# *Maritzburg Matters*

October 2017

PIETERMARITZBURG MODEL ENGINEERING SOCIETY

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(No postal delivery)

**Club Meetings-** **General Meeting:** Third Monday of each month at 19H45 at Halley Park. Visitors welcome
**Running Day:** First Sunday of each month
**Committee meetings:** First Monday of each month
**Work Day:** Saturday following the General Meeting

**Web Page-** www.pmes.co.za

**Facebook-** Find us on Facebook (Pietermaritzburg Model Engineering Society)

**GPS co-ordinates-** 29.5833° S, 30.4167° E

No responsibility is taken by the Society for any subject matter in this Newsletter other than official Society notices.

**Editorial Matters** Martin Hampton

While it's fresh in my mind, please make sure that your name is on the list for the Supper Evening on Saturday 4th November. This is to commemorate our 30th anniversary of public running, to thank all of those who were involved in WWW2017, and lastly as a year-end/Christmas party. There is no charge, the Club will pay all costs! We will supply some wine and beers, if you have any other preferences, please bring your own. The supper will be a lamb on the spit, with salads, etc..

We have continued to make good progress with various projects, the passenger cars are going well, as is the re-sleepering and ballasting, by all reports the track is running very well. The grounds have unfortunately really suffered with the drought and extreme heat, while the trees are all decked out in their spring finery, the lawns have almost disappeared, this last despite many hours of irrigation each week through pumping from the adjacent Foxhill Spruit.

The engine project also continues to surprise us with ongoing sales each month. We do have a stock of both Model As and Bs as well as upgrades for both. Something that I would like to re-iterate is the reason for this project ….. to attract members to the Model Engineering fraternity, not as a simple fund raising exercise. There are a lot of people out there who just want an engine and who are not interested in building one, they are not really our target!! A further development using the same components as the Model B is the radial and rotary design that some of us have been toying with. These are great runners that have helped to generate a lot of interest, have a look at them next time!! (see the pics in the following article!)

**Circular Engines** Alan Hill

There has been a recent flurry of radial and rotary engines on display at running day. Much interest has been shown in these circular engines. What I have found is that many people don't know the difference between radial and rotary engine types. The appearance of the two types is very similar but they function in vastly different ways.

The rotary is one of the oldest aero engines around and reached its peak during the First World War. The famous planes of that time being powered by them, Sopwith camel and Snipe being the most well-known. The red Fokker tri plane made famous by the Red Barron was also powered by a rotary engine.

The Radial engine is a development of sorts from the Rotary engine. It reached its zenith during and just after the Second World War and is still in use today. There are several makers of Radial engines at the present time. The radial was the engine of choice for the American air force bombers during the war, the B17, B24 and B29 being the most well-known.


Radial Engine

The difference between the two engines lies in the fact that in the Rotary engine, the entire engine spins with the propeller, and the crank shaft stands still and is bolted to the air frame. While in contrast the radial engine stands still and the crankshaft drives the propeller, the engine being bolted to the air frame. The reason for the rotary engine was that as the cylinders were air cooled it was felt at the time that the propeller blast and slow forward speed would be insufficient to cool the engine. Hence the decision to make the engine spin so as to cool the cylinders. As planes became faster it was found that the problems associated with the spinning engine far outweighed any advantages it may have offered in the cooling department.

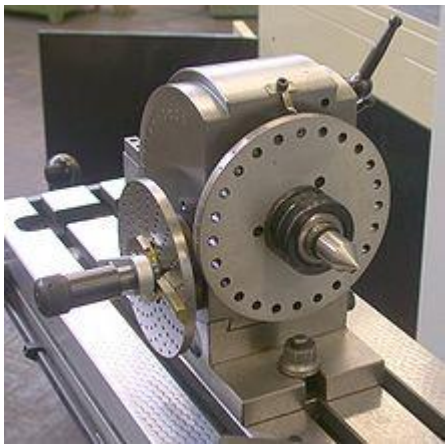

Rotary Engine

The peak of Rotary engine development was the Bentley BR 2 and the Siemens-Halske engines. These were the last of the line as far as Rotary engines were concerned as there were just too many disadvantages to the concept.

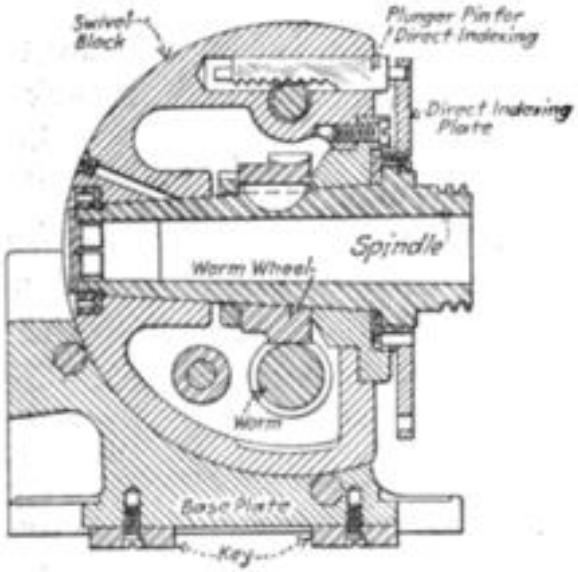
The radial engine has been developed to an extraordinary degree over the years with power outputs in the many thousands of horsepower. The number of cylinders in a Radial can be from 3 to 36 in aircraft engines and as many as 45 in diesel ship and submarine engines. During the Second World War they were even used to power the Sherman tank.

**What is a Dividing Head?** Wikipedia

An indexing head, also known as a dividing head or spiral head, is a specialized tool that allows a work-piece to be circularly indexed; that is, easily and precisely rotated to pre-set angles or circular divisions. Indexing heads are usually used on the tables of milling machines, but may be used on many other machine tools including drill presses, grinders, and boring machines. Common jobs for a dividing head include machining the flutes of a milling cutter, cutting the teeth of a gear, milling curved slots, or drilling a bolt hole circle around the circumference of a part.



The tool is similar to a rotary table except that it is designed to be tilted as well as rotated and often allows positive locking at finer gradations of rotation, including through differential indexing. Most adjustable designs allow the head to be tilted from 10° below horizontal to 90° vertical, at which point the head is parallel with the machine table.




Cross section of a dividing head

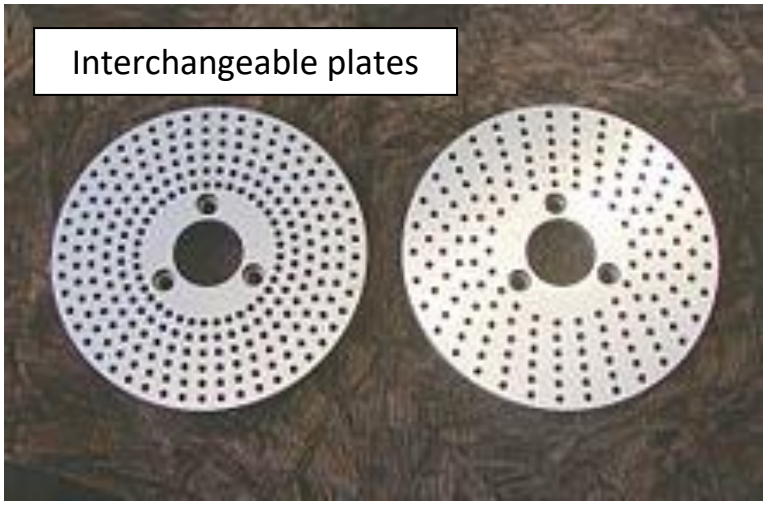
The work-piece is held in the indexing head in the same manner as a metalworking lathe. This is most commonly a chuck but can include a collet fitted directly into the spindle on the indexing head, faceplate, or between centres. If the part is long then it may be supported with the help of an accompanying tailstock.

A dividing head mounted on the table of a small milling machine. The direct indexing plate and centre are visible facing the camera. An interchangeable indexing plate is visible on the left side.

Indexing is an operation of dividing a periphery of a cylindrical work-piece into equal number of divisions by the help of index crank and index plate. A manual indexing head includes a hand crank. Rotating the hand crank in turn rotates the spindle and therefore the work-piece. The hand crank uses a worm gear drive to provide precise control of the rotation of the work. The work may be rotated and then locked into place before the cutter is applied, or it may be rotated during cutting depending on the type of machining being done.

Most dividing heads operate at a 40:1 ratio; that is 40 turns of the hand crank generates 1 revolution of the spindle or work-piece. In other words, 1 turn of the hand crank rotates the spindle by 9 degrees. Because the operator of the machine may want to rotate the part to an arbitrary angle indexing plates are used to ensure the part is accurately positioned.

Direct indexing plate: Most dividing heads have an indexing plate permanently attached to the spindle. This plate is located at the end of the spindle, very close to where the work would be mounted. It is fixed to the spindle and rotates with it. This plate is usually equipped with a series of holes that enables rapid indexing to common angles, such as 30, 45, or 90 degrees. A pin in the base of the dividing head can be extended into the direct indexing plate to lock the head quickly into one of these angles. The advantage of the direct indexing plate is that it is fast and simple and no calculations are required to use it. The disadvantage is that it can only be used for a limited number of angles.




Interchangeable indexing plates are used when the work must be rotated to an angle not available on the direct indexing plate. Because the hand crank is fixed to the spindle at a known ratio (commonly

40:1) the dividing plates mounted at the hand-wheel can be used to create finer divisions for precise orientation at arbitrary angles. These dividing plates are provided in sets of several plates. Each plate has rings of holes with different divisions. For example, an indexing plate might have three rows of holes with 24, 30, and 36 holes in each row. A pin on the hand crank engages these holes. Index plates with up to 400 holes are available. Only one such plate can be mounted to the dividing head at a time. The plate is selected by the machinist based on exactly what angle he wishes to index to.

For example, if a machinist wanted to index (rotate) his work-piece by 22.5 degrees then he would turn the hand crank two full revolutions plus one-half of a turn. Since each full revolution is 9 degrees and a half-revolution is 4.5 degrees, the total is 22.5 (9 + 9 + 4.5 = 22.5). The one-half turn can easily be done precisely using any indexing plate with an even number of holes and rotating to the halfway point (Hole #8 on the 16-hole ring).

Brown and Sharpe indexing heads include a set of 3 indexing plates. The plates are marked #1, #2 and #3, or "A", "B" and "C". Each plate contains 6 rows of holes. Plate #1 or "A" has 15, 16, 17, 18, 19, and 20 holes. Plate #2 or "B" has 21, 23, 27, 29, 31, and 33 holes. Plate #3 or "C" has 37, 39, 41, 43, 47, and 49 holes.

Universal Dividing heads: some manual indexing heads are equipped with a power drive provision. This allows the rotation of the dividing head to be connected to the table feed of the milling machine instead of using a hand crank. A set of change gears is provided to select the ratio between the table feed and rotation. This setup allows the machining of spiral or helical features such as spiral gears, worms, or screw type parts because the part is simultaneously rotated at the same time it is moved in the horizontal direction. This setup is called a "PTO dividing head".

**What are Collets?** (just a few thoughts!) Martin Hampton

It is quite often thought that the use of collets is old fashioned and that there is no longer a place for them in the workshop! There is nothing further from the truth, they are used more commonly nowadays than ever before, most particularly in CNC machines, and normally in milling machines. The most

common collets are those that fit into specific holders such as the 5C and ER series. Also very common are collets that fit directly into spindles, particularly milling machines, which suit the spindles, such as the R8 and Morse Taper series. All of these collets have large ranges of different sizes internally as well as externally.


R8, 5C, and ER series collets

One of the great advantages of collet use are that they provide a much greater gripping surface as well as, generally, a more accurate and repeatable setup. All of these collets are readily available.


A set of Morse taper collets

With a bit of thought and a lot of care, you can make your own collets. This is usually done for special applications or jobs where standard collets are not easily available.

These few collets mentioned here are just the few that we commonly hear about, but there are a vast collection of different ones available for use in many different spheres, from wood working to watch making! Some more in the next newsletter!

**Club Notices**

- The next **General Meeting** will be a General Natter around the do's and don'ts of pattern making and casting on the 16th October in the Clubhouse at 19h45.
- Don't forget the **Supper Evening** on Saturday 4th November!!
- Remember Colin Healey's **Open Day** on Saturday morning 4th November! For info call him on 031 7622058.