An Electric Power Drawbar for Milling Machines

Mike Stratton describes a novel approach that can be used with any larger mill.

The completed power drawbar.

A couple of years ago I bought a second-hand Warco WM20 turret mill. This is like a ¾ size Bridgeport. I soon found that spindle to table distance was too small when drilling on the rotary table, so I made a 125mm deep riser for the head. This cured the problem but introduced another – I could now only reach the drawbar bolt by using a stepladder!

The solution seemed to be a power drawbar of some sort. Trawling the internet showed that the vast majority of power drawbars were air operated, using an air impact wrench combined with an air cylinder to bring the wrench down onto the drawbar. As I did not have, or want, a noisy compressor in the workshop I started to look for an electrical solution.

A few tests with an old cordless impact wrench showed that it could do the job and it was really only a matter of fabricating a suitable structure to lower the wrench onto the drawbar (**photo 1**). Note that an ordinary electric drill will not work – it will simply spin the mill spindle in its bearings. It is the hammer action of the impact wrench that does the work, without rotating the spindle. The spindle does not need to be locked during operation and it remains perfectly stationary. This means that it is safe to hold the tool being inserted or removed, but a pair of gloves might be a good idea for sharp cutters in collets.

There are no drawings for this project, but the dimensions would need to be altered to fit the mill in question anyway. The photos should convey the basic

Baseplate.

Old impact wrench.

Linear bearing.

Spring winding on the lathe.

principle. It should be possible to convert any mill that has room around the top of the drawbar to fit a baseplate to support the guide bars (**photo 2**). My mill has an R8 spindle and the impact wrench easily releases the taper. This would be the case with International tapers as well. I don't know if it would release a Morse taper, and I have not tested this as I don't have a suitable spindle. As a guide to size, my baseplate was a converted 150mm diameter backplate. The guide bars are 20mm diameter x 200mm hardened and ground steel. They are spaced at 125mm centres.

Construction

The assembly consists of a baseplate for the guide bars, a moving plate to support the impact wrench and linear bearings, the 2 guide bars with springs, and an extended handle to pull the wrench down onto the drawbar bolt.

The baseplate could be any shape to suit the mill in question and just needs a central bore for the drawbar and two holes for the guide bars. These two holes need to be a good fit on the bars and at exactly the same spacing as those for the linear bearings in the motor support plate, to prevent binding (**photos 3** & **4**). The bars are retained with grub screws.

I had originally intended to remove the electric motor from its wrench housing but changed my mind when I saw how well it was mounted in the plastic moulded case. I elected to machine a register on the removable aluminium nose of the wrench and use that, with longer screws, to mount the whole wrench including the case on a 16mm aluminium plate. The handle was sawn off the wrench about 10mm proud of the body and the excess material heated with a heat gun and moulded back to fill the hole where the handle had been (**photo 5**).

I was concerned that the twisting effect of an off centre load to pull the wrench down onto the drawbar would cause the bearings to jam, so I chose to use linear ball bearings. I had not used these before, but I was very impressed with their smooth, low friction action (**photo 6**). They run on 20mm hardened steel bar. Both the bearings and bar were purchased from Marchant Dice. The cost of the linear bearings was cheaper than a suitable chunk of bronze and the hardened and ground bar was a similar cost to silver steel. It looks as if the cost of these items has come down considerably as CNC machines have become the industry norm.

The handle extension is made from a piece of rectangular steel tube fitted on the end with a ball handle. The ends were brazed up with steel blocks. By using tube, it is possible to fit the switch and cable inside for neatness. The ball handle should be positioned so that when gripping the ball and pulling downwards, the thumb can be used to press the switch at the same time.

The springs need to be strong enough to support the weight of the impact wrench but still allow it to be pulled down onto the drawbar easily. I found one supplier that sold 22mm bore spring by the metre, but these proved too strong for this job. I eventually made my own springs with 1.8mm spring steel wire on

Profiling the motor support on the rotary table.

the lathe. The pitch needed was approx. 2TPI, which was way outside anything that could be geared from the leadscrew, so I chose to feed manually using the leadscrew handwheel and 25rpm on the spindle. This proved to be very successful and much easier than I had imagined. A 16mm mandrel gave a spring with a 23mm bore (**photo 7**).

The wrench has a ½ inch square drive and I used an ordinary ¾ inch socket from a spare socket set. Impact rated sockets are available but are probably unnecessary for this light duty application. They also are usually hexagon rather than the bi-hexagon of conventional sockets, doubling the chance of the socket not lining up with the drawbar bolt. If the happens just blip the wrench motor to move it to a different position.

Electrical

The impact wrench that I used was rated at 19.2 volts and had a 1.7amp/hr Nicad battery that had failed. It gave a maximum torque of 280N.m, whereas tests with a torque wrench showed that around 30 to 40N.m were all that the drawbar needed. A few experiments showed that if it was connected to a 12-volt car battery the lower voltage limited the torque to the range needed. At 12 volts the current, unloaded, was 5 amps, and hammering under load 19 amps.

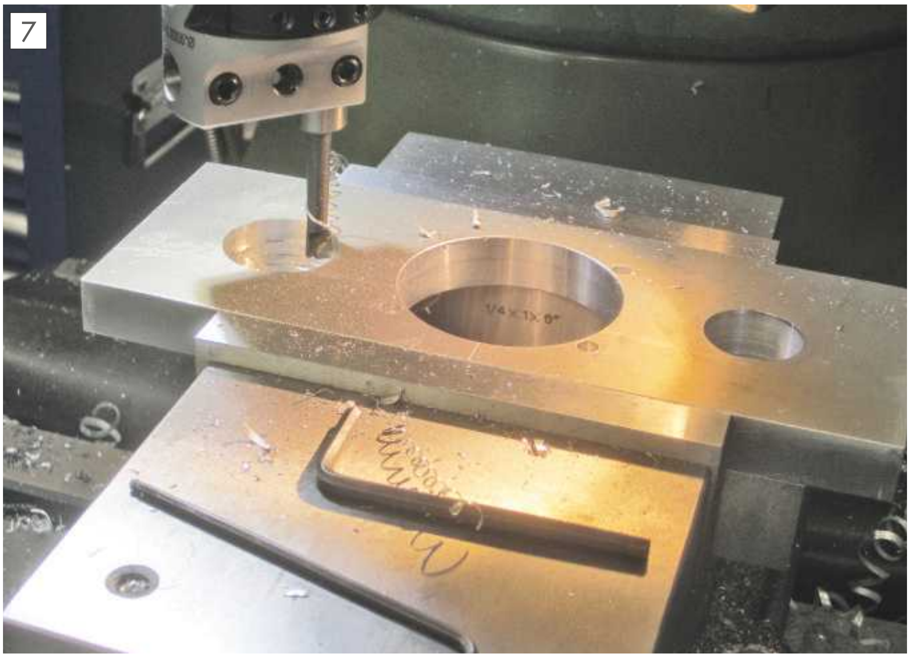
The direction of rotation is changed by merely reversing the polarity of the motor supply. This can easily be done with a DPDT, centre off, momentary contact switch, but I had difficulty locating a switch with a high enough DC current rating. Instead I found that generic car window winder switches are available cheaply that have a 20 amp DC rating. To support the high current a suitable heavy cable is needed and I used some twin core 2.5mm2 that seems to do the job.

I did not want to use a car battery as a power supply as I did not have a spare battery, nor did I want to be recharging one at regular intervals. Instead I used a 10 to 14 volt, 25 amp switch mode power supply that is sold for low voltage LED lighting. This is available on eBay at £17 for the 25 amp version, which is a fraction of the cost of an alternative DIY version using a transformer and bridge rectifier (**photo 8**).

In Use

I have been genuinely surprised how well this powered drawbar works, and how simple it is to construct, having been made from mostly scrap box materials.

In use the handle is just pulled down onto the drawbar bolt, the switch pressed until it hammers 3 or 4 times and then released. The other hand is used to support tool in the spindle. The whole operation takes literally two seconds. I use R8 collets for all my cutters so every cutter change needs the drawbar released. This tool certainly encourages me to change cutters when necessary, rather than carry on using the existing one because of time and effort of a tool change. ■



Boring holes for the vertical support columns.

The 25 amp power supply, a suitable outer enclosure is needed for electrical safety.

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