A BORING SOLUTION TO SPHERICAL TURNING

David Haythornthwaite uses a boring head for ball turning

Background

I do envy those model engineers who turn out magnificent scale models which can be put on display for all to admire. I seem to spend much of my workshop time making tools and tooling to enable me to make bigger and better tools.

My lone Stuart no.9 steam engine sits proudly on display and friends dutifully say “Oooh” and “Aaah” at the right moments, but I can hardly display a tool and cutter grinder on the hall table, can I? I have learned from experience that to casually mention over the prawn cocktail that I have spent 3 trillion hours making a case-hardened widget, with adjustable sliding gizmo’s on each end, for the workshop is a sure way to ensure that I am never invited to dinner again – EVER.

But I make no apologies to MEW readers, I like making tools. It gives me great satisfaction to make a tool which works well and has a useful place in my workshop. However I do like my efforts to look professional and well engineered. In my eyes, good tools are a thing of beauty.

It is therefore with some trepidation that I submit an article about a tool that is a “lash up” in the workshop, a “quick and dirty” solution to an engineering need. This article is about something that looks as though Heath Robinson thought about it in the middle of a nightmare – but it works superbly and it took me less than one hour to put together.

Spherical Turning

Spherical turning, – or ball turning if you prefer, is something that many readers will never have the need to carry out. I like ball handles on the tools that I make and when I made my T&C grinder in the style of a Quorn, I needed a ball turning attachment for my lathe. I can think of 5 ways to make turn ball handles. Form tools, hand turning, milling with an angled rotary table, and lastly two methods with ball turning attachments on the lathe. I chose to make an attachment as illustrated in **Photo 1.** and this was from a plan in MEW Issue 26 December 1994. It is a good tool, well designed and gave me great satisfaction both to make and use. The tool is configured such that the tool bit rotates about a vertical axis in order to create the ball. The problem with this is that the swarf falls onto the swivelling tool during turning and therefore you are trying to rotate the

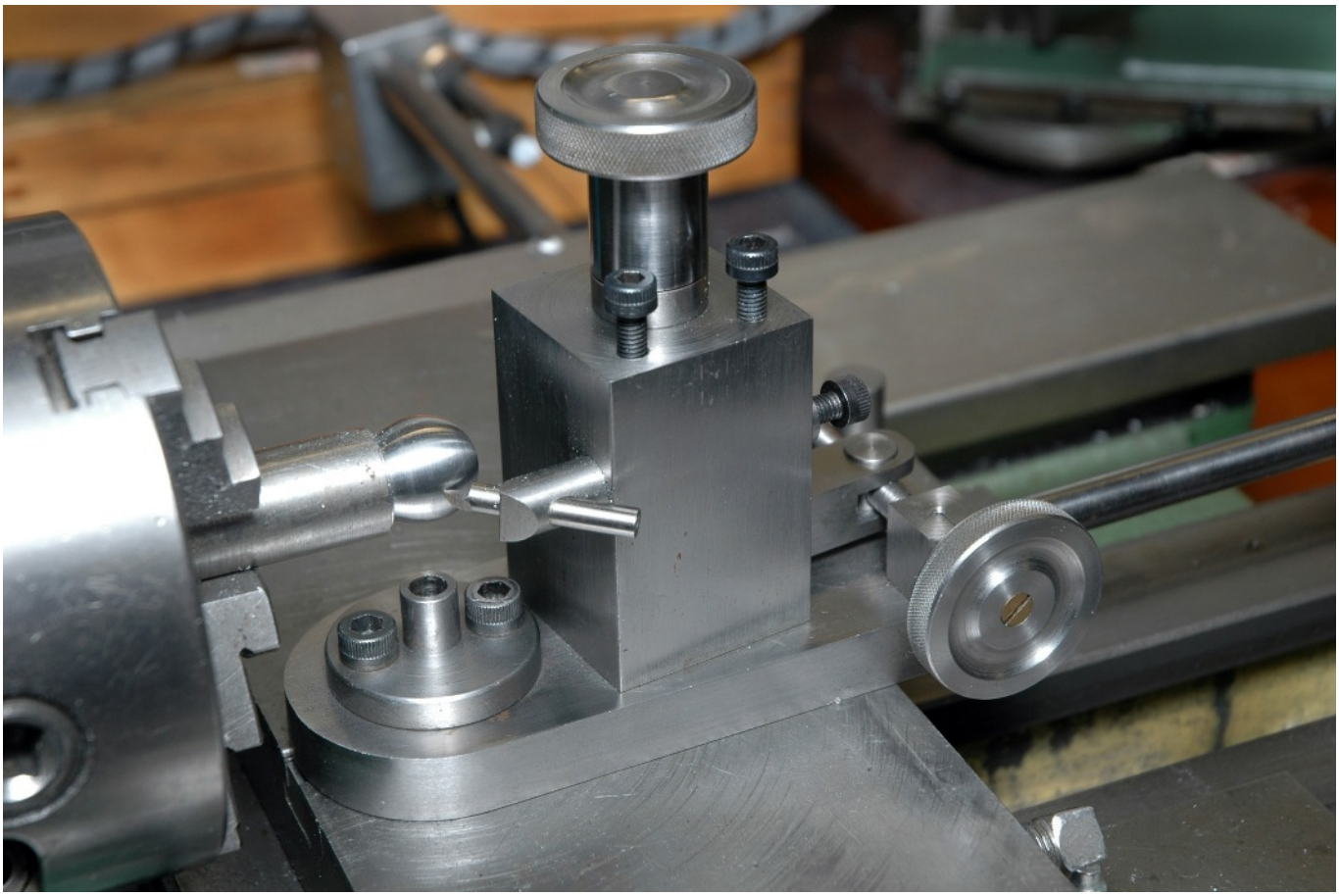

Photo. 1 The original ball turning tool built from plans in MEW

attachment on the cross slide, scraping swarf beneath it. After making the attachment I wished that I had made a ball turning attachment where the tool rotates about a horizontal axis, - a shaft held in the tool post. Such an attachment was designed by J.A. Radford, improved by Geo. H. Thomas and is available as a kit of parts from www.HemingwayKits.com .

The Current Project

I was trying to make a handle similar to a topslide handle on my Myford when I realised that my ball handle attachment would not turn a spherical section in the middle of a shaft, but that such a shape must be turned on a ball turning attachment that rotated about a horizontal axis. The ideal solution was to send off for the Hemingway kit and start cutting dovetails, but the more I looked at the attachment, the more I realised that it was essentially the same as a boring head attachment – and I had one of those. I also had a workshop spindle (which doubles as a T & C Grinder spindle, a lathe milling spindle and a drilling spindle for use on the cross slide of the lathe). The spindle already had a clamp to clamp it to the cross slide at centre height and it also had a No. 2 Morse taper socket. All I needed was the tool bit and a handle to rotate the device. I set about rigging this together and the set-up is shown in **Photo.2**. I almost feel ill when I look at it, but it works. The overhand looks impossible, but the tool is cutting on the top of the ball and the cutting forces are such that the tool is being pushed horizontally backwards towards the spindle. The cutting tool needs to be nice and sharp and the arrangement turns spherical objects with that wonderful feeling that you get when everything is cutting just right.

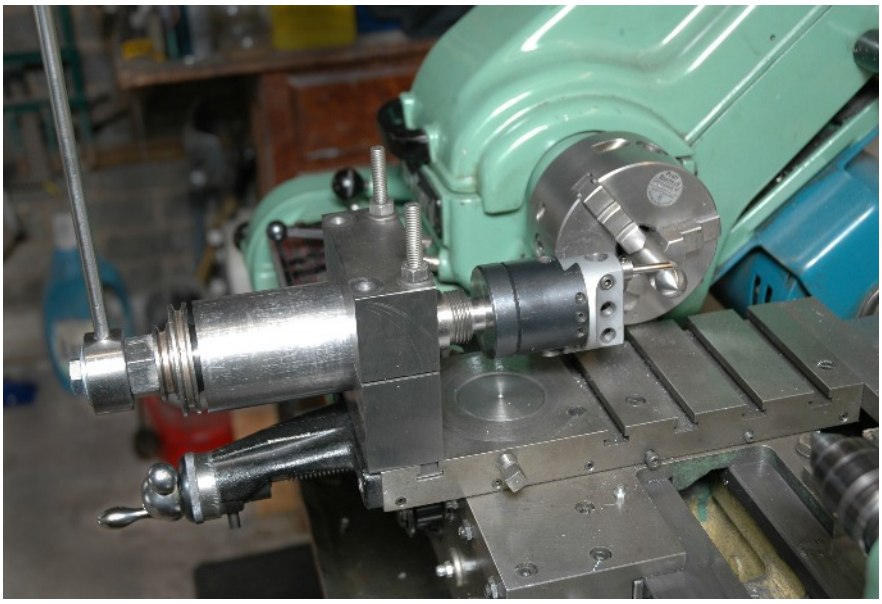

Photo. 2 The original lash-up on the Cross Slide

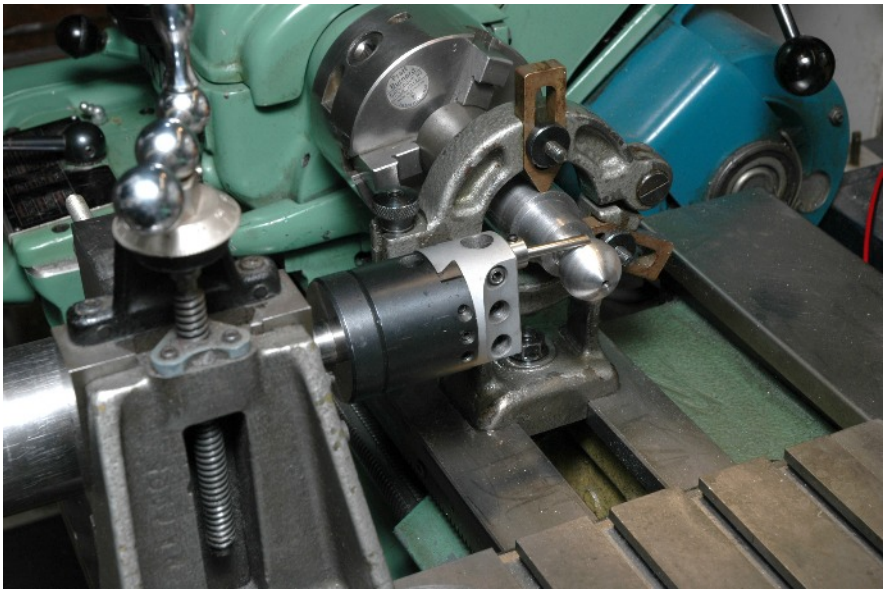

Photo.3 The boring head arrangement set up on the vertical slide.

Photo.3 shows the unit in action on the vertical slide. Using it in this way makes the unit more adaptable in that it can be used in close proximity to a fixed steady as in the photograph. The cross slide is out of the way. However, careful setting up is needed to ensure that the centre line of the unit is at the centre height of the lathe.

Photo. 4 shows the “business end” of the tool You will see that the tool is pointing down at 5 Deg to give a clearance angle and that the end of the tool has been ground back by 25 Deg. Giving a straight cutting edge of 65 Deg.

Making the Tool

My boring head takes tools of ½ “ diameter, so I cut a ½ “ piece of silver steel 1.5” long and faced off both ends in the 3 jaw. This is to fit into the boring head and to hold the much smaller ball turning bit. I took a piece of 3/16” (0.1875”) round tool steel as you would use for a small boring bar bit and used it to make the actual cutting tool. The length was 1.8” and I ground a flat along the end for 0.45” reducing the thickness of the tool bit to 0.119” i.e. I ground off 0.068” to make the flat. This becomes the cutting face. I then ground the end of the tool to 25Deg. Thus giving a total angle of 65Deg. along the cutting edge. The 1.5” length of silver steel was Placed in a tool holder on the top slide in such a way that the centre was exactly at centre height and in line with the axis of the lathe. The top slide was then rotated through 5 deg. And the silver steel was drilled axially and then reamed 3/16” to a depth of 0.9”to take the tool bit. A 2 BA grub screw was fitted to hold the tool in place as shown in **Photo 5.** At the end of all that I found that the tool bit was too tight to go into the holder, so I drilled the holder out 4.8mm which gave a nice sliding fit on the 3/16” tool bit.

Photo 5. Shows the finished cutting bit.

Using the Tool

First turn a groove in your blank ball handle to form the back of the ball. If you are using ¾” bar to make a ¾” ball, then cut a groove just over ¾” from the end of the bar to leave a ¾” x ¾” cylinder in which to make the ball. This gives tool clearance when turning the ball.

Set up the boring head in a spindle on your cross slide and set it exactly at centre height. Also ensure that the spindle is exactly at right angles to the axis of the lathe. Place the bar requiring the ball end into the chuck and move the cross slide in or out until the end of the cutting tool is on the centre line of the lathe. Open the dovetail slide of the boring head until the cutting edge of the tool just rests on the top centre of the bar in the chuck when the tool is at it's highest point. Wind the saddle towards the tailstock and swing the boring head clockwise through 90 deg. And then wind the saddle towards the head-stock until the tool bit presses on the end of the bar to be turned. Lock the saddle in that position.
Now open the dovetail slide of the boring head until the tool bit will clear the "corner" of the end of the bar when the boring head is rotated. Start the lathe and rotate the boring head slowly back and forth using the han-dle, closing the dovetail slide a little on each pass to put on the cut. If you have all the angles right and a sharply honed edge on the tool bit, you should see nice curls of steel peeling off with a satisfying hiss and the ball appears with a mirror surface.

Conclusion

Fig.1 shows the dimensions of the tool bit. As for the rest, well, readers in different workshops will tackle this according to the parts to hand. You may not have a spindle like mine, but it is easier to make an adapter for your boring head to swivel in the tool-post than it is to create a ball turning tool from scratch and start cutting dovetail slides. It isn't a pretty solu-tion, but very practical.
Oh dear – the next door neighbour is asking what this contraption is on my cross-slide I must remove it !!

David Haythornthwaite

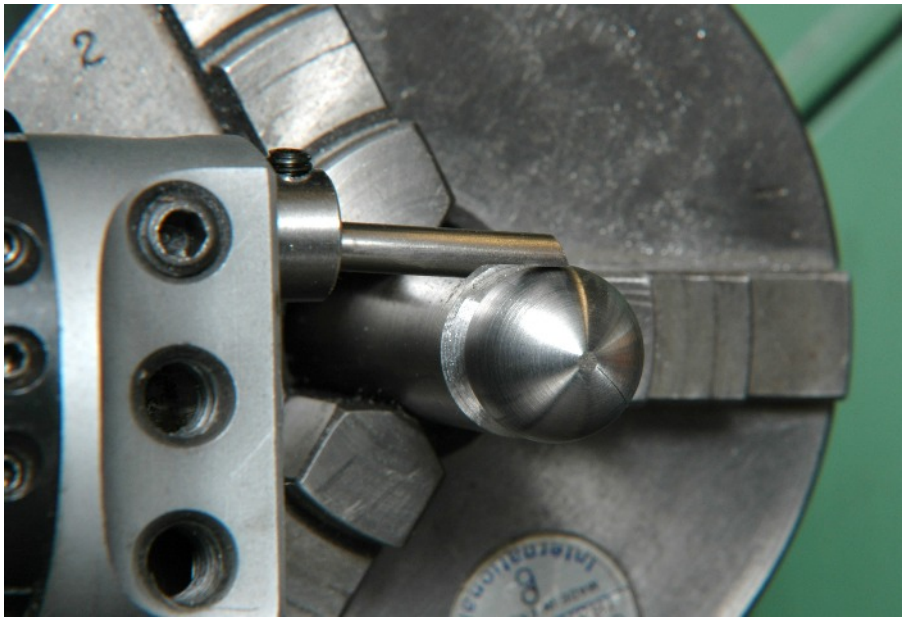

Photo. 4 The sharp end of the tool.

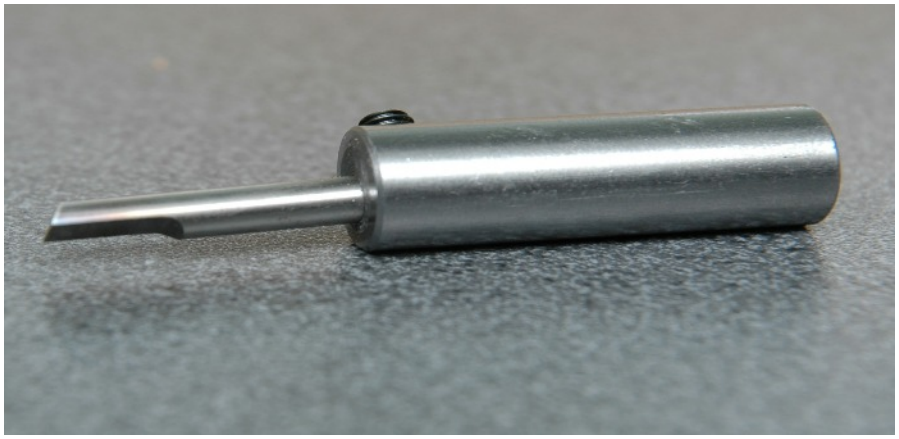

Photo. 5 The cutting tool

Fig 1. Cutting Tool