FITTING A ONE-SHOT LUBRICATION SYSTEM TO A MYFORD ML7 LATHE

Tony Jeffree makes his lathe easy to lubricate

■ OVERVIEW

One of the deeply frustrating aspects of owning a Myford ML-7 is its lubrication system, if it deserves to be called that. The drip oilers are a pain to adjust, and half of the time, they are totally useless because you forget to turn them on at the start of a session; the other half of the time, you forget to turn them off when you have finished, so the next time you want to use the lathe, the oilers have emptied their contents uselessly, via the head bearings, into the drip tray.

The original glass dome oilers did at least let you see what the drip rate was; however, I had fitted my lathe with the modern oilers that Myford currently sell as replacements, and these manage to run the oil down the sides of the sight tube without giving any visible drip. And of course, then there are the oil-nipples-from-hell and the appalling and utterly useless little toy oil gun that was issued as standard equipment with the lathe. The more modern oil guns that Myford now sell are a vast improvement, but it is still nothing short of a black art to persuade the gun to form a seal with the nipple that is good enough to prevent a high pressure jet of oil squirting you in the eye when you push the plunger. So, it was with considerable interest that I read in the Arc Euro Trade catalogue that they now stock a range of parts that will allow you to design and install a "one-shot" oiling system (**photo 1**).

System components

Photograph 2 shows the heart of the system, which is an oil reservoir with a built-in manually operated pump. You pull back the spring-loaded plunger and release the handle; the spring then forces a measured quantity (3ml) of oil out of the reservoir and into the pipework that you have attached to it. The tank holds 180ml of oil, so there are approximately 60 shots per tank.

Photograph 3 shows the main components of the system. On the top row is a straight hose adapter and a 90-degree elbow adapter. These have a male M6X1 thread that screws into an oiling point on the machine, and a female M8X1 thread that is designed to accept a compression bushing and a compression sleeve or olive (right hand column in the photo) so that you can insert 4mm Nylon tube into the fitting and get a good seal.

To the left of the middle row is a "banjo" assembly; this does a similar job to the 90deg. elbow connector, but is useful for use in awkward positions where there isn't room to "swing" the 90deg. elbow as you screw it in. The banjo bolt is M8X1, and is sealed top and bottom with O-rings.

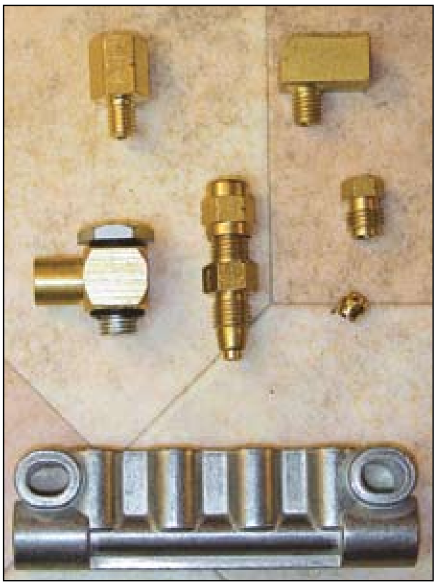
In the middle of the photo is one of the metering unit assemblies. Alan at Arc Euro Trade showed me one that he had hacksawn in half to show the internal structure. Built into the device are a small filter plate, an accurately machined metering orifice, and a spring-loaded non-return valve. This latter point gives you a clue that these units fit only one way round - you can just see the arrow on the flat at the left of the unit, indicating that flow direction starts at the pointy end and exits through the screw on cap. This cap hides a compression sleeve, so the 4mm Nylon tube can be attached to the outflow end of the metering unit. The metering units come in four sizes; the flow rate increases by a factor of two when you go from one size to the next largest size in the range.

At the bottom of the photo is a 6-way manifold. The six ports in the manifold are threaded M8X1 to accept either the pointy end of a metering unit, or a compression bushing and its compression sleeve. Naturally, one of the ports will be used for the inflow of oil from the pump; the remaining ports can be used to feed individual oiling points, or to feed another manifold. The manifolds come in a variety of sizes, from 2-port manifolds to 10-ports. I can already hear the question being asked - why have a 2-port manifold? The answer is simple - the metering units should be kept as near to the oiling point as practically possible, so if there is a long run of pipe from the nearest manifold to the oiling point, then you place a 2-port manifold near the oiling point and screw the metering unit into that. A short stub of tube can then run from the business end of the metering unit to a straight or 90 degree adapter at the oiling point.

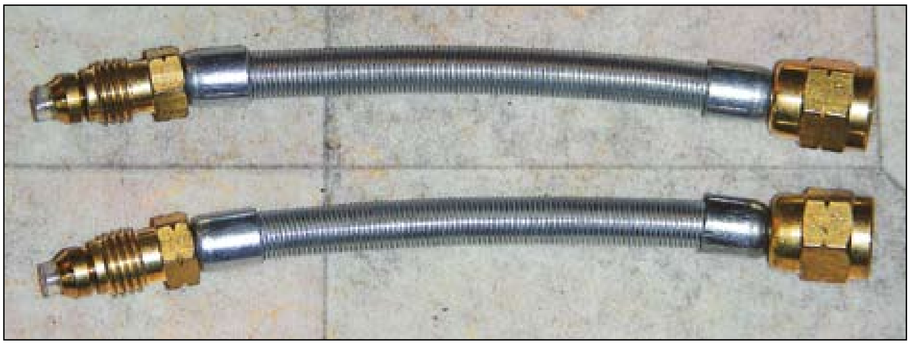
Not shown in the photo are the ranges of tubing clips that are designed either to clip the bare 4mm tubing, or to clip the tubing after it has been sheathed in the 6mm spring tube guard that protects the Nylon tube in places where it may be vulnerable. There are also metal ferrule ends available to make a neat job of the tube guard. **Photograph 4** shows a couple of pipe assemblies made up with compression

1. Most of the lubrication system can be seen in this photo.

2. The oil reservoir with pull handle.



3. Lots of different connectors are available.



4. A couple of made up hoses.

Table 1	
Type of bearing	**Oil requirement (cc/hour - measurements in inches)**
Plain bearing or drive screw	0.15 X bearing shaft diameter X bearing length
Gear	0.3 X gear pitch diameter X gear face width
Slideways (flat)	0.04 X [length of moving member + travel] X width
Slideways (cylindrical)	0.15 X diameter X [length of moving member + travel]
Ball or roller bearing	0.1 X bearing shaft diameter X number of rows of balls or rollers

sleeves at one end to fit an oiling point adapter, and metering unit caps at the other end to fit the business end of a metering unit.

As the compression olives grip tightly onto the plastic tube, you will appreciate that there are ample opportunities when using this system to forget to put all the right bits in place before tightening down the olives, with the result that you have to dismantle, cut off the ends of the tubes, and start again. There is also a point of technique that is worth noting here - when the tube goes around corners, the length of spring guard tube that is required decreases slightly. I found that the best approach was to make up tube assemblies with the tube held straight, and temporarily fit the caps or compression sleeves to a socket in a manifold or to a metering unit to partially compress the olive at each end before attempting to fit the tube in its final position.

Because the larger manifolds only have even numbers of ports, and because it is inevitable that the number of ports you actually need won't match, the system also includes a blanking plug that looks rather like the compression bushing but with a pointy end and no through hole that can be used to block off unused ports in manifolds. However, if like me you forgot to order one, it is possible to improvise by using a compression bushing and olive with a short length of Nylon tube that you have filled either with hot melt glue from a glue gun or with a short stub of suitable diameter rod.

Designing a system

The first decision is which bits of the lathe you want to lubricate. On my lathe, I decided that I would attempt to use the system with as many of the oil points as I could manage. So, my list of points to lubricate was as follows:

- Two headstock bearings.
- Two countershaft bearings.
- Two leadscrew bearings.
- Two saddle oiling points.
- One oiling point on the front of the saddle (this feeds the rack and pinion and associated gears).
- Two oiling points that I would have to create at the front of the saddle to feed oil into the cross slide dovetails.

It should be intuitively obvious that all oiling points are not created equal; the headstock bearings probably need more oil than the others, closely followed by the saddle and cross slide bearings, followed pretty much by the rest. However, it is possible to apply rather more objective analysis to the problem in order to choose the right size of metering unit to place at each oiling point, as discussed later.

It might be tempting to save money by sharing a metering unit between two oiling points, for example feeding the output of a metering unit to a 3 way manifold, and then feeding the remaining two ports of the manifold to each of the oiling points; however, this is best avoided unless the resistance to oil flow seen at both oiling points is identical. If it isn't then the consequence is that one of the oiling points will get more oil than the other, which would rather defeat the object of installing the system in the first place. So, for this installation, I chose to use individual metering units for each of the eleven oiling points listed above.

Determining the size of metering units for each oiling point is a multi-step process. The first step is to work out what volume of oil, in cubic centimetres per hour, the bearing associated with the oiling point should receive. There is a formula associated with each different bearing type that allows this to be calculated, as shown in **table 1**.

Using these formulae, I arrived at the following, based on not terribly precise measurements taken from my ML7:

- Headstock: Large bearing is 1.25in. diam X 2in., so oil requirement per bearing = 0.15 X 1.25 X 2 = 0.375 cc/hour. In reality the left hand bearing is smaller, but I chose to treat them as the same.
- Leadscrew: 0.625in. diam X 2in. (1.25in. for the shorter bearing at the tailstock end), so oil requirement per large bearing = 0.15 X 0.625 X 2 = 0.19 cc/hour and oil requirement per small bearing = 0.15 X 0.625 X 1.25 = 0.12 cc/hour.
- Saddle slide: Oil requirement per large bearing = 0.04 X 1.75 X 15 = 1.0 cc/hour, and oil requirement per small bearing = 0.04 X 1.25 X 12 = 0.6 cc/hour.
- Cross slide: Oil requirement per bearing = 0.04 X 1.25 X 12 = 0.6 cc/hour.
- Countershaft: Oil requirement per bearing = 0.15 X 0.75 X 1.75 = 0.2 cc/hour.

I didn't attempt to calculate the requirement for the rack and pinion gears - I figured that if it got the same as the lowest requirement in the system then it would be getting more than it was getting before!

With a bit of rounding here and there, this resulted in the spreadsheet below.

This requires a little explanation. The "nominal volume requirement" is in cc/hour, derived from the calculations shown above. So, using these formulae, the system nominally needs about 4.5 cc/hour to be delivered in total, proportioned as shown in the second column of the table.

The "flow rate" column simply assigns relative flow rates to each lubrication point, based on the size of the metering unit that will be used at each point. Hence, the smallest size of metering unit is assigned to the leadscrew bearings, the

Oil point	Nominal volume requirement	Flow rate	Volume per shot	Metering unit size
Headstock 1	0.4	4	0.571428571	AJB2
Headstock 2	0.4	4	0.571428571	AJB2
Saddle 1	1	2	0.285714286	AJB1
Saddle 2	0.6	2	0.285714286	AJB1
Cross-slide 1	0.6	2	0.285714286	AJB1
Cross-slide 2	0.6	2	0.285714286	AJB1
Leadscrew 1	0.19	1	0.142857143	AJB0
Leadscrew 2	0.12	1	0.142857143	AJB0
Countershaft 1	0.2	1	0.142857143	AJB0
Countershaft 2	0.2	1	0.142857143	AJB0
Pinion gears	0.2	1	0.142857143	AJB0
Total	**4.51**	**21**	**3**	

5. The reservoir is mounted on the belt guard.

countershaft bearings, and the pinion gears; the next larger size of metering unit (twice the flow rate of the smallest) to the saddle and cross-slide, and the next larger size to the two headstock bearings. You will note that this doesn't actually follow the relative sizes of the calculated flow requirements, as these suggest that the slideways should get more oil than the headstock bearings; my rationale here was that I suspect that the slideway lubrication rates are calculated on the assumption that the slideways are in constant reciprocal movement, which might be true of a machining centre but not true of a hobby lathe. So I decided to give the headstock bearings more oil than the slideways.

Add up the flow rate column entries and you get a total of 21 "units of flow"; i.e., the smallest metering unit will deliver $\frac{1}{21}$th of the total volume (3cc/shot), the mid sized ones $\frac{2}{21}$ths of the total volume, and the large sized ones $\frac{4}{21}$ths of the total volume. The "volume per shot" column then shows how much of the 3cc shot will be delivered to each point. This shows that if you give one shot per hour, then the headstock bearings get about the right volume, but the remaining points a little less than the theoretical requirement. However, as under normal circumstances,

6. The three way connector on the back of the lathe bed.

you would leave the drip oilers running continuously, and maybe give the other lube points a squirt once in a while, it is probably a reasonable balance. Clearly, you could choose to vary the arrangement by choosing different metering units to the ones I used.

The final column shows which metering units I selected in order to meet the requirement. I decided to go for the largest ones that Arc sells (AJB2) for the headstock bearings and work down from there; if I had started with AJB1 for the headstock and worked down to AJB00 for the smallest, then the only difference in performance would be that the time taken to deliver a shot of oil would double. With the units chosen, the shot gets delivered over approx. 30 seconds.

Assembling the circuit

The circuit was designed around three manifolds; one 8-way manifold, located close to the pull handle oiler (**photo 5**), which serves the headstock, countershaft, and leadscrew bearings, a 3-way manifold, mounted on the back of the bed (**photo 6**), that allows a Tee-take off point to be located in the pipe that feeds the tailstock end leadscrew bearing, and a 6-way manifold attached to the front plate of the saddle (**photo 7**) that serves the slideway oiling points (4off) and the pinion gear oiling point.

The first step was to attach the pull handle oiler and the 8-way manifold to the pulley guard at the left hand end of the lathe, as shown in photo 5; I used screws and nuts that I had to hand for this. In order for this to work properly, you need to reverse the position of the mounting plate on the oiler; simply remove the four screws that screw down through the top

7. Multi-way manifold on the lathe carriage.

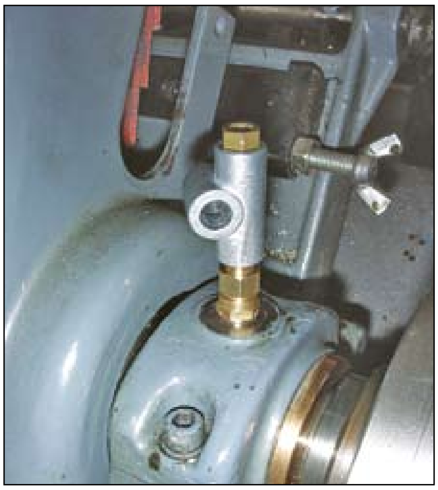
plate of the oiler into the mounting plate, spin the mounting plate through 180 degrees so that the mounting holes are on the right of the oiler handle instead of the left, and re-assemble with the four screws.

The plumbing work can now start. The first connection is from the output of the oiler to the top end port on the manifold. This is straightforward enough; you start by fitting a compression bushing and an olive over the end of a length of Nylon tube, insert them into the output port of the oiler, and screw the bushing home with sufficient turns to compress the olive so that it both grips the tube and seals the joint. You then cut the tube to length so that it will fit all the way into the port on the manifold, cut a length of the spring tube to the right length so that it will allow for two ferrules plus a compression bushing and an olive to be fitted and still allow about 2mm of Nylon tube to protrude through the olive, fit the ferrules, bushing and olive in place, and screw the bushing into the manifold port.

It is now a matter of working your way down the remaining ports, and connecting them up as required (photo1). The second port feeds the left hand countershaft bearing (looking from the operator's side); to do this, I used a two-port manifold, mounted onto the countershaft bracket by means of a socket head screw into a tapped hole in the bracket. The tube from the 8-way manifold feeds into the bottom of the 2-port manifold, with a compression bushing and olive as before; the metering unit screws into the top end of the 2-port manifold (pointy end first) and a short length of tube from the outflow cap of the metering unit connects to the 90-degree elbow that is screwed into the countershaft oiling point. There are two ways that the

8. Turning and threading the connector.

9. Unmodified (left) and modified (right) connectors.



10. Headstock connector fitted to lathe.

11. The headstock has been piped up.

12. Banjo connector to leadscrew bearing.

13. The split bush.

14. Modified banjo bolts.

15. Modified adaptors.

elbow can be fitted here. The first is to disassemble the countershaft, remove the standard oil nipple, drill and tap the nipple hole M6X1 to suit the thread on the elbow joint; the second is to modify the thread on the elbow joint to fit the standard oil nipple thread. I chose the second approach; the elbow joint can be gripped in the 4-jaw chuck so that the threaded end is on-axis, and the thread is then turned down and threaded 2BA to fit the nipple hole (**photo 8**). If you go that route, then you may as well modify all four of the 90-degree elbows to 2BA threads at the same time, as they are all used to replace existing 2BA threaded nipples.

The next port in the 8-way manifold feeds the left hand headstock bearing (looking from the operator's side). Having removed the standard drip oilers, you are presented with a ⅛ BSP threaded hole in the bearing cap. It turns out that of you turn down the hex portion of the screw cap on a metering unit, there is just enough meat left to take a ⅛ BSP thread. **Photograph 9** shows the "before and after"; the original metering unit on the left, and one with a modified cap on the right. The pointy end of the metering unit is screwed into another 2-port manifold, and then the whole assembly can be screwed into the bearing cap (**photo 10**). It is then a matter of fitting the Nylon tube, spring tube, compression bushings and olives as before; the tubing fits neatly through the gaps in the countershaft hinge assembly, and is held in place using cable ties (**photo 11**).

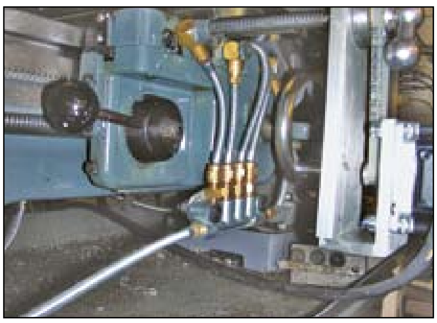
The next two ports on the 8-way manifold feed the right hand countershaft bearing and headstock bearing; the assembly is simply a repeat of the left hand ones. I fitted a couple of two-tube clamps to these four tube assemblies to keep things neat and tidy (photo 1). The next port isn't used; ideally you would use a blanking plug (part number 084-025-00400) to blank this off, but a perfectly workable alternative is to find a short length of rod (plastic or metal) that is a close fit for one of the compression olives, and fit that in place using one of the standard compression bushes.

The penultimate port feeds the leadscrew bearing at the changewheel/gearbox end of the leadscrew. **Photograph 12** shows the assembly that is required there; a "banjo" assembly screws into the oiling point, the metering unit screws into the banjo assembly, then a 2-port manifold attached to the pointy end of the metering unit, and then the tube feeds back to the 8-port manifold. Again, you have a choice with the banjo as to whether you will drill and tap the leadscrew bearing to take the banjo's M8X1 thread, or whether to modify the banjo thread to 2BA. I chose the latter approach; you need to make a split collet like the one shown in **photo 13** to allow you to hold the banjo screw in the 3-jaw chuck. **Photograph 14** shows "before and after" shots of the banjo screws. Fitting the metering unit to the banjo assembly is a bit of a cheat, and is probably not what was intended, but it works; basically you remove the cap of the metering unit, cut a length of Nylon tube that is just a tad longer than a compression olive, and then screw the metering unit, tube and olive into the port of the banjo assembly, tightening to make the seal. **Photograph 15** shows the same general idea but with one of the straight adaptors instead of a banjo unit. Two more banjo units will need modification to 2BA if you choose to go that route - one for the tailstock end leadscrew bearing, and one for the pinion gear oiling point on the saddle.

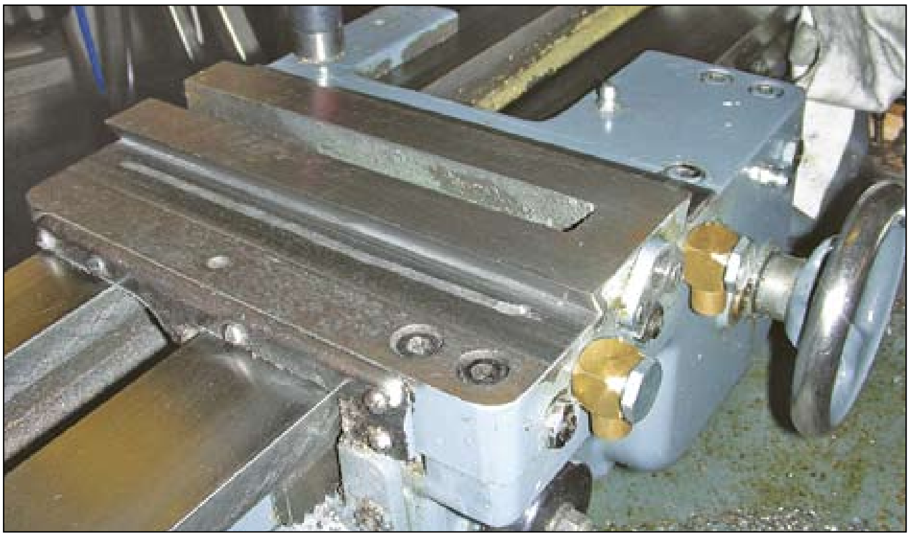
The final port on the 8-port manifold feeds a tube across to the 3-port manifold; this is mounted on the back of the bed (photo 6). This acts as a Tee-splitter. One branch (the straight through branch) feeds the tailstock end leadscrew bearing (**photo 16**) and is simply a repeat of the left hand leadscrew bearing assembly. The other branch feeds across to the front of the apron and into the left-most port of the 6-way manifold (**photo 17**). This manifold was attached to the front of the apron, below the cross slide feed screw, using a piece of aluminium plate from the scrap box. The tube from the 3-way manifold obviously has to be long enough that it will allow the saddle to traverse the entire length of the bed without snagging.

The remaining 5 ports of the 6-way manifold are all reasonably close to their points of delivery, so I chose to screw the metering units directly into the manifold,

16. Tailstock end leadscrew bearing banjo.

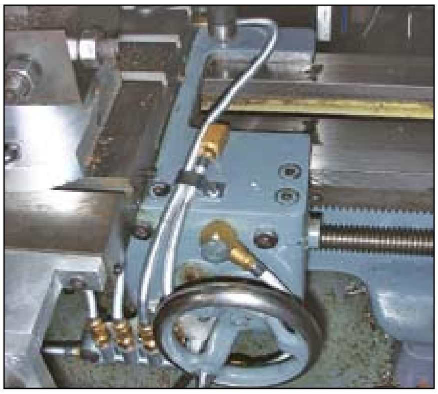


17. The carriage all piped up.



18. Two of the carriage connections.

19. Another connection, this time on top of the carriage.



20. A final view of the carriage connections.

which makes the plumbing a bit simpler as you don't need to mess around with any more 2-port manifolds. The left-most pair of ports feed into banjo assemblies that feed the cross slide bearing surfaces. There aren't any convenient oiling points for these, so this is the first case where the only way to fix the problem is to make an irrevocable change to the machine. First, remove the cross slide assembly so that you have access to the front of the apron. Now drill horizontally into the top member of the cross slide with a 4mm drill, directly below the bearing surface and in the direction of travel of the slide, to a depth of about an inch. The hole should start about ½in. down from the top surface so that the banjo doesn't interfere with the slideway, as seen in **photo 18**. Drill down from the bearing surface so that the hole connects with the horizontal hole. The horizontal hole needs to be opened out for tapping M8X1 to take the banjo screw, and I also made an oil groove in the bearing surface (as can be seen in the photo) to allow the oil to flow pretty much the full length of the bearing surface. This is easy enough to do with a Dremel-style drill fitted with a small mounted grinding wheel; I just made a straight(ish) groove, but you could of course zig-zag it, or do it a lot neater by putting the saddle on the mill. Obviously the procedure is repeated for the second bearing surface. Once the banjo assemblies are in place, pipework is installed to connect to them from the two left-most metering units.

The next two ports carry the metering units for the saddle slideways. These terminate in 90 degree elbows, modified to 2BA thread as described above (**photo 19**). Again, the tubing is installed as described before, and a cable clip holds the tubes reasonably tidy (**photo 20**). The clip is held by a self-tapper screwed into a hole drilled in the top of the saddle casting. For the tube that feeds the rear of the saddle, I left a reasonable loop of "spare" so that the tailstock can still be brought close to the saddle without trapping the tube against the cross slide. The final right-most port of the 6-way manifold feeds the pinion gear lubrication point behind the saddle handwheel, via the last remaining modified banjo assembly.

Testing and final comments

Fill the oil reservoir with your favourite Myford lubrication oil, pull back the plunger, and release. You will need to do this several times to drive all of the air out of the system and fill the pipework with oil, but before too long the plunger action will slow down as the spring meets more resistance, and oil should start to ooze out of the various bearings. Check all of the compression joints to make sure that they are not leaking; if they are, tighten them down and check again.

The system seems to work very well for me; the only downside seems to be that spare oil from the countershaft tends to fly about, leaving the tell-tale black stripe down the left shoulder, but if I get too irritated by that it is probably fixable with the installation of a simple spray guard. All in all, for the relatively small amount of effort involved, it is a worthwhile addition to the machine, and gives you peace of mind that all of the parts that need lubricating are getting their proper dose.

The complete bill of materials is shown in the following table. ■

■ MEW RESOURCE BOX

Arc Euro Trade, 10 Archdale Street, Syston, Leicester LE7 1NA
Tel: 0116 2695693
Website: www.arceurotrade.co.uk

Editors Note: "To save customers having to state each and every part number for this project, ARC have created a new product code which covers all the part numbers and quantity mentioned in the bill of materials. The code is: 084-025-10000 – One Shot lubrication parts for Myford ML7"

Arc part number	Quantity	Description
084-025-00001	1	Pull handle oiler
084-025-00250	4	90 degree elbow hose adapter
084-025-00500	5	Banjo assembly
084-025-00606	1	Junction bar 6-way
084-025-00608	1	Junction bar 8-way
084-025-00602	6	Junction bar 2-way
084-025-00603	1	Junction bar 3-way
084-025-00100	5	AJB0 meter unit
084-025-00101	4	AJB1 meter unit
084-025-00102	2	AJB2 meter unit
084-025-00700	6	metres 4mm Nylon tube
084-025-00750	6	metres Spring Tube Guard for 4mm Nylon tube
084-025-00760	5	packs Ferrules for Spring Tube ends - pack of 6
084-025-00300	5	packs 4mm compression bushings - pack of 6
084-025-00350	6	packs 4mm compression sleeve (olives) - pack of packs 6
084-025-00800	1	packs 6mm tubing clip (1 tube) - pack of 4
084-025-00810	1	packs 6mm tubing clip (2 tubes) - pack of 4
084-025-00400	1	Blanking plug