One Small Step for Man

One giant leap for the home workshop! *Sorry – I got carried away.*

John Stevenson introduces the new EMG-12 End Mill Re-Sharpening Module from Arc Euro Trade.

For years model engineers have been fascinated with tool and cutter grinders, from the simple to the complex. It's probably true to say that a tool and cutter grinder is high on the list of machines to own, when budgets permit, or you can get around to it.

The EMG-12 Module.

There are many simple kits out there like the Kennet, Worden, Stent and others, leading up to the ultimate, The Quorn, which has often been described as the holy grail of Model Engineers.

When considering a kit, there are several challenges to overcome. Do I want to build it? Can I build it and how long will it take for me to build it? Time and cost probably don't come into it too much, I suppose, as you are building it for your own pleasure.

Once you have built it, how easy or difficult is it to use? Some of the kits are straight forward, leading up to the more complex processes involved with kits like the Quorn. Setting up time can either be described as interesting if you like the thinking process, or time consuming, if all that you really wanted to do was to re-sharpen an end mill quickly.

Now let's take the staple diet of a milling machine which is end mills or slot drills. Unless you are squaring up big blocks of material you only use the last 1mm up to ~4mm of a cutter, depending on the size and rigidity of the machine, so in theory if you were able to keep this last bit sharp then the cutter would have a very long life.

Cutters fail because they degrade on the cutting edge and being human we always try to get the utmost out of one, so as it degrades you need more force to push the cutter through the work. This starts a vicious circle because it degrades more, you need more force which again degrades even more, then BANG! 'Damn - who'd have thought that?'

R.I.P that cutter which, with care should have lasted years, but care costs money, be it sending out for regrind or getting the kit made Quorn out for the mental challenge ahead.

Now as some readers and members of the M.E. forum know, I run a bodging shop, sorry jobbing shop, for a living. I also own a commercial tool and cutter grinder, similar to a Clarkson, bought new 20-odd years ago and its probably only got less than 10 hours on it in all that time. The truth is that at commercial rates I cannot afford to use it.

Last year I was over in China for the best part of a month with Ketan from Arc Euro Trade doing various factory tours and shows. This has to be done as it's the only way to ensure some quality control, as working by email or phone will not achieve the same thing. At one factory we visited they were producing all sorts of projects from large machining centers for wind turbines to small tooling. Unlike hobby machines none of this was built to a price, only to a quality. There's not much point trying to save 10 Yuan on a slide way grinder with a travel of 68 metres!

This factory was that large they even built their own CNC machining centres for their own use, as well as various other machines.

One of the machines that caught my eye was a range of end mill grinders. Each machining centre had one of these and the operator after swapping tools, sharpened the end up and replaced it in the carousel. The part that interested me was the speed at which he did this. Basically he picked a cutter up, put it in a holder, poked it into 3 holes on the machine and that was it. So in typical Stevo fashion, learnt off Yosser in the TV program *Boys from the Black Stuff*, I asked 'Gizzago!'

The operator showed me how to use it'. Remember he's got no English and I don't think I'd have got far with the three Chinese words I know, so basically hand

It's possible to get carried away sharpening cutters.

The collets and cams supplied as standard.

signals. Now my turn, got it first go, but slow having to feel my way through. So I signalled for another cutter. Phone out, stop watch on and for a 12mm, 3 flute cutter it took 58 seconds. Did I mention I was in love with this machine?

Later on that day discussing machines and orders and I asked about these grinders, just a basic question like 'How much?' I should have asked 'How MUCH!!!???' Just let's say if that you have to ask you can't afford.

After more talks and bearing in mind their grinders were far bigger than the average home shop needs, let alone can, afford they offered a smaller version and that is what you see in the picture. I have no idea whose idea it was to make it look like a lunar lander, it certainly wasn't ours and their commercial versions are large cast boxes but after all the tittering in the back seats, it works, and works well.

We specified cutters from 3mm to 12mm in 2, 3 or 4 flutes and they must be either conventional 4-flute with the clearance hole in and/or centre cutting. They came up with 2mm to 12mm in normal or centre cutting. It will grind carbide and HSS. The unit weighs just under 7kg or 15 pounds. The size is just under 29cm cube or a foot cube.

It ships with an electroplated diamond wheel but CBN wheels are also available. I have no idea on the life of the wheel. I have had the prototype machine for about 6 months [up till mid-March] and for the first 3 months I only used the diamond wheel grinding everything whilst I was waiting for the CBN wheel to arrive. During that time it has done in excess of 400 cutters and when I came to swap it for the CBN to do a load of HSS cutters I could see no wear (**photo 2**).

Over Christmas I swapped it back to a Diamond wheel and went to visit some friends down in Welsh Wales as I'd offered to show it them and also grind some cutters up. It turned out that most were HSS but these electroplated wheels don't seem to suffer like the resin coated wheels, also they are coarser than you would think. Anyway over a period of 2½ days we sharpened every cutter he owned, 175 in total. Everyone who has seen and tried this machine has been amazed at how quick and how good a job it does.

It takes between 5 and 10 minutes to train someone up to use it. There are two very simple setting operations, cutter height and tooth location. Both of these are done with a simple inbuilt setting jig and that's all there is to set the cutter. Two Allen keys are supplied with the machine and that's all you need as regards tooling, one is for setting the cutters the other is for changing a wheel which is a five minute job. The wheels are special to the machine as all the angles are built into the wheel and the cams.

The machine comes with a set of 7 holders 3, 4, 5, 6, 8, 10, and 12mm as well as 24 cams, all in a very nice aluminum padded and profiled box with all the sizes printed on the foam insert (**photo 2**).

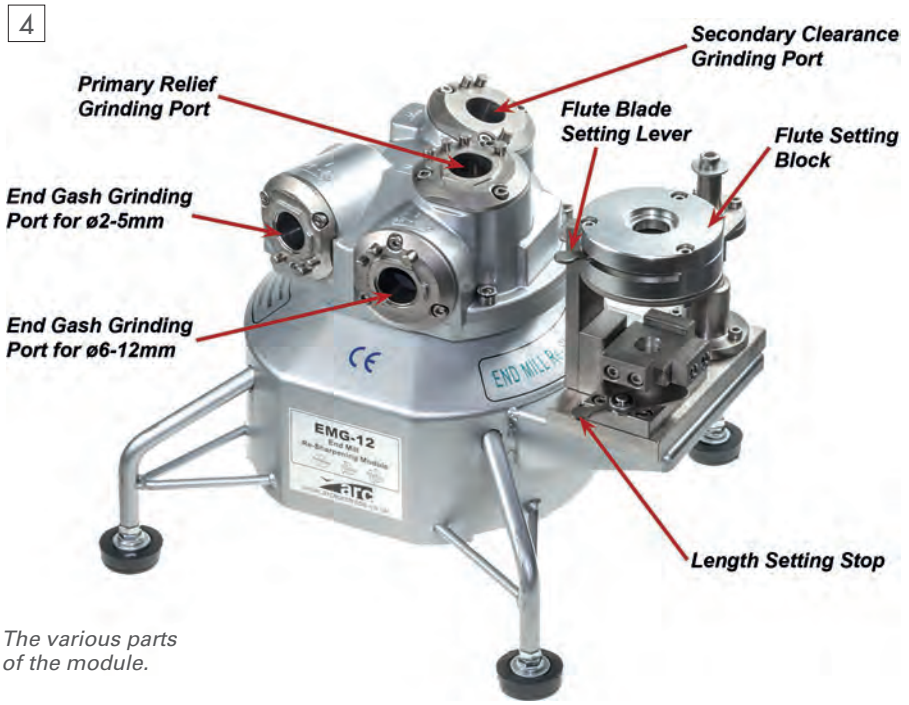
There are 8 cams for 2 flute cutters in 2, 3, 4, 5, 6, 8, 10, and 12mm sizes and the same for 3 flute and for 4 flute. There is no 2mm holder as they assume the 2mm will be on a 3mm or 6mm shank. You can play mix and match using, say, a 6mm holder but 3mm cam. There are no holders for imperial cutters as it's a metric machine but they are very easy to make as the holder is just a piece of 20mm steel with a grub screw hole in and bored to suit whatever cutter you need.

A ¼ inch holder would be used with a 6mm cam as it's the closest size, ⅜ inch with a 10mm cam and ½ inch with a 12mm cam. The differences between a 10mm cam and a 12mm cam are not visible with the eye, they are that subtle. Where the skill would be with the operator on a T&C grinder, the skill here is built into the machine. The machine has a die cast alloy body with hardened steel inserts where the cams and holders fit and these are also hardened for long life.

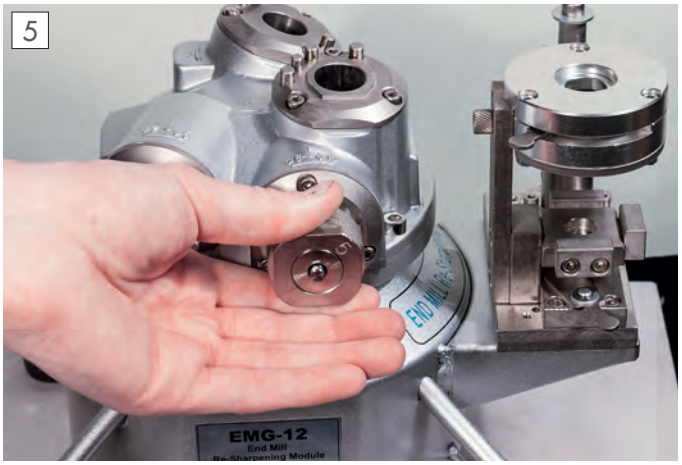
The surround and legs are pressed/tubular steel and the motor is a 3 phase brushless unit that works off its own single phase power unit that plugs into the back via a 4 pin plug.

The manual has been put together here in the UK by people actually using it and saying what they are doing and has then been translated from my Ilson dialect into proper English and clear concise pictures taken of each operation.

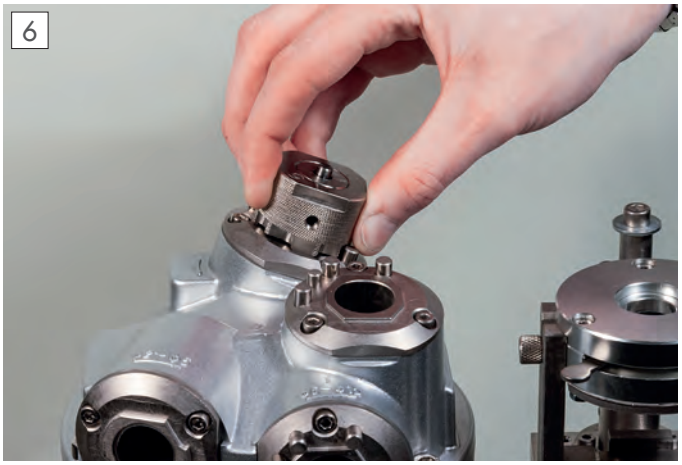
Looking at the machine in **photo 3** you can see that it has four ports in it to take the cutter but you only use three. The two horizontal ones at the front are nearly duplicates. These ports do the gashing of the flutes for centre cutting (**photo 4**). The left hand one does 2mm to 5mm and the right hand side one does 6mm to 12mm.



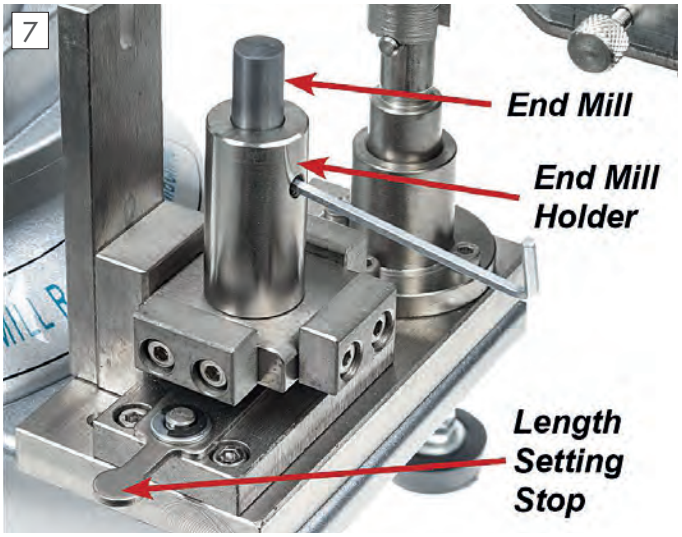
The various parts of the module.



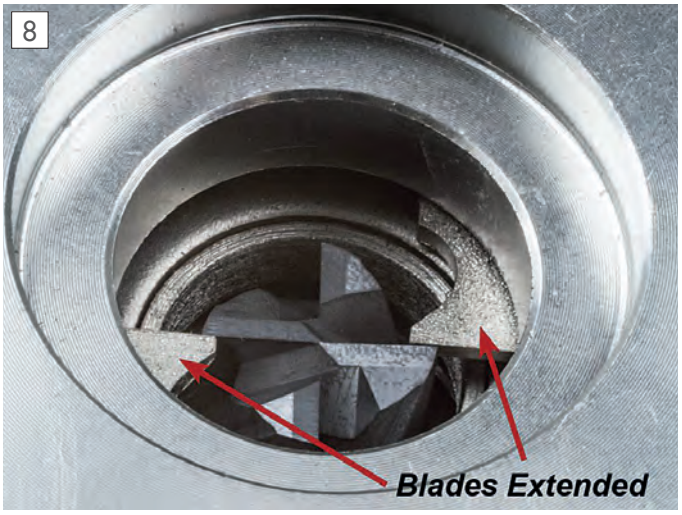
Gashing a cutter.



Putting on the secondary clearance.



Using the depth setting jig.



Aligning the flutes.

Both are clearly marked with raised die cast numbers. The port above does the primary grind and the far one does the secondary or clearance grind (**photo 5**).

To set the machine you place the cutter into the holder, cutting edge down so it sits onto a length setting stop and the grub screw is tightened up (**photo 6**). The cam is then fitted to the holder once it has been reversed and the flute setting block swung over and the longest cutting edge is rotated so it sits in the 3 o'clock position and then the cam grub screw is tightened and that is all the setting required (**photo 7**).

Each cam has index lugs on it equal to the number of flutes and these are then positioned between the relevant pins on each port and with the wheel running the holder and cam is pushed in and rocked between the pins until it stops cutting. This is done for each flute in turn and then you move on to the next port.

As you can see there are hardened pins on each of the ports. Two of the pins are for locating the cam so it is in the correct position; the other pins are just stop pins so none of the three different cams can be inserted incorrectly.

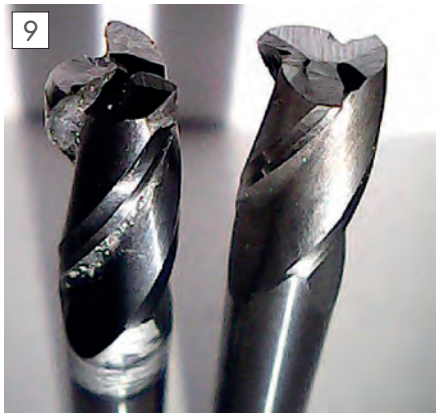
It really is a very easy machine to use but more importantly because of the lack of skill needed to operate this and the speed it can do a whole selection of popular cutters it can save a lot of money. The first 17 solid carbide cutters I reground came out of the carbide/HSS scrap box where badly damaged or broken cutters live before being converted into slotting tools or fly cutters. All these required cutting back with a carbide slitting saw to get rid of broken flutes but the machine can handle a cutter with a blank end, i.e. no original cutting edges left.

Photograph 8 shows a close up of two 8mm cutters, one is worn with the typical wear damage and the other has been backed off to get rid of damage. **Photograph 9** shows a close up of the same two cutters after grinding. I must apologise for these last two pictures as they were taken at x5 magnification under a USB microscope and the quality of the lighting could be better. What looks like flaking of the edges are actually minute burrs thrown up by the wheel. To the naked eye they look perfect.

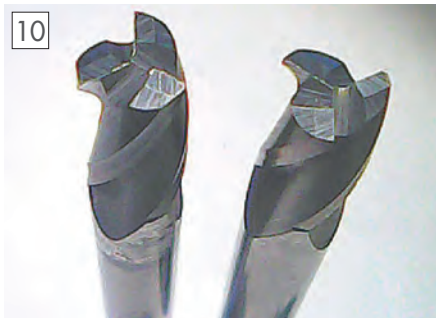
With the OK from Ketan at Arc Euro Trade, I will be taking this machine to the Harrogate show for the whole of the three days. The Harrogate show, this year runs from Friday, 8th of May until Sunday the 10th of May.

Whilst there if anyone attending the show wants to bring some cutters up I will sharpen them whilst they wait or if its busy they can collect them from the stand later. I must put a cap on of 4 – 5 cutters per person to give everyone a chance, they need to be from 3mm to 12mm or ⅛ to ½ inch in 2, 3 or 4 flute and they can be carbide or HSS.

The show organizers will be providing a charity box on the stand for donations, we will not be charging. This will be an ARC stand for the purpose of demonstrating this machine only. ARC will not be selling any products at the show. ■



Worn cutters before...



...and after.