Yankee Screw Driver

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Note: all dimensions in this document are in inches unless otherwise stated. Drawings are third angle projection.

Introduction

The Yankee screwdriver was invented in the late 1800's by the North Brothers and was eventually sold to Stanley. The screwdrivers were made by Stanley and others (e.g., Millers Falls) up until around 2000. They have been replaced by cordless drills. However, they are a useful tool to have, especially when you can't recharge your cordless drill's batteries. In this document, we'll look at these screwdrivers and what they can do.

Here's a picture of a Stanley Yankee 130A screwdriver:

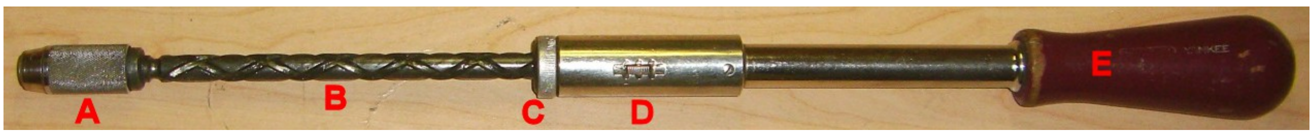

Figure 1

These devices are sometimes called a **spiral ratcheting screwdriver** because of the "spiral" at B[1]. The bit holder and grip at A holds various screwdriver bits and when you push on the handle E, the bit turns clockwise or counterclockwise, depending on which position the three-position switch D is in. With the switch D in the central position, the shaft B is prevented from turning and the whole device works like a regular screwdriver. Collar C is used to lock parts A and B in the compressed (stored) position for storing the tool. Part A is composed of a bit holder with a knurled cylinder that rotates around it when the driver turns. You pull the knurled part towards the handle to release bits.

> One rotation is generated when the rod is pushed in 2 inches and the outside diameter of the thread is 0.363", meaning it probably started life as a chunk of 3/8" bar stock. If it's hardened, it's not much, as my hardness files indicate it's less than 40 Rc. The total distance that the head A moves with respect to part C is 5.25 inches. Thus, one full push generates 2.6 rotations.

The device is also called a **push-drill** because it commonly came with small drill bits with straight flutes that were used to drill pilot holes for screws. There was a smaller size push drill model that stored bits in the handle and was chromed all over (it was popular with telephone installers).

When you're finished using the tool, you push the bit holder all the way down and turn knob C, which locks the helix inside the body for more compact storage:

Figure 2

To give you an idea of its size, this screwdriver closed is 12.3 inches long and the largest diameter of the wooden handle is 1.46 inches. The finger hold A is 0.87 inches in diameter.

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1 "Spiral" is a misnomer -- it's a helix (a spiral is a two-dimensional figure). It's a high-lead thread with a nominally-rectangular thread profile; there are two threads of opposite handedness to provide right-hand and left-hand rotation.

Here's a picture of the bits I use with this screwdriver:

Figure 3

The item at A is an Irwin 1/4" hex bit holder that has been turned down on a lathe to fit the Stanley 130A. At B is a Phillips #2 bit (Stanley model 302S-2PT.) that fits the screwdriver directly. The drive is engaged by the slot in the end of the bit and the notch to the left of the drive slot is used to retain the bit in the screwdriver by a pin until it is released. Here's a drawing of the bit end (this profile is easy to hand-file to shape):

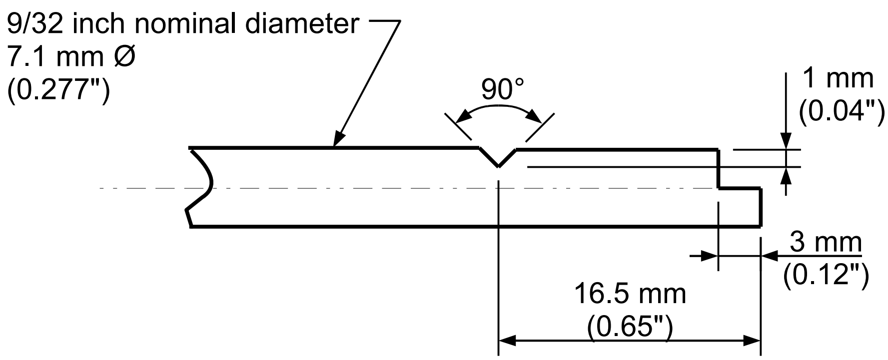


Figure 4

There were three common sizes of bits used in different models of spiral screwdrivers[2]: 7/32" (5.5 mm), 9/32" (7.1 mm), and 5/16" (7.9 mm). Here are a few other bits:

2 At least these are the various sizes I have collected over the decades.

At A is a Yankee 3082 adapter that lets a Yankee driver that takes 9/32" bits utilize some 11/64" bits (I had a few of these 11/64" bits from some other driver and I was able to special order this adapter in the 1960's). At B are two of the typical straight-flute drill bits that were commonly used with these tools. At C is a pair of bits with the smaller 7/32 shank.

> That adapter at A is more sophisticated than it looks. There's a flat spring on the opposite side that is closely fitted to the holder and there's a matching dovetail in the steel cylinder to hold it in place (it's a clever design and would be nontrivial to manufacture, at least compared to a screwdriver bit). A crimp closes the dovetail over the spring, clamping it in position. The spring is bent into a form that exactly matches the recess it sits it.

A few decades ago I was in a used tool store and bought an old used push drill with a patent date stamped on it from the 1800s. Even though it was nearly a 100 year-old tool, it still worked fine and I gave it to my son-in-law. The point here is that if you want one of these tools, you might be well-served looking in a used tool store, or checking out flea markets, estate sale, etc. You should be able to find a serviceable unit for $10 or under, especially if the seller isn't aware of how useful they are.

You can also buy these items new, although Stanley no longer makes them. McFeely's sells a model made in Taiwan. Shroeder in Germany bought the rights to the Yankee name and continues to manufacture them -- you can find them at Amazon, Garrett-Wade and Traditional Woodworker. These modern versions take 1/4" hex bits, which of course are what you'll want to use. Lee Valley sells bits that fit the original Yankee design.

> An Amazon review mentioned that the Shroeder instantiation uses a cheap o-ring to hold the bit in place and it's a loose o-ring, ready to lose on a job site. I consider the bit-holding feature extremely important (I've lost too many bits from poor holders and it's always at the wrong time) and would recommend seeing if you can either adapt a better holder or find a genuine Stanley Yankee screwdriver and make the modification I recommend below or buy the Lee Valley bit holder.
>
> **I would NOT recommend buying the Schroeder version if it uses an o-ring in the chuck**. I want a locking chuck that holds the bit so it cannot be pulled out no matter what.
>
> Also look for the brand name Easyload (they use the silly name "push pull click click" for these screwdrivers), but the customer reviews on Amazon seem to indicate this is a poor-quality reproduction for around $30.

The adapter A in Figure 3 above was made by turning the shank of an Irwin 1/4" hex extender and quick release holder (this is a handy tool to have). It doesn't appear these Irwin adapters are available anymore, but a visit to a tool store will turn up something that is usable (here's one place to try). The form in Figure 4 is easily hand-filed onto the adapter in a few minutes; it can all be done with a plain flat mill file. Nothing has to be a real close fit (and you can keep testing the fit until you get it right). For a little practice, take a 9/32 inch drill from a fractional inch drill set and file the end on the shank (they're usually a low carbon steel and easy to file). If you have an adapter like the Irwin one in Figure 3, remember to leave enough clearance for the knurled shroud to be pulled back to release the hex bit. A nice feature of these Irwin bits is that the hex bit can be pushed into the holder and it will automatically lock in place (assuming it's a locking bit), unlike other holders that require you to slide a sleeve or push a button with your other hand. If you're in a used tool store looking for a Yankee driver, you should also look for one of these bit holders. When I bought mine, I also got 6" and 12" long versions, as they make useful 1/4" bit driver extensions. Or, if you don't want to make something, you can buy an adapter from e.g. Lee Valley.

Another adapter you can make if you have access to a lathe is to cut off the female end of a 1/4" or 3/8" square drive adapter for sockets and put a Stanley Yankee screwdriver end on it:

Figure 5

This lets you use sockets with the push-drill. Of course, if you make the adapter to 1/4" hex bits as shown above, it's easier to just use a 1/4" hex to 1/4" square adapter, as they're commonly available.

A similar thought exists for any shanked tools you can get cheaply or for free that must be turned. If they have a shank larger than 9/32 in diameter (e.g., nut drivers), you can turn them down on a lathe and adapt them to the Yankee. For smaller bits, braze them into a shank made from 9/32" stock. For example, the Xcelite 1/4" nut drivers with red plastic handle (made unchanged for many years) already has a shank exactly the size you need. Cut it off with a hack saw, file it to size, and go to work. I use a 1/4" nut driver a lot on fasteners.

If you had to deburr lots of drilled holes, one of these push drills with a Weldon-style countersink works well and is faster and less work than lugging an electric drill to each hole.

Since it's easy to make bits to fit the screwdriver, this opens up the possibilities of making custom turning tools when needed.

In the 1960's in college, I moved into a new apartment and the Yankee 130A screwdriver shown above was left on a closet shelf. I knew what it was (they were pretty common when I was a kid) and immediately adopted it. I've been using it ever since. It's especially useful with an adapter for 1/4 inch hex locking bits; I use it a lot for driving screws around the home and yard.

Use

These screwdrivers were used with Phillips and straight screwdriver bits as well as straight-flute drills for drilling pilot holes. If you can use 1/4" hex bits, then of course, you can turn many more types of fasteners.

Here's a typical example of use. You'd put in a drill bit and push the direction switch all the way forward, which causes the bit to turn clockwise when looking from the handle (i.e., in the direction a right-hand drill would cut). You'd hold the rotating collar A (see Figure 1) with the thumb and index finger of one hand while pushing on the handle with the other hand. The collar will stay stationary in your fingers while the bit rotates, drilling the needed hole into the work. You'd also apply a force with your thumb and index finger to push the drill bit into the work. A softwood like pine could be drilled the length of the drill bit with a few pushes. An optional second step would be to drill the clearance hole for the screw. Then you'd switch to a screwdriver bit and drive the bit in.

When driving screws with slotted heads, it's not uncommon for the bit to slip out and scratch the surface the screw is being driven into. This is a good argument against using slotted screws; however, there are a lot of them installed, so you have to be careful. If you have to do a lot of this type of driving and you've adapted to use 1/4" hex bits, there are slotted screwdriver bits with shrouds available. More importantly, try to use a properly-fitting hollow-ground screwdriver bit to minimize the stripping out.

Push-drills came in two styles: those with return springs and those without. Some workmen removed the return springs from theirs. This gave them a bit more control and perhaps reduce the chance of slipping out of a slotted screw. Try it both ways and see what you like.

The straight-flute drills were made because they were cheap to manufacture and easy to sharpen. They were never great at clearing chips, but they did a fair job, though never as good as a helical drill bit. If you do plan to drill numerous holes with a push drill, make or buy helical drill bits with 1/4" hex shanks and you'll be happier. Plus, when the drill gets stuck in e.g. green wood, you can reverse the push drill and it will help back out the helical drill bit.

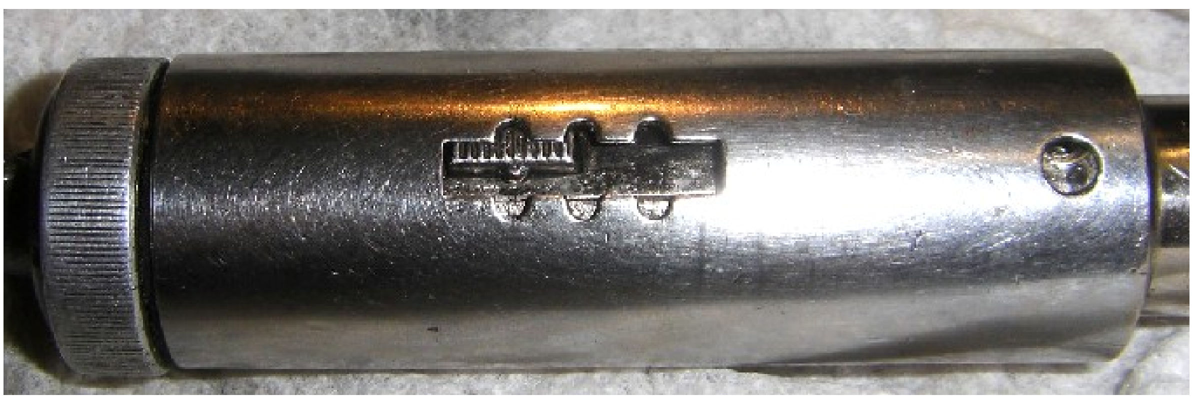
Disassembly

Here's a blog that gives some information on how to disassemble one of these screwdrivers. I'll show some pictures of the partial disassembly of my Yankee 130A screwdriver, as I wanted to both see what the construction was like as well as give it some cleaning (as mentioned, I got this driver about 50 years ago and it was well-used even then). I'll also give some dimensional sketches of some of the parts, as this could enable someone to make a new part some day if necessary.

First, extend the driver portion so that the internal spring in the handle is unloaded (if you don't, the screw plug in the end may shoot across the room when you unscrew it). Then unscrew the large screw plug at the end of the handle. You can now remove the screw, spring, and a wooden plug, in that order.

To get at the heart of the ratchet mechanism, remove the small screw holding the shroud in place. This will take a small screwdriver, such as a 0.1" wide jeweler's screwdriver. I recommend you clean the threads and lubricate the screw with Vaseline or an antisieze compound to make it easy to remove decades from now.

To get the shroud off requires a trick: move the button under the shroud as follows:



Push the button down with a screwdriver and simultaneously rotate the shroud. You'll have to fiddle a bit to make this happen (note the shroud has been rotated away from the tapped hole for the screw), but once it does, you can slide the shroud off the ratchet assembly. (This was a clever assembly method.) Here's what things will look like:

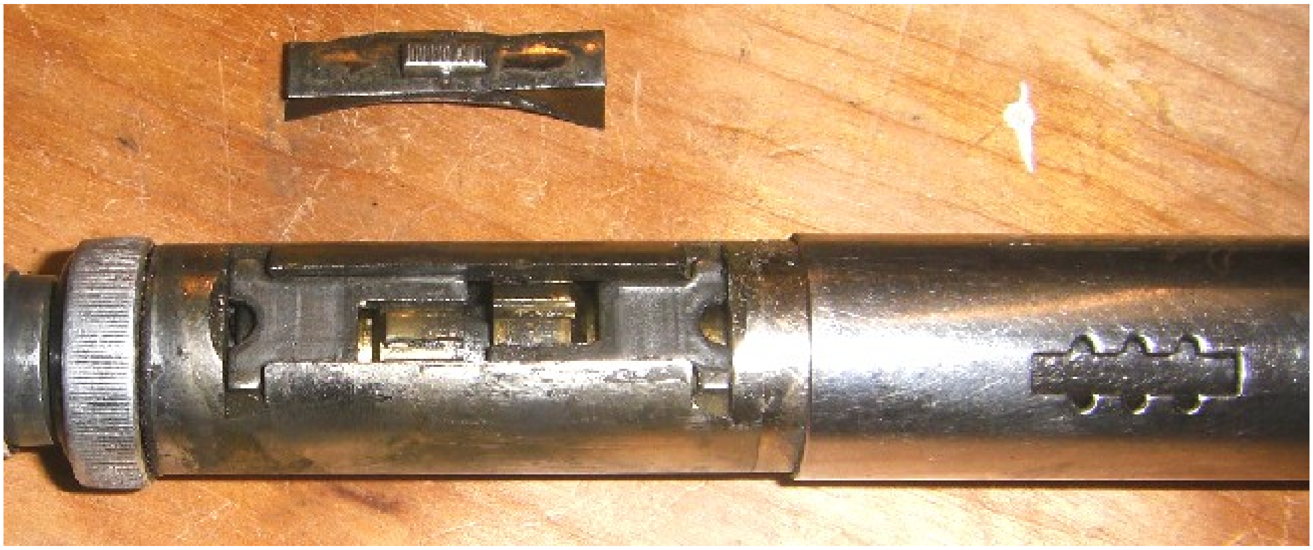
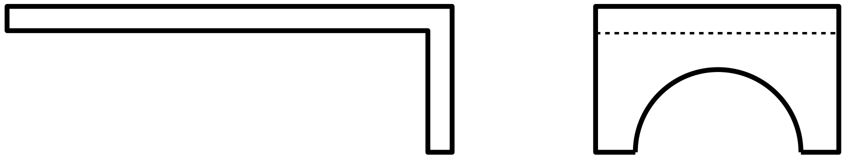


Figure 6

It's an elegant and sophisticated design. You'll want to fiddle with it a bit to see how it works.

I removed the two pawls and used a Q-tip with acetone to clean out the accumulated crud from decades of use. Here's what things look like with one pawl removed:

After cleaning, I lubricated things with Vaseline and reassembled them -- I didn't bother with any further disassembly. However, to take it all apart, I'd imagine the screw just to the left of the coined collar (you can't see the screw in the picture, but it's coaxial with the driver shaft) needs to be removed, then these internal parts can be removed. You'd probably need to make a special screwdriver such as the following sketch to take the thing apart:



I also cleaned the switch button shown at the top of Figure 6 and lubricated it with Vaseline. This was important because it made the switch activation easier -- this is important when your hands are greasy or cold.

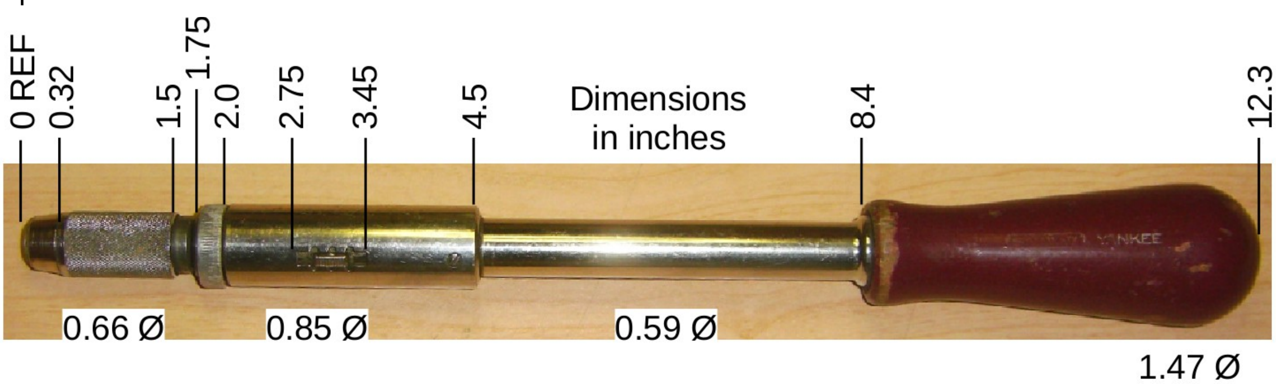
I also used Q-tips and acetone to clean out the channels in the helix. Here's what it looked like when I was finished:

It is plated steel to avoid rust. It was lubed up with Vaseline, wiped off, and the screwdriver was put back into service for another few decades. It will easily outlive me.

Dimensions

All dimensions are given in inches and none of the drawings are to scale.

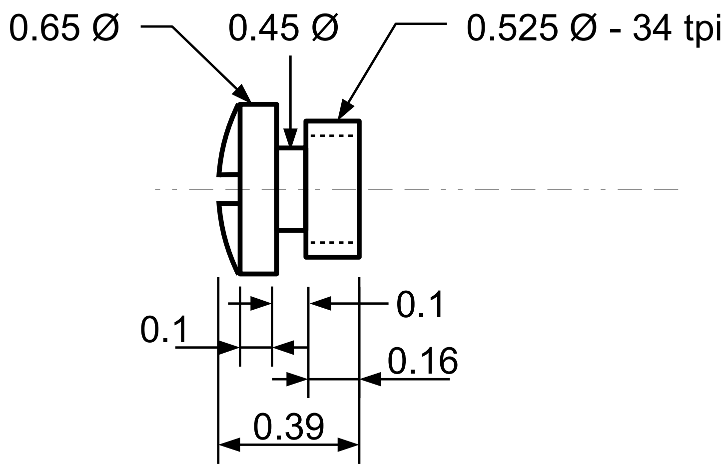
The Stanley Yankee 130 screwdriver is 12.3 inches long when closed and 17.1 inches long when open. Here's a sketch of some of the main dimensions:



Parts sketches

There are no tolerances given or implied -- these are nominal measurements in inches unless otherwise noted.

Screw cap

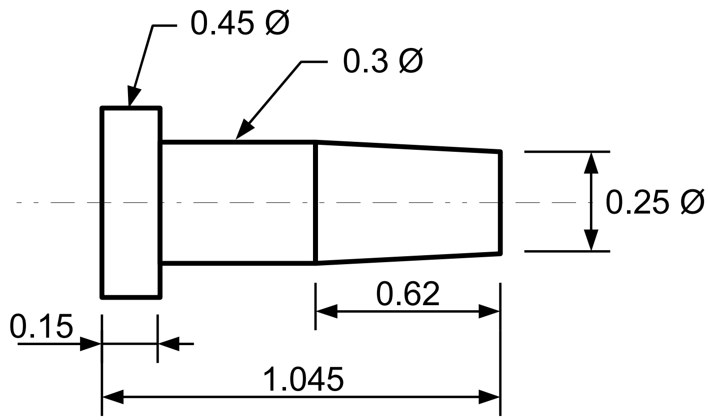


Spring

Free length = 7.7
Outside diameter = 0.44
Wire diameter = 0.032
3 collapsed coils at each end, tapering to 3/8 Ø over about 3/8
Pitch = 0.21
39 turns plus 3 close turns at each end

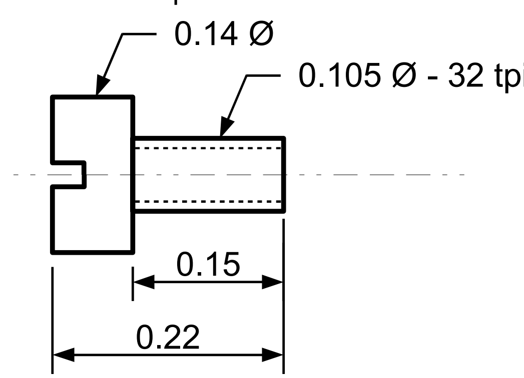
Wooden plug

The 0.3 inch diameter of the wooden plug fits in the end of the spring.



Shroud screw

This is the little screw that holds the shroud cover in place.



After removing mine, I cleaned the threads and put antiseize compound on them to ensure it could be removed again later.

Maintenance

The only maintenance I've needed to do for my Yankee screwdriver is to clean and lubricate it. I clean the helical screw with a solvent like acetone and a Q-tip, then put a dab of Vaseline on my fingers and rub it into the nooks and crannies of the helix. I run the shaft in and out to distribute the Vaseline.

You'll also want to put a drop of oil in the gap to lubricate the finger grip A in Figure 1 (there's "oil" stamped there to remind you). However, a better method of lubricating this is to pull the knurled sleeve back and put a little Vaseline on a toothpick onto the metal shaft with a flat. Then heat things gently with a propane torch for a moment and the Vaseline will melt and distribute itself. Vaseline lasts longer than a drop of oil -- the oil's solvents evaporate and the stuff gums up over time.

> This lubrication technique also works well on pliers with close joints, as they are sometimes hard to lubricate. An easy way to do this is to put a dab of Vaseline on the joint and set the pliers out in the summer sun; the Vaseline will wick into the joint.

You will eventually touch the helix when you're using the tool and it will leave some black grease on you. If this is objectionable, you might give the helix a good cleaning and switch to some powdered graphite, work it in for a while, then wipe it off. I haven't tried this, but it might work. A commercial dry lubricant like Moly-Cote would be good too. If you're rich, have it Dicronited.

Of course, you should try to keep the helix clean when using it. If it falls into dirt or sand, the particulates can gum up the works and cause excessive wear. I'm sure most people would know that the tool deserves a good cleaning when this happens.

Sharpening straight-flute drill bits

These are easy to sharpen, as you just hold the existing tip at the correct angle to a grinding wheel and grind a flat surface. There's no required hand movement like there is for sharpening helical (twist) drills.

Note these bits <u>cannot</u> be used with either direction of rotation -- they are a right-hand cut, just like normal drills. I've seen a couple of web sites that stated they could be used in either direction, but the writers didn't look closely at the bits. It's impossible to have a bit that cuts in both directions unless you don't care about efficiency, bit wear, and proper cutting clearances.

Making bits

If you like to fiddle in your shop, there's no reason you can't make custom bits for your Yankee screwdriver. I haven't done this, but I don't see any insurmountable challenges. Here's how I'd proceed if I wanted to make a special slotted screwdriver bit:

1. Get some appropriate tool steel (drill rod is the logical choice, but any high carbon steel that can be hardened is suitable).
2. Turn the shank down to the Yankee screwdriver's bit size and file the notches in the end.
3. Heat one end up and forge the rough shape of the tip you want. This should just require a propane torch (maybe two and a helper), hammer, and a reasonably heavy flat metal piece to pound on.
4. File the tip to the shape you want.
5. Heat treat the tip: harden it, then temper it. I'd recommend a spring temper, so go for a purple or blue color. An advantage of making your own is that you can make it harder if you wish for longer life or tough service (but this also means it will be easier to break).

However, since 1/4 inch hex bits are so common, it makes more sense to adapt your Yankee screwdriver to take 1/4 inch hex bits if possible. You can then e.g. buy a gunsmith's screwdriver bit set from Brownells and have a bit to fit nearly any slotted screw you'll come across.

Buying a used Yankee screwdriver

If I was looking for a used Yankee screwdriver, I would want to buy one that was in good shape. The lack of any bits coming with the screwdriver would be irrelevant because I'd make or buy an adapter to take 1/4" hex bits.

How do you determine if the device is in good shape? Since I haven't gone shopping for one in recent years[3], I can't give you any definitive advice; what follows is speculation, so take it with a grain of salt.

I'd first inspect the helixes and see if they were in good shape. I'd look for minimal wear and, if it could be wiped off, the plating should be in good condition so it still protects from rust.

I'd want the locking knob to still solidly lock the screwdriver in the retracted position. If this didn't work, I'd reject the screwdriver unless the price was excellent and I knew I could fix it.

Inspecting the internal ratchet mechanism is obviously difficult unless you have the tools and the seller's permission to take the tool apart. Thus, you'll just have to make a guess from how the driver operates. The tool should operate smoothly and you should be able to apply a retarding torque to the tip and still have it rotate when you push the handle. Lock the driver and you should not be able to turn the screwdriver. If it does turn, reject the tool.

Make sure the rotation direction switch works and the driver turns both clockwise and counterclockwise and locks in the middle position. If the switch is sticky, this is probably something that can be fixed by disassembly and cleaning.

You also want be sure that it takes and holds bits properly. This is pretty much impossible to do unless you have a bit handy.

> But I would feel this is not an absolute requirement because I could make or adapt something new in the shop by e.g. converting the driver to take 1/4" hex bits. If you can do the fabrication suggested in the next paragraph, then the bit holder's condition isn't important.

I believe the tip on my screwdriver is fabricated as follows. The holder has a pin and spring inside it. When you pull back on the knurled portion against the spring, the pin moves radially outward, unlocking the bit and letting it be removed. In the relaxed position, the spring holds the pin in the 90° notch of the bit, locking it in place. From an inspection with a loupe, my best guess is that this bit holder assembly is a tight interference fit onto the helix shaft (or possibly brazed). In other words, it's permanently assembled. If the bit holder was damaged, I'd cut it off and weld on a 1/4" hex holder, giving a functional screwdriver.

If the wooden handle is damaged, the old one can be removed and a new one made. I couldn't see how the handle is held onto the screwdriver, but my guess is that it's glued. There's a steel tube that is threaded to hold the end screw and this tube goes to the end of the handle. There's no cross pin through the tube (it would block operation), so the most likely supposition is that the handle is glued. If you had to replace the handle, just machine off the old one and epoxy a new one on. I'd make it from aluminum or wood and coat it in a non-slip tool grip, perhaps by dunking it in a liquid like Plasti Dip rubber coating or an industrial-grade neoprene paint.

If I made one from aluminum, I might extend it a bit over the end screw of the screwdriver and drill a cross-hole to allow it to take a Tommy bar. This would be a useful addition to allow the driver to handle tougher turning tasks (for example, when you're using a socket to turn a nut). It's a separate question whether the ratchet mechanism will be capable of withstanding the applied torque, so you of course do this at your own risk. Another solution would be to machine a hex at the front of the handle for a wrench. Score or groove the steel tube and the inside of the handle to provide additional bonding strength.

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3 Not to mention that the three used tool stores that I frequented for more than 30 years have all gone out of business.

Should you buy one of these screwdrivers?

To be truthful, I don't use my Yankee screwdriver very often if I have a cordless drill or impact driver available. However, I often take it with me when I have to do some remote work and want to minimize the amount of stuff in my toolbox.

> Replacement battery prices for cordless drills are ridiculous, so currently I'm without a cordless drill (a single replacement battery costs about 80% of what I paid for the drill <u>and</u> two batteries when new).

I personally wouldn't spend the $75-$100 it would take to buy one of the drivers made by Shroeder, as that money could be better used elsewhere. However, if you can find a reasonable deal for a used Stanley driver at a used tool store or estate or garage sale (say, a few dollars to $10 or $15), then it might be worth the money getting one. The real question will be how you're going to get bits for the driver. The only practical and quick answer to this question in my mind is to make it take 1/4" hex bits. The most straightforward solution for this would be to get the Lee Valley adapter, so plan on another $10 expense. If you like making things in the shop, then of course that's an option. But working folks often don't have the time for such things.

There are pros out there who keep one of these Yankee screwdrivers in their toolboxes and use them when doing specialty work. I can see making a case for one in this case, as they don't take up much space, double as a regular screwdriver handle, and can drill small pilot holes (and can do a reasonable drilling job in wood with drills up to maybe 1/4" in diameter, which handles a lot of hole-drilling tasks). There are no batteries to go dead. If I have to go somewhere and have limited room for tools, then the Yankee screwdriver is a good choice over a heavier and more cumbersome cordless drill. But I'll always choose the drill or impact driver over the push-drill if I can.

Related tools

The Kuri-Kuri Mini Drill can seen at http://www.highlandwoodworking.com/kuri-kuriminidrill.aspx ($70). The bits are $6 each.

This is pretty spendy and the bits are sized in metric. But it's a good idea and a handy person could make one in his shop. A starting place might be a 1/4 inch square drive speeder handle used with sockets. You can buy 1/4" hex bit holders with 1/4" square drive, so that's an option. However, these sockets don't retain the locking bits, a feature I want. You could tap the socket for a small thumbscrew as shown in the picture.