NEWSLETTER February 2022

Good Evening Gentlemen,

Welcome to another good read. I hope all your fences and shed roofs escaped the ravages of the recent gales. It's been a slow start to the year but our draft calendar is filling up, and as soon as any visits and talks are confirmed they will be added to the calendar on the PEEMS website.

If you have a diary, don't forget the first Wednesday in the month is the Club Night and the third Tuesday in the month is a workshop morning . Then don't forget to look in your diary!

Stay safe,
Jonathan.

Club Meeting 2nd February 2022

PEEMS Chairman Jonathan Milner, welcomed everyone to the meeting, the first for 2022, and there was a good turnout. The meetings continue to be set up with ZOOM for those members unable to attend and for those who live some distance away.

Jonathan opened the meeting with some announcements:

- **The Next Club Meeting ~ 2nd March.**

  William Burrell will be talking about his time working as a Marine Engineer.

  If anyone wants to give a talk to PEEMS, Mike Sayers is willing to help put a *Power Point* presentation together for them.

- **The Hungate Centre.**

  PEEMS meetings will be moving back to the Hungate Centre, hopefully in May. The February, March and April meetings will still be held in Pickering Memorial Hall in order for CaVCA (Coast and Vale Community Action), who have taken over the running of the hall from RVS, to complete any outstanding renovations. It looks like a May start, but members will be kept informed.

- **The Doncaster Show.**

  The Doncaster Show has been cancelled for 2022.

- **The Workshop TIG Welder.**

  Someone came to the workshop to give some instructions on how to setup and use the TIG welder. Some 'gems' of information on how to operate the machine were offered. If anyone wants to use the TIG welder, it is now there for use. David Proctor has taken some notes which will be written up, and Jonathan has downloaded some basic operational details. These instructions will be available in the workshop.

  As regards TIG itself, it is assumed that users will be competent and have knowledge in this type of welding. It is a cross between gas and arc welding.

  Gas will need to be paid for, and the charges per hour will be posted in the workshop at some later date.

  The availability of the TIG welder will be on the current workshop days of Tuesdays and Thursdays, and the current rules for booking time on site still apply.

  It should be noted that the TIG welder is only suitable for steel and stainless-steel welding as it is D.C. (aluminium welding requires A.C.). 1.6mm steel filler rods are available.

- **Calibration Rods Or Slip Gauges For Micrometers.**

  Jonathan asked if anyone has any spare calibrating rods or slip gauges for micrometers that he could buy. 1", 2" and 3" (25mm,50mm or 75mm) range would be suitable.

  Mike Sayers said that calibrating rods were unnecessary if there was an object of known accurate size available, such as ball races ground to a known diameter.

- **Myford ML7 Lathe For Sale.**

Advance notice of the sale of the PEEMS workshop lathe.

When the replacement Super 7 lathe is commissioned, the ML7 will be for sale. This has suffered a little set back and is expected to be towards the end of next month.

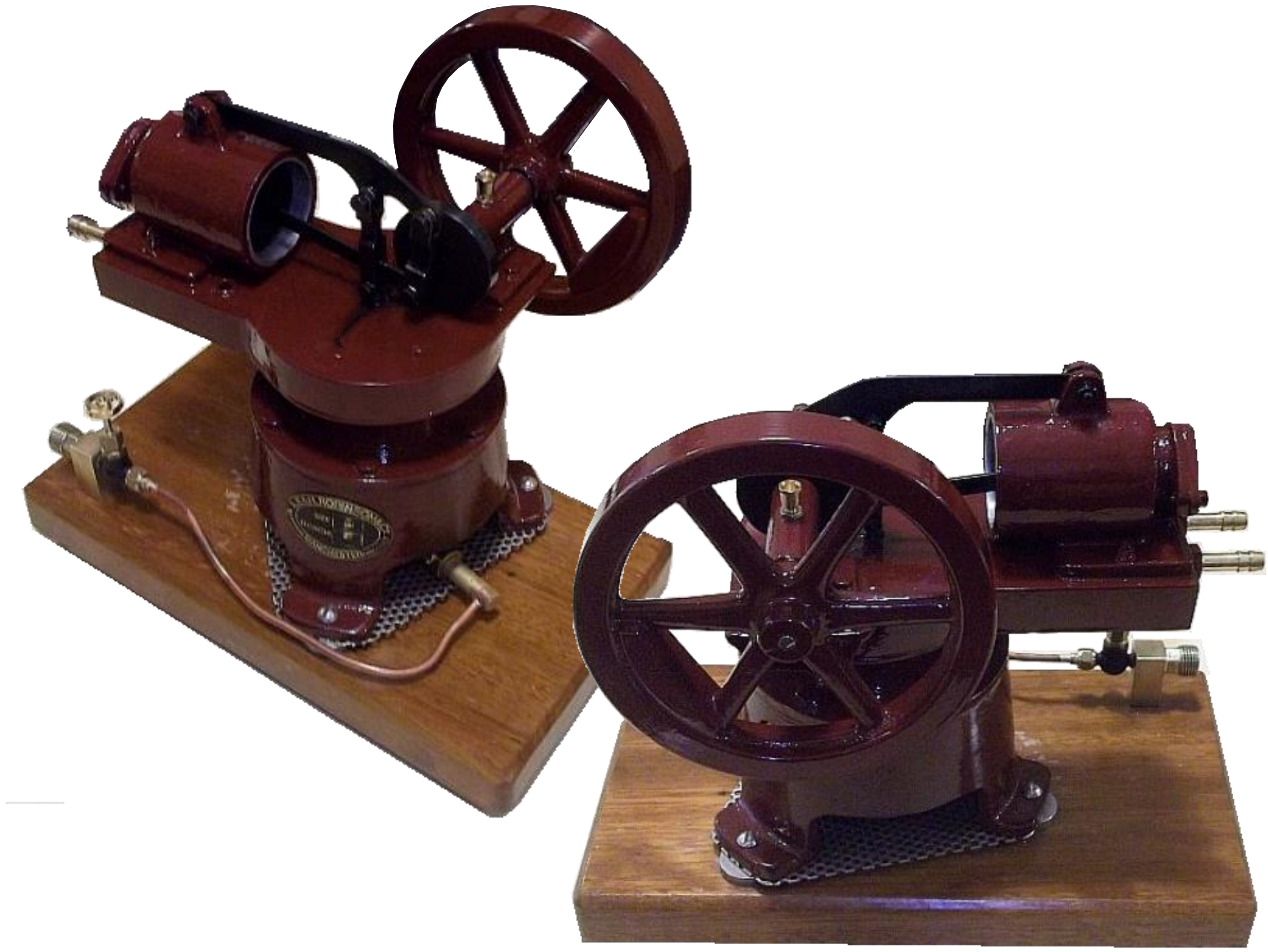
The cabinet has a footprint approx. 300 x 950 mm, overall height 1420mm .

The lathe was refurbished by the Club, and fitted with a variable speed motor, running on a domestic 13 A socket. It sits on the Myford cabinet stand, on raising blocks, and has a lever operated tailstock. It’s Imperial with a set of change wheels, and it will cut metric threads . It comes with 3 and 4 jaw chucks, a faceplate , a fixed steady and a quick change toolpost, with 2 holders. There is a resettable cross slide dial (not fitted), the original square 4 way toolholder, spare oilers, and original tailstock operating wheel.

The price is £600 to a Club member, and in the event of multiple interest we will ask for sealed bids or possibly an auction. If the Lathe isn’t sold to a Club member, the price will be £700 if advertised to non members.

A Model Of A Robinson Hot Air Closed-Cycle Engine ~ Paul Gammon.

Paul presented his model at the Club meeting. It’s a Robinson hot air closed-cycle engine, which was developed in the late 1880s. Philips developed the engine later for light duty work such as “silent” generators for cooling fans and coach engines.



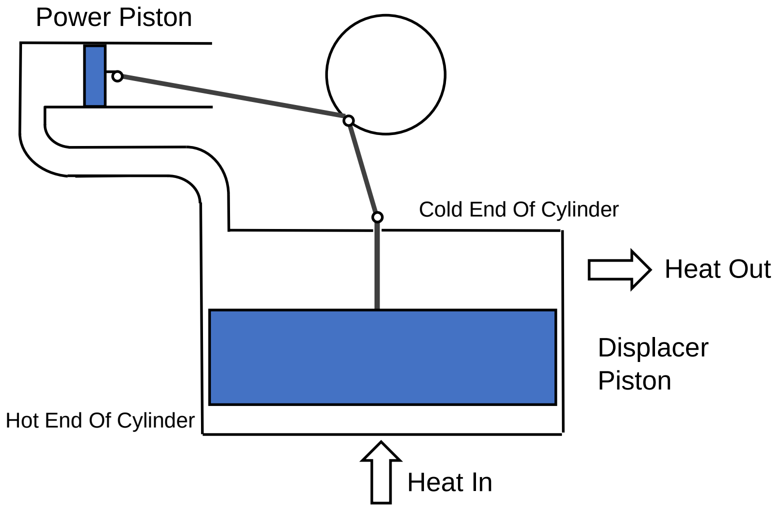
These engines are not very efficient, but if pressurised, can be as efficient as internal combustion engines (38%).

There are two pistons, a displacer piston and a power piston.

The engine operates at 150 rpm, the heating source is Butane, and the engine has water cooling.

There cannot be any friction in the system for the engine to operate.

The castings came from *Maidstone Engineering*.



A Traditional Way Of Cutting Straight Spur Gears ~ Peter Bramley.

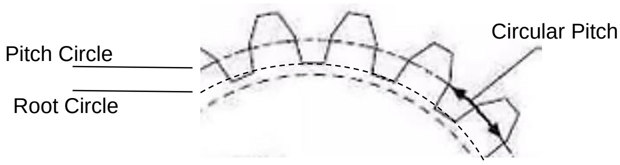
- **Introduction**

Peter said that the talk was a ‘beginners guide’ to gear cutting and it concerns “imperial gears” not metric, as the numbers are slightly different when it comes to “modules” as seen later.

The 1943 *Machinery’s Handbook* (11th edition) was referenced, and this has approx. 250 pages on gears, gear drives and chains etc. so it is quite a deep subject.

The evening’s talk was going to concentrate on straight spur gears, as seen on the periphery of the two traction engine gears seen below. The smaller gear has a 12 DP, and the larger 8 DP.

DP is shorthand for Diametrical Pitch and is the number of teeth that will fit on 1" of the circumference of the PCD or Pitch Circle Diameter.



- **Why Are Gears Used?**

Gears are used to give a positive and uniform drive from on shaft to another. With alternative methods such as ‘V’ belts, there is always the possibility of slip. Also, by having different sizes of interlocking gears, shaft speeds can be different.

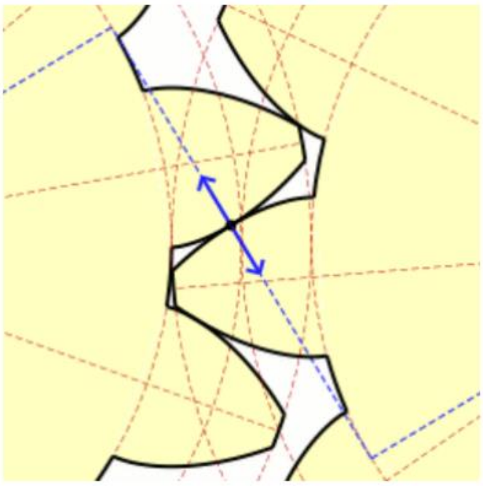
- **‘Non-Round’ Gears**

There are various ‘non round’ gears, but they are rare and are only used in special cases. There are:

- Square Gears.
- Oval Gears.
- Gears with gaps in them.

The evening’s talk was going to concentrate on round gears.

- **The Involute Gears**

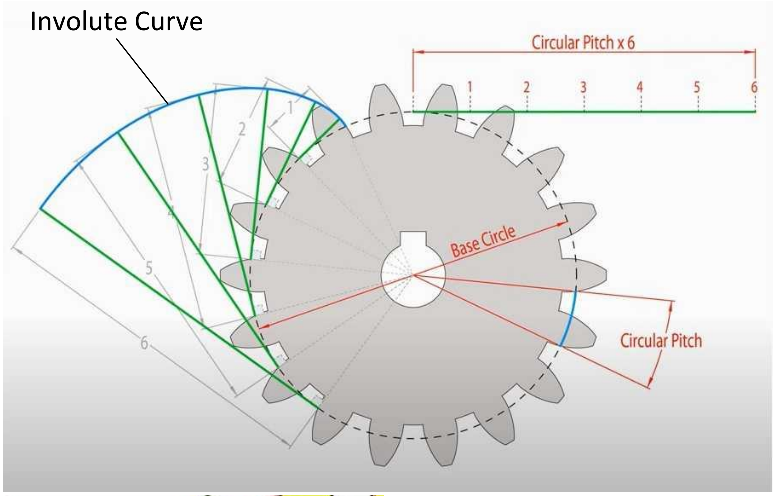


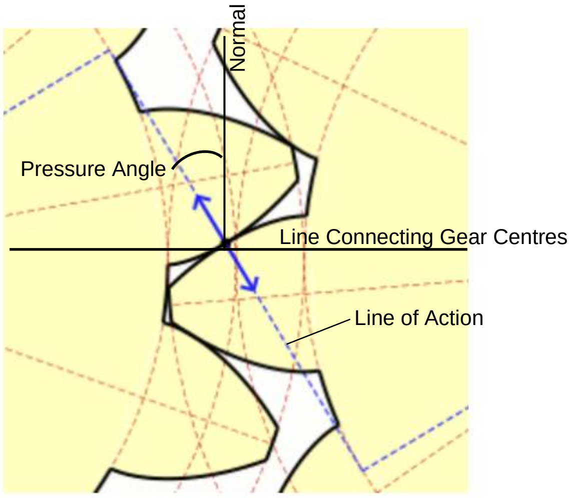
The **involute gear** profile is the most commonly used system for gearing today. In an involute gear, the profiles of the teeth are involutes of a circle. The involute of a circle is the spiralling curve traced by the end of an imaginary taut string unwinding itself from that stationary circle called the base circle (see next page).

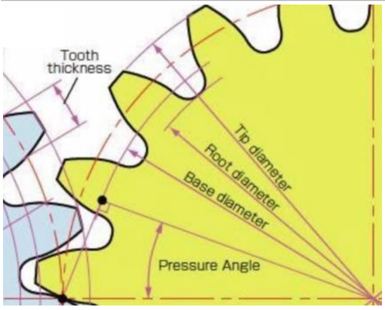
Two involute gears, the left driving the right: Blue arrows show the contact forces between them (1) downward force applied by the left gear and (2) upward resistance by the right gear. The force line (or line of action) runs along the long leg of dashed blue line which is a tangent common to both base circles.

Reference Wikipedia`

Animation at this link:
[*https://en.wikipedia.org/wiki/Involute_gear#/media/File:Involute_wheel.gif*](https://en.wikipedia.org/wiki/Involute_gear#/media/File:Involute_wheel.gif) *(Click back arrow to return).*







The pressure angle is the acute angle between the line of action and a normal to the line connecting the gear centres. Pairs of gears must have the same pressure angle in order for the teeth to mesh properly, so specific portions of the involute must be matched. (*Reference. Wikipedia).*

On pre-Second World War machinery gears, the pressure angle was 14.5°, whereas after that time, the pressure angle is 20°.

The base diameter is the diameter of the base cylinder from which the involute portion of a tooth profile is generated.

- **Gears Of Infinite Radius**

A gear of infinite radius is called a rack. If a piece of string is taken off a rack it would come off at an angle of 14.5° to the vertical. The talk continued referring to 14.5° angles (20° angles gave slightly different measurements).
A 14.5° gear can usually be identified as it is a fairly ‘stubby’ gear. A 20° gear is thicker at the base and thinner at the tip. Nowadays it’s best to assume the gears are 20°.

- **Other Types Of Gears.**

Other than Spur Gears there are:

- Bevel Gears.
- Worm Gears.
- Hypoid Gears.

- **Making Gears ~ Determination Of Tip Diameter.**

There are a number of equations that are required to find out what diameter, and what root depth is required for the gear teeth. To cut an Imperial gear, one of the first of the formulae required is:

$$\frac{\text{Number Of Teeth} + 2}{\text{DP}} = \text{Tip Diameter Of Gear}$$

The 2 is added to the number of teeth to allow for the fact that the teeth are above the base diameter of the gear. The base diameter is the diameter of the base cylinder from which the involute portion of a tooth profile is generated. The formula is relevant for both imperial and metric gears.

If the gear to be cut is metric, the formula is:

$$\frac{(\text{Number Of Teeth} + 2) \times \text{pitch}}{\pi} = \text{Tip Diameter Of Gear}$$

Where the Module $= \frac{\text{pitch}}{\pi}$ The bigger the module the bigger the tooth.

- **Making Gears ~ Why Was The Pressure (Pitch) Angle Changed From 14.5° to 20° ?**

The change was made in Pressure Angle when gear teeth started failing under high loads, such as in aero engines during the Second World War. By changing the angle from 14.5° to 20°, the tooth tips were made slightly thinner in width whilst the tooth root widths were made slightly thicker.

As machined gears have been made for at least the last 150 years, things have been modified over time. During the Second World War, Rolls Royce found that the gear teeth were wearing quickly on their Merlin engines. They did a few tests and found that the teeth were flexing under load. So, rather than changing the shape, they took about two or three thou off the tips, and that stopped the flexing and wear on the teeth. A Merlin engine normally operated for about 500 to 600 hours before overhaul. Before the modification they were failing around 200 hours.

- **Making Gears ~ Gear Cutters.**

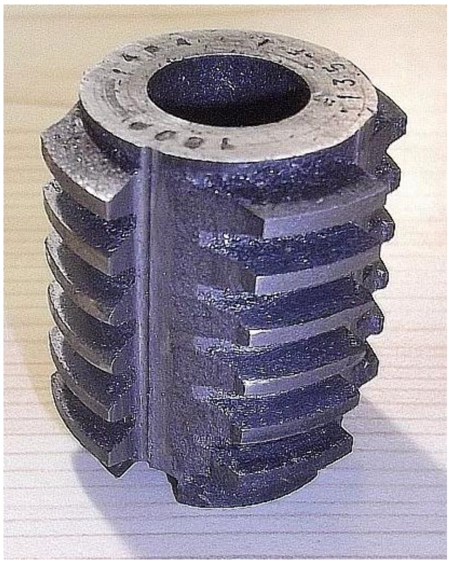
Peter brought four typical gear cutters in that would typically be used in a workshop. There was an Imperial DP one and a Metric Module one, which had been reground. The smaller cutters have a high DP number. One of the smaller cutters was homemade, which shows these can be made if so desired. The homemade cutter is 8 DP. This was made when Peter was making the traction engine gears shown on page 4.

Involute Imperial gear cutters are normally about 4 DP up to 100 DP (or more). For Imperial gears, the lower the DP number, the bigger the gear and the thicker the teeth.

Below is an Imperial No. 4 12 DP cutter, a Metric No.3 M2 cutter (where M is the module ~ see previous page) and some smaller cutters, one of which is 8 DP and homemade:

Homemade 8 DP gear cutter

Peter had also brought in a selection of *HOBS* cutters, some of which were homemade. How he made this is for a future discussion.



As mentioned before, DP numbers vary from about 4 DP up to 100 DP, but a 4 DP would be rarely used except for some massive machinery. For normal workshop use, DPs will range from about 16 DP to about 64 DP.

The gear cutters are expensive to buy, for example, the 12 DP cutter above is well over £100, and eight are required for a full set. These go from 12 teeth up to 135. That also only applies to a single DP, so if the gears needing to be cut have different tooth thickness, this is all adding up in cost. That is why Peter has home made some of the *HOBS.* The HOB cutters will cut any number of gear teeth required.

If metric gears are required, then the same number of cutters may be required (with the same expense).

- **Making Gears ~ Tools Required.**
    - A Lathe to Turn A Blank On.
    - A Milling Machine To Use The Cutter.
    - A Dividing Head.
    - Cutter.

If a 20 DP gear (or below) is being cut, fairly robust machinery is required. For example, the full depth of each tooth on the traction engine gear shown on page 4 was cut through in one operation**. As can be seen, there is quite a distance from the centre of the gear (where the blank was held) and the outer edge of the tooth. For this reason, the outer periphery of the gear wheel was supported while the gear was cut. In this case Peter used a rounded metal ball to take the thrust from the cutter. Such was the force that the ball created small indents in the wheel. This is further illustration of how robust the machinery has to be.

** Some people cut through half the depth of each tooth on the first revolution of the gear wheel, and then the other half when the gear wheel is rotated again. This can lead to errors.

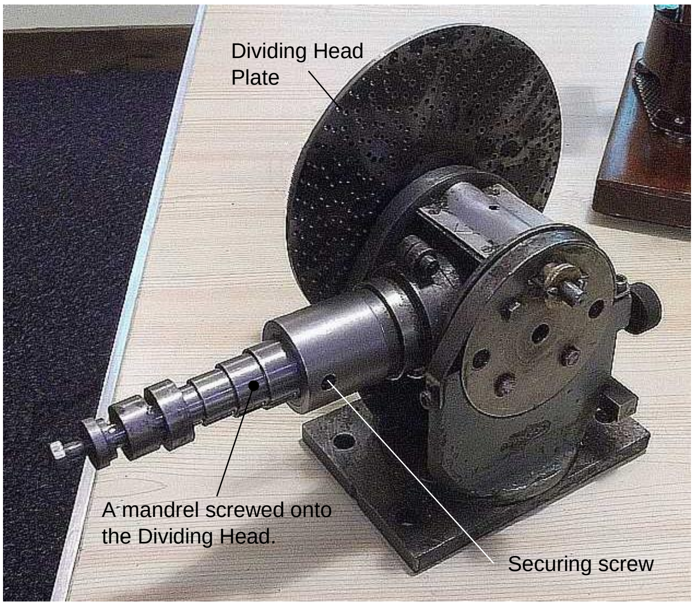
- **Making Gears ~ Operations.**

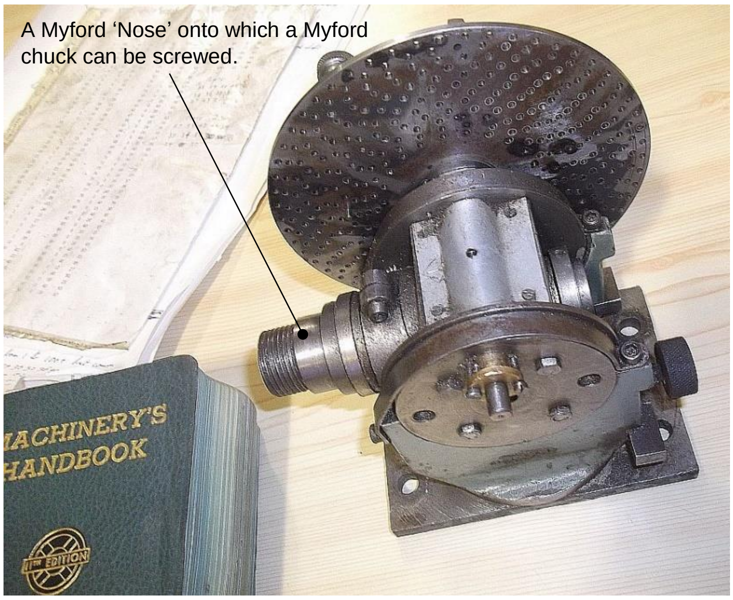
The first operation is to turn the blank to size. The outside diameter of the blank is determined by the formula for Imperial gears on page 5.

The bore of the blank must be concentric with the outside circumference. If a chuck is used in turning the blank, there is always the chance that when the blank is transferred to the dividing head, there may be a small eccentricity. There are two ways to avoid that:

- The Dividing Head Peter brought in has a 'Myford Nose', so if a Myford lathe is being used to turn the blank, then the chuck can be screwed off the lathe and screwed on the 'nose' with no problem.
- if a blank is being turned in a collet on the lathe, a mandrel can be made which screws on to the Dividing Head as shown below, and the blank will remain concentric.

When the smallest gear is being cut, if the blank is on the mandrel or in a chuck, then you have to make sure there is plenty of space between the chuck or the arbor of the mandrel and the Dividing Head so that the cutter doesn't cut into the mandrel or even the Dividing Head itself.





On both the chuck and the mandrel, there is a small screw which can be used to secure firmly either to the spindle of the Dividing Head. This is important because if there a lot of interrupted cuts, the mandrel or chuck can come loose. The interrupted cutting of gears does cause vibration and this can lead to a lot of things coming loose.

- **Making Gears ~ The Dividing Head.**

This is the most important tool used for cutting gears. The Dividing Head consists of a base and a head. Peter's Dividing Head is an all-purpose tool that can be used to cut bevel gears by swivelling the head.

To make this dividing head Peter bought a 40:1 worm gear (with 40 teeth on the wheel). The worm wheel goes on the Mandrel shaft, and the worm itself is on the rotation axis of the Sliding Arm. When the Arm is turned, the spindle rotates in the ratio of the worm wheel. Most commercial worm gears, especially second-hand ones will be 40:1 ratio. Most model engineering worm gears are 60:1 and some are actually 90:1.

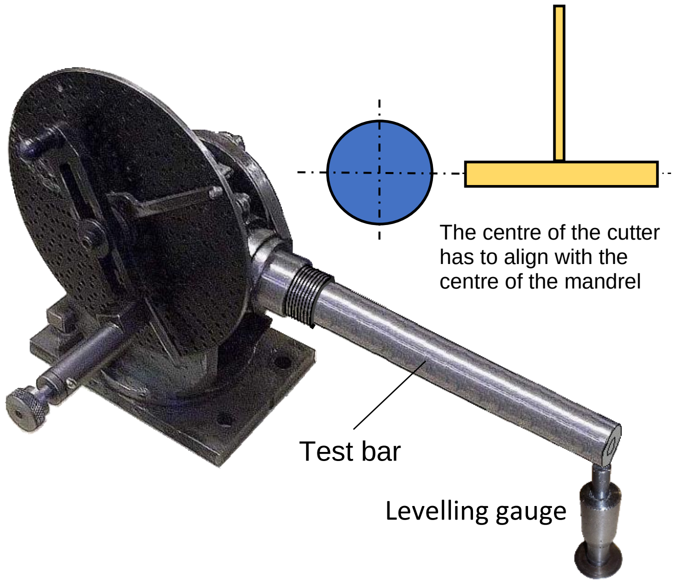
For Peter's Dividing Head, to find out how far to rotate the Arm for each gear tooth cut, 40 is divided by the number of teeth on the gear.

If the Arm is rotated once on this Dividing Head, the spindle turns 1/40th or 9°. Very rarely is a number of teeth required on a gear not divisible into 40.

- **Making Gears ~ Setting Up The Dividing Head On The Bed Of The Vertical Milling Machine.**

Before the Dividing Head is attached to the bed of the vertical milling machine, the machine must be cleaned down, lubricated and a check made that all adjustments are as minimal as possible. This is all to prevent the cutter ‘grabbing’ the work and twisting the Dividing Head.

The spindle must also must be horizontal and parallel with the table movement. To check this, Peter made a 2MT test bar which is a tight fit in the Dividing Head as shown:

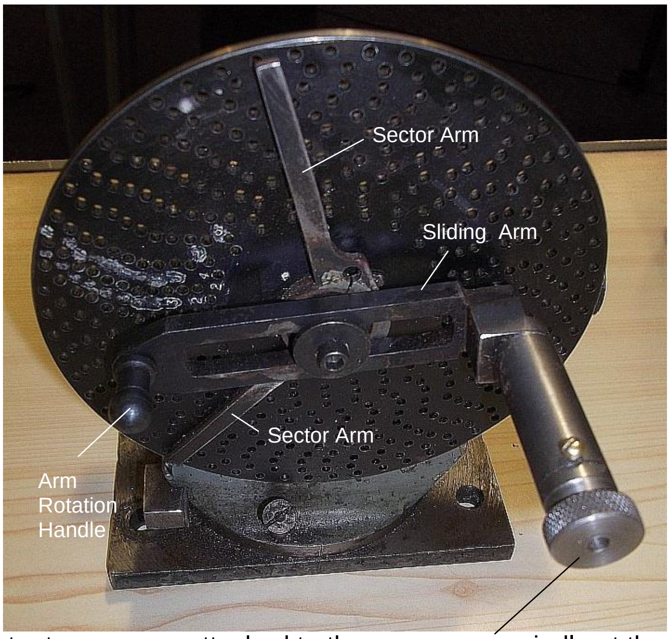


The Dividing Head is then mic’d up until it is level on the mill bed. If the Dividing Head is not level on the bed, the result maybe slightly bevelled teeth. Peter made a special gauge which exactly fits under the test bar tip. It can be slid along the length of the bar to check how parallel the test bar is to the bed, and levelling adjustments can be made. To get the height of the centre of the test bar at the tip, the diameter of the test bar is measured with a micrometer and the height of the levelling gauge added to half the diameter of the test bar gives the distance of the centre of the mandrel to the bed. The Dividing Head needs to be very firmly attached to the mill bed after levelling adjustments.

This helps with the positioning of the cutter which also needs to be at the centre of the mandrel

- **Making Gears ~ How Does The Dividing Head Operate?**

For most gears cut, the Sliding Arm will either be turned once, or two turns and a bit, or a part turn.



Detent on an arm attached to the worm gear spindle at the centre of the Dividing Plate

Dividing Plate

As mentioned before, the worm gear has a 40:1 ratio and the amount the Arm is turned is a function of 40 divided by the number of teeth required.

Some Examples:

- If 20 teeth are being cut 40 / 20 = 2. This means the Arm is turned two full turns for each tooth (18° mandrel spindle rotation).

  The detent on the end of the arm attached to the central worm gear locates into the same hole in the plate each time a gear tooth is cut. It’s rare to have that few teeth on a gear, though.
- If 30 teeth are cut on a gear 40 / 30 = 1turn + 1/3rd turn.
- If 45 teeth are cut on a gear 40 / 45 = 8/9th turn
- For 64 Teeth 40 / 64 = 5/8th turn.

To use all these numbers, there are a number of rows of holes in the Dividing Plate. On the plate on the previous page there are 13 rows. Each row has a different number of holes in it.

To use the plate, Peter made a table as shown below:

				DIVIDING HOLE POSITIONS				
Division	Turn	Hole	Circle		Division	Turn	Hole	Circle
1	40	0	0		48	0	25	30
2	20	0	0		49	0	40	49
3	13	7	21		50	0	24	30
4	10	0	0		51	0	40	51
5	8	0	0		52	0	30	39
6	6	12	27		53	0	40	53
7	5	4	28		54	0	20	27
8	5	0	0		55	0	24	33
9	4	3	27		56	0	20	28
10	4	0	0		57	0	40	57
11	3	7	33		58	0	20	24
12	3	12	27		59	0	40	59
13	3	3	39		60	0	20	30
14	2	18	21		61	0	40	61
15	2	18	27		62	0	20	31
16	2	14	28		63	0	40	63
17	2	12	34		64	0	15	24
18	2	6	27		65	0	24	39
19	2	4	35		66	0	20	33
20	2	0	0		67	0	40	67
21	1	19	21		68	0	20	34
22	1	27	33		69	0	40	69
23	1	17	23		70	0	16	28
24	1	14	21		71	0	40	71
25	1	14	21		72	0	15	27
26	1	18	30		73	0	40	29

The first column shows the number of teeth on the gear. The calculations are then done to work out the fractions of the Arm turns required. The bigger the fraction, it is expedient to make sure that there are three or four gears to be cut that can use the same row of holes.

As mentioned before, attached to the worm gear spindle at the centre of the plate is an Arm, at the end of which is the detent. At the back end of the detent is a small rod which goes into the holes. It is a fairly good fit. When rotating the Arm, it is easy to determine if the right hole is located; if the Arm approaches close to the required hole, it can be slightly tapped and it will drop in. The sliding arm allows the detent to operate across the available holes.

When making the next cut, the starting point is always the hole for the cut just made. To make this easier to reference, there are two sector arms which are movable of themselves. A sector arm is moved so it touches the detent in its current hole position. The hole needed for the next cut is then counted to (not including the current hole position), and the Arm is rotated so that the detent almost locates into it. It is then gently tapped into the hole. The sector arm is then moved around until it touches the detent in its new hole position. This makes sure that the position of the detent is known at any one time. It’s a good idea to mark the plate at the current sector arm position with a piece of chalk so there is a good reference to go back to. There are a lot of precautions that are needed to be taken when cutting a gear.

An example is given on how to count holes between cut positions: Referring to the table above, if a 64 teeth gear is being cut, each position is 15 holes along from the current position on row 24 on the plate. 15 holes are counted from the current position (which doesn’t include the current hole). It is also important not to accidently move to an adjacent row.

When cutting gears, it always pays to cut the smallest gear first, because if the largest is started and there is a mistake, that’s a lot of time and material spent.

- **In Summary**

- Before making the first cut, clean the milling machine thoroughly before mounting the Dividing Head.
- Check the Dividing Head and make sure it is clamped down firmly on the bed of the Milling MACHINE.
- Using a test bar, align the Dividing Head with the bed of Milling machine so the mandrel or chuck will be parallel with the bed.
- The mandrel used for holding the blank during cutting (or in the case of the Myford, the chuck holding the blank) is screwed firmly onto the Diving Head’s ‘nose’.
- A tightening screw is used to secure either onto the ‘nose’.
- In the case of the mandrel, put the blank on the mandrel, put the spacers on and then tighten it up. Make sure it is TIGHT, otherwise a ‘spiral gear’ may result.
- With short mandrels a free end support is not required. For longer mandrels a jack/prop can be made.

- The cutter is then adjusted in height so it's horizontal centreline aligns with the horizontal centre line through the mandrel. The blank should be in a position on the mandrel to provide adequate clearance between the cutter edge and the Dividing Head 'nose' or chuck.
- The next thing to know is how far into the blank the cutter needs to move to make the cut. The depth of cut is normally marked on the cutters.

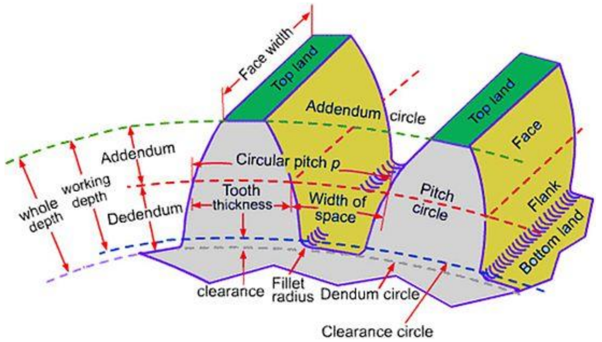
  Modern cutters normally have four pieces of information on them:

  i) The D.P.
  ii) A number from 1 to 8.
  iii) The number of teeth it's supposed to cut.
  iv) The depth of feed, (D+F) that is how far into the blank the cutter needs to be fed. In the case of the cutter shown 0.18" = 4.6 mm.
  Because they are modern cutters the angle (20°) is not notified on the cutter.
  The only time this is important is when a replacement gear is being cut for a very old machine.

- Wind the 'Y' axis handle of the mill until the cutter almost touches the feeler gauge placed between the cutter and the blank. Move the cutter until it just 'nips' the feeler gauge. This is the start of the cut.
- Remove the feeler gauge. The operator should not start cutting until they are clear of the blank!
- Engage the cutter and wind it in the thickness of the feeler gauge plus the depth stated on the cutter.
- The latest gears are made so they give a little bit of clearance at the bottom of the tooth.
- There are two parts to a gear tooth:

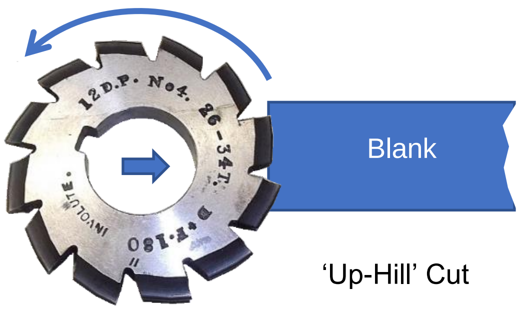
  The outer Addendum
  The inner Dedendum

  The Dedendum is normally slightly longer than the Addendum. The two together give the depth of feed.
- TAKE A REST before making any more cuts!



Reference ~ Wikipedia

- When restarting operations, lock the workshop door behind you, as you need all the concentration without disturbance. Turn off the phone and turn on some music because cutting gears is the most tedious job you can do. For example, Peter made three traction engine gears as shown on page 4. Each gear has 57 teeth. There's a smaller gear that runs off it with 10 to 12 teeth. In all Peter cut 800 teeth. He did them all at once and he was in his workshop for 8 hours a day for 3 months!
- Before starting, everything is checked again, making sure everything is tightened and the depth is right for cutting.
- The coolant is then turned on.
- The cutter speed is then selected. With the cutters displayed on the evening, 200 rev/min is recommended for starting off. Depending on the direction of cut, make sure the cutter is cutting not 'rubbing'. A simple thing that can easily be overlooked.
- Peter recommends cutting towards the strongest part of the mandrel (not the tip).
- For a large gear like the traction engine gear, a support was required on the outer periphery, inside the teeth, especially as it had been thinned down and it had a tendency to flex.
- Whichever way the cutter turns, make sure the cutter is cutting 'up-hill'. If it cuts 'down-hill" the cutter will 'grab the blank and pull everything apart. With 'up-hill' cutting a large piece is removed first then the pieces get thinner and thinner.
- Winding the cutter in can either be done manually or with the use of an auto-feed.
- As soon as cutting starts, listen to what is happening. If it doesn't sound right, stop the machine immediately.



'Up-Hill' Cut

- Teeth aren't being cut, just the space between them.
- With a horizontal cutter cutting into a blank, it is difficult to know what the space looks like until the cutter is pulled back.

- After making the first cut, the Dividing Head Arm is rotated to the next hole position. If the detent moves beyond the required hole, always wind back at least half a turn. This is why the previous advice to chalk mark the position of the sector arm is so important. Remember to remove the existing chalk mark when moving to the next hole position.
- The only way to tell if you've gone wrong with a lot of teeth already cut on the gear, is if a tooth is too thick or too thin.

  Brian: You can cut five teeth, and then measure them up before moving on to the next five and so on. It that way you make sure you don't proceed too far beyond an error.

  Q: Do you make a single cut, or do you do more than one cut each time?

  Peter: Normally, if your machine can take it, do one cut. If you do one half, and then later the other half, you are doubling your chances of error.
- Say you've cut 30 teeth, and the Arm has gone round, the detent will not be at the starting point. Rotate the Arm until the detent is in the starting hole, and start cutting again. If you hear any cutting noise, you have got it wrong. That's another way of checking.

- **A Practical Tip.**

  Do not worry if you cut too deep by 2 or 3 thou, the tooth will be slightly thinner, but practically it doesn't matter, as the gear will run. If the teeth are slightly thicker, the gears will not run on the right centres.

Locomotives Pre-Restoration Or Being Restored, Photographed At NRM Shildon (For Your Interest).

On a visit to NRM Shildon a few years ago, I photographed two locomotives, either being restored or pre-restoration, with the intention of producing some paintings.

The top loco is a Stanier Class 8F 2-8-0. Originally designed by LMS to haul heavy freight. At the outbreak of WW2 the class was chosen to be the UK standard freight design. 45170 was in regular use on the Turkish State Railways until the 1980s. It couldn't cope with steep gradients, so was relegated to shunting and local freight.

The other loco is a Kitson Works No. 5469 *Conway* 0-6-0 ST. The loco was built in 1933 and was employed in quarry work.

Nevile Foster

Further Progress On My Full-Size Flash Steam Engine ~ Paul Windross.

This steam generator was one of the entries to ‘The Mike Sayers Trophy’ evening, in October 2021 where it was awarded third prize.

This steam engine has been built for a motorcycle or three-wheeler in order to break the steam powered speed record.

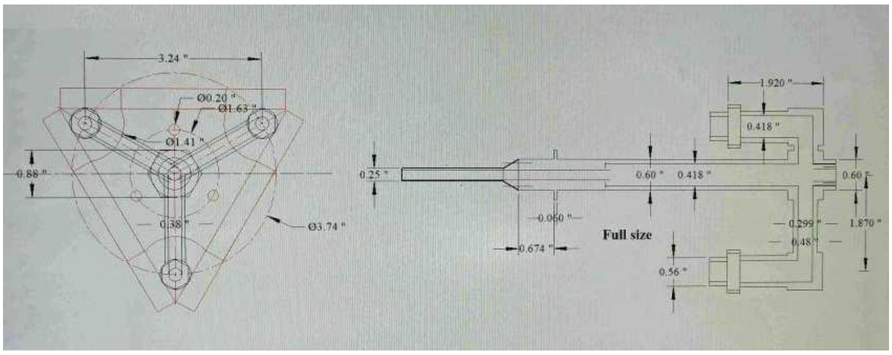
So, a bit more on my project’s steam generator after my visit to the last PEEMS 2021 workshop meeting to collect some stainless sheet:

The sheet metal burner end cover was given a heat test to see if there was much distortion. I used to do this on the flash steam model hydroplane.

Warming Up

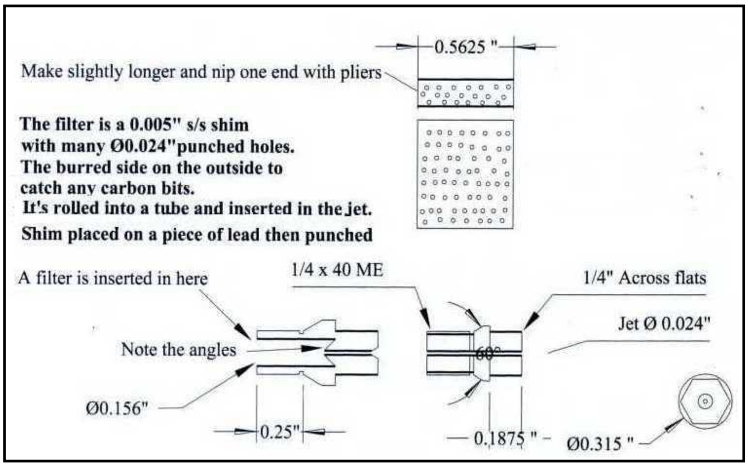
After The Heat Test

Not too bad. I’m now making the jet block mounting that will be spot welded to the *Venturi Nozzles*.



A basic drawing of the jet arrangement is shown above. It will be modified slightly to take home made filters on each jet.

Here is a drawing of the model’s jet filters:



They were very successful on the model, as you can get carbon flakes blocking the jets if the burner vaporiser gets too hot.

A friend brought me a motorcycle aluminium main frame to see if the engine and ancillaries would fit.

That would be a straight forward fix, although the steam generator might be an issue.

More to follow as I progress.

Paul (Windy).

My 80th Birthday Spent At The Elvington 'Straightliners Open Weekend'   12th - 13th February.

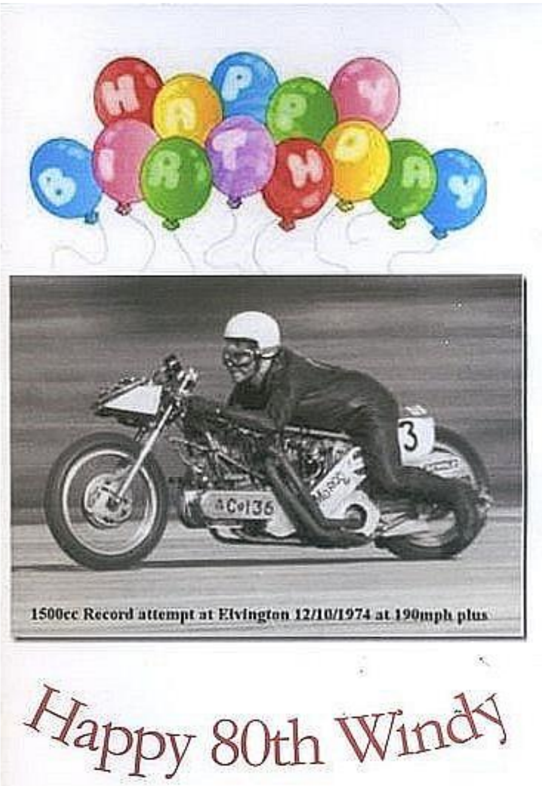
This was a truly memorable weekend for me at the Elvington Show. Thank you to all that made that possible.

The weekend was one of the highlights of my life. I met so many from my past and present life of speed.

When I was taken to a place where there was a Birthday Party for me, my emotions ran high.

I had no idea about that party. The 'Speed Lot' are sneaky. I never know what to expect from them!

Here are some of the photos that were in the birthday card I was presented with:



Paul actually did 207.9mph average.
The 1500cc machine was fitted with *Morgo* barrels for the whole of 1974.

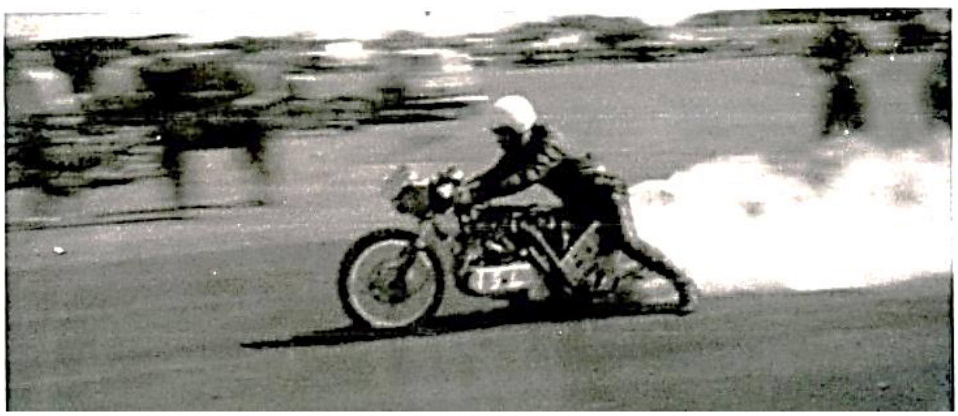
Windy's mighty double

Paul Windross hangs onto his double - engined 1300cc Triumph.
He hit 183mph with the unfaired bike in 1973, but it wasn't enough to topple Fred Cooper's 187mph British record.

Photo copyright stevemcdonald photography@outlook.com

48 years later, riding at Elvington

Another smoky run



Auto 66 Club

Sprint at Elvington 7th May 1972

Class 1. 50cc.

1.	D. Poppitt							
2.	J.F.Droughton	36.692						

Class 2. 125cc.

~~6.~~	~~J.Ellam~~	~~19.934~~	~~21.196~~	~~20.318~~				
9.	D.Heckle	13.711	13.703	13.815	13.633	13.803	13.601	

Class 3. 250cc.

11.	P.Irons	12.735	12.546	12.663	12.201	12.321		1st
12.	T.Duckworth	16.754	15,652	15.261	15.551	17.608	15.450	2nd
13.	D.Wilkinson	16.011	16.033	15.759	15.960	16.321	16.312	
14.	T.Wynne-Jones	26.272	28.668					
15.	D.C.Cozens	24.772	27.764	17.469	23.892	19.050	23.859	
16.	S.Carr	22.249	16.033	16.824	16.479	16.761	17.009	
17.	T.A.Surr	27.333	17.182	16.385	16.245	16.236	19.098	
18.	A.Hughes	30.501	33.280	25.943	19.449			
19.	S.Green	19.962	19.215	20.507				

Class 4. 350cc.

26.	D.Poppitt							
27.	E.M.Denyer							
28.	P.Irons	12.215						2nd
29.	D.Walker	18.550	17.396	17.715	24.115	16.179	16.593	
30.	J.S.Heeley	19.470	15.968	15.755	15.251	17.385	15.734	
31.	G.I.Wormald	16.484	13.860	11.567	12.851			1st
32.	J.F.Droughton	18.055	16.702	16.189	16.025	16.108	15.874	
33.	R.Preston	14.698	14.689	14.561	14.409	14.463	14.369	
34.	B.Renshaw	14.530	14.380	18.547	17.137	20.781	20.122	
35.	D.G.Bancroft	30.030	16.539	16.179	25.257			
36.	L.Auckland	17.277	16.232	16.003	20.681	31.303	16.960	

Class 5. 500cc.

46.	M.V.Christoforou	11.927	12.045	12.067	11.784	12.537	11.708	
47.	M.Sullivan	13.284	12.252	14.647	11.574	11.515		
48.	H.Sherwood	15.145	14.913	14.200	15.580	14.069	16.361	
50.	R.Daniel	11.970	11.485	11.232	11.112	11.089	13.074	1st

Class 6. 750cc.

56.	D.Ward	14.159	15.154	15.059	14.727	15.058	15.567	
57.	D.M.Aspinall							
58.	M.C.Pickstock	14.421	13.022	14.242				2nd
59.	P.Windross	10.796	11.808	10.760	11.241	12.656		1st
60.	S.Whitton	12.572	12.383	12.580	12.750			
61.	E.M.Denyer	17.101	16.993	16.824	19.926	16.340	16.509	
62.	C.Shaw	13.903	12.427					
63.	A.Stocks	14.829	20.084					

Contact:
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