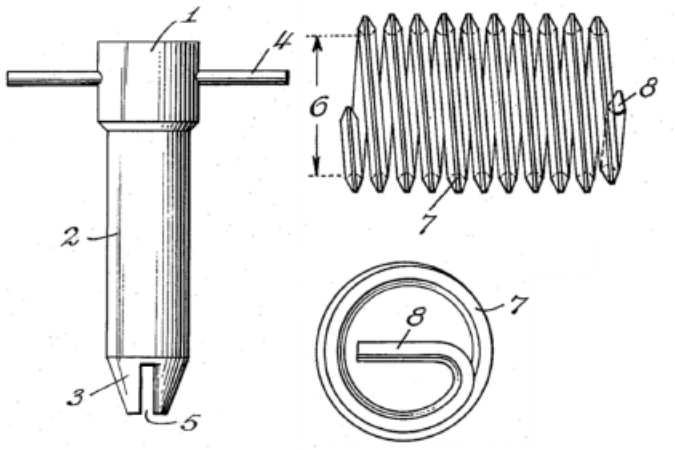
Thread Fixing

Keeping it tight and together with threaded inserts

By Bruce Smith

Many folks are familiar with the idea of thread repair, too often following that holy-crap moment when you know righty-tighty has gone terribly wrong. There are a few repair options out there that have been around for a very long time. For internal threads, helical screw thread inserts (STI) were first devised in the 1930s by Aircraft Screw Co., Heli-coil, and others. These were developed to secure a hardened bolt or stud into a soft metal boss like aluminum or soft alloys. By lining a tapped hole with a coiled wire insert, the softer boss could withstand torque and repeated tightening without damage. Shown below is an early design of such a coil (7) and the tool (2) used to insert them. Though there have been some improvements over the years, today's coil inserts (aka Heli-coils) still resemble the early designs. These helical inserts include a tang (8) at the base of the coil designed to engage the insertion tool and be sheared off after assembly.



Drawings from a 1930's Aircraft Screw Co. patent showing helical thread inserts, now commonly called Heli-coils.

Our beloved Porsche engines use helical inserts to strengthen the threaded holes in the heads for spark plugs. These holes were bored then tapped with v-shaped threads for insertion of a coiled wire insert, like the one in the diagram above. During insertion, the wire expands into the threads to form a hard metal thread lining to become an integral part of the bore. The photo below shows a coil insert lining the plug hole in a typical 356/912 head.

Spark plug holes in our 356/912 motors use threaded coil inserts from the factory.

There are other options to strengthen internally threaded holes. External thread inserts, such as the Time-serts or Keen-serts shown below, are solid metal bushings that are threaded both inside and out. When installed with a special driver, they are screwed into a tapped hole to complete the thread cutting and secure them in place. They are generally larger than helical inserts, which can limit their application in tight spaces. Since they are solid, these can be secured with a thread sealer, something that shouldn't be done with wire inserts since both sides of the threads would become coated.

Three options for thread repair: a Heli-coil insert (left) and external thread inserts, Time-sert (center) and Keen-sert (right).

Where to use them

Although inserts were developed to strengthen new threads, they're commonly used to repair old threads that have gone bad. You'll usually know when you need one. The question becomes whether you do it yourself or take it to a shop for repair. Thread repair into a case or head can often be difficult without removing them from the car, and it's easiest when torn down. If the fix can be accomplished by simply chasing the bad threads, the concern may be limited to ensuring the clean removal of debris. But the challenge with engine thread repair is having adequate access and achieving the accuracy needed for the new borings. Special jigs or fixturing can be used to ensure alignment and indexing of parts, and critical hole repairs might be best left to a machine shop. But repairs less dependent on alignment are certainly doable as a DIY, as are fixes to damaged threads in soft alloy carbs, fuel pumps, etc. *Continued*

DIY repair of soft alloy threads

I'm guessing that some reading this article are already thinking of a pretty common part needing thread repair in our old cars. If you've got Zenith carburetors, you're likely familiar with the poor design used to secure the carb top. Especially under the return spring bracket where the cover screw is held into the carb body with just a few threads. After years of rebuilds and removal, there is likely to be a stripped hole. Problems aren't limited to Zenith carbs as the same ZAMAK alloy is used in Solex carbs and both A/B and C/912 style fuel pumps. Any of the threads in these bodies can become stripped, and indeed thread damage is common with any hole for a fastener that needs to be removed during rebuilding. Sometimes, a simple chasing of threads with the appropriate tap is all that is needed (like with the grub screw hole for the venturis in Zenith bodies). But this likely isn't enough, especially if torque on the fastener is necessary. For a demonstration of the repair approach, a Zenith carb body is certainly a good candidate.

Zenith 32NDIX – Good carbs but weak holes

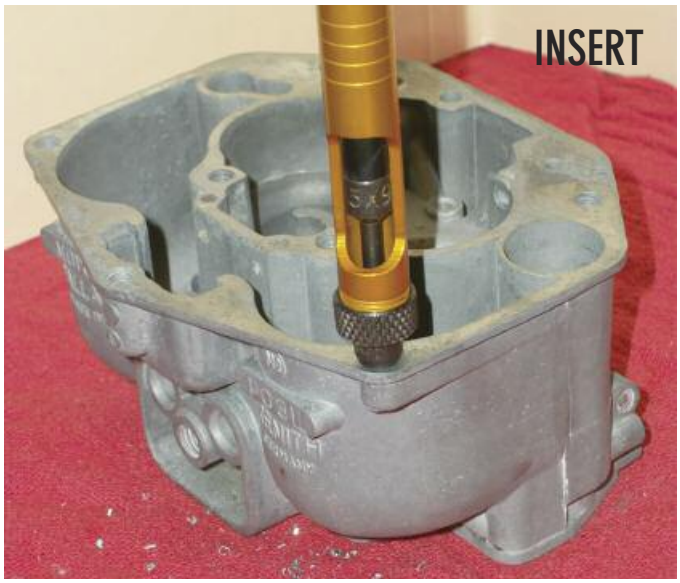
You'll know when you've got stripped threads in a Zenith carburetor. If not completely stripped already, you'll feel the dread when you snug down the cover screw and it becomes easier to turn. Repairs throughout the years have included using a backing nut to hold a replacement screw, which works fine if one side of the nut is ground down a bit. Another option is to weld a failed hole closed, re-drill it to size, and tap it to receive the original cover screw (which is an unusual thread pitch of M5x0.9mm). There is a product suited for this application called Muggy Weld, which is a low melting point alloy solder that can be used to repair pot metal. The version called Super Alloy 1 can bond to alloy castings at about half the melting point of the metal itself (about 350°F). This allows for fairly easy filling of a hole using a small butane torch, once you master the technique using their special acid flux. There are two problems with this type of fix. The first is getting the technique down to properly fill a damaged hole, which should be drilled out, cleaned thoroughly, and backed to keep the solder in place (for through-holes). If you've got a junk carb body you don't care about, you can probably master the technique after you've drilled and filled every hole. The other problem is even when it's successfully filled, drilled, and tapped, the threaded hole is no stronger than it was to begin with. Indeed, because the solder is softer than the carburetor body, it's very likely to fail again after a few cycles of removing the fastener. To help, you can pick up a few threads by grinding some metal off the back of the spring clamp and swapping out the M5 split washer for a wave washer, as shown below. But the threads are probably going to strip out again in the future. It might not be in your lifetime, but a solder repair probably isn't going to last another fifty years.

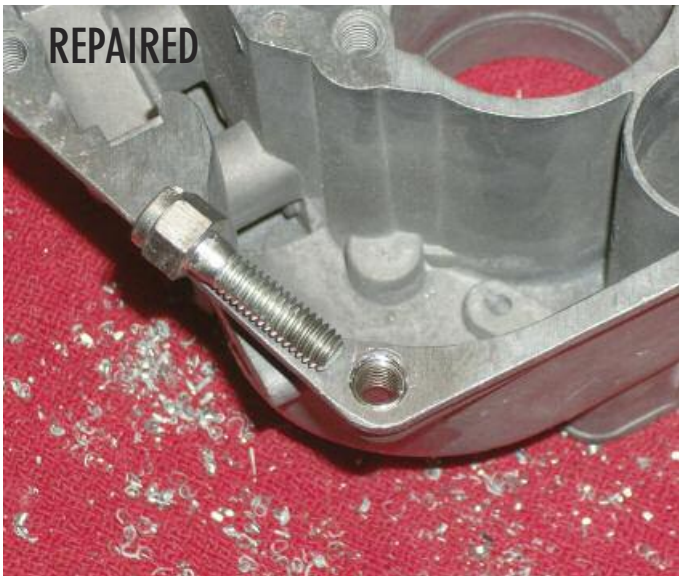
Thinning the carburetor spring clamp and using a thinner washer (right) can gain a few more threads into a carburetor body.

So a more permanent fix is desirable. If a threaded hole in the soft alloy were secured with a thread insert to begin with, the problem would not have occurred. So the best fix now is to use a thread insert. In this case, because of the limited space available around the screw hole, a Heli-coil is a better choice than an external thread insert. The basic repair approach is fairly simple: drill to size, tap to the necessary thread, screw in the insert, and then shear off the tang. But each step is critical with opportunities for error. The first thing to think about are the necessary tools. For Heli-coil type inserts, there are a few options. You can find a cheap import kit that will cover all standard metric sizes between M5 and M10 with all the bits, taps, inserts, and tools for less than $50. This is a perfect example of 'you get what you pay for'. Don't be tempted. Inserts are really a one-chance deal and if it goes wrong they're nearly impossible to re-do, especially when repairing a blind hole. Use quality kits and parts from reputable suppliers, like the ones shown below. These examples include properly sized drill bits, taps, insertion tools, and the corresponding coil inserts.

Three helical insert sets for thread repair: M12x1.25mm for carburetor fuel ports (left), M7x1mm for jet cover bolts (center) and M5x0.90mm for Zenith cover top screws (right).

The sequence for repairing Zenith cover holes can be seen in the photos that follow. These are through-holes but the technique is similar for blind-holes. The inserts require a specific bit size to bore and a tap that corresponds to the external size and pitch of the wire coil. When drilling, it's important that the new bored hole is centered and perpendicular to the reference surface (here the carb top). This will be especially important when repairing a thread used for sealing, like those for the jet covers and fuel lines. Fuel leaks are guaranteed if the insert isn't perpendicular. The right tap to use will be furnished with the kit. Since the body is a soft alloy, cutting fluid during drilling/tapping isn't necessary but can be used. Now comes the trickier part. When inserting the coil, you'll need to ensure that it starts correctly and follows the tapped threads. If any resistance is met, an insert can usually be backed out if it isn't fully seated and the tag removed. It's important that the wire follow the threads, otherwise they will become crossed. The length of the coil should be sufficient to fill all threads and coils can be shortened from longer ones if needed. Once the coil is fully inserted, which should be just below the top surface, its tang is broken off with a sharp tap from a small rod inserted into the hole. The last photo shows a repaired hole together with the Zenith top cover screw.





The sequence for repairing a threaded hole using a Heli-coil style insert.

Zenith jet covers, A/B fuel pump top covers, Solex top cover threads, Zenith base threads, fuel pump fuel ports, fuel pump screw threads, sheet metal screw holes, case threads, and other stripped stud or screw holes are additional opportunities for repair using thread inserts. The only odd thread pitch of the lot are the M5x0.90mm ones in the Zenith. Others are standard sizes available in repair kits. In most cases, the repair you do will be stronger than it was to begin with – and will last throughout many more custodians of your car.

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