Unit 046 Advanced milling

Dividing heads and rotary tables
Rotary tables come in two formats:

- Angular
- Indexable

They are both similar in design but there are specific design aspects to each that need understanding.
This design of a rotary table has the capability to read angles or parts of angles on an index.

Basically you can read off the angle on a scale, the scale can also have a vernier element for parts of a degree.
This design of a rotary table uses an indexing plate rather than a dial with angles on it.

You need to make the calculation of how many turns and parts of a turn are made for the number of flats or positions you need.
Dividing Head

One of the more important attachments for milling machine.

• Used to divide circumference of workpiece into equally spaced divisions when milling gear teeth, squares, hexagons, and octagons.

• They can be **right or left handed** depending on which end you have it assembled.

• Also used to rotate workpiece at predetermined ratio to table feed rate.
Dividing Head

- Headstock with index plates
- Headstock change gears
- Quadrant
Section view of a dividing head
Dividing Head Parts

- Sector Arm
- Index Pin
- Index Head Spindle
- Worm Wheel 40 Teeth
- Index Crank
- Index Plate
- Worm Shaft
- Worm Single Thread

Diagram illustrating the parts of a dividing head.
Dividing Head terms

• Swivel block
  – Mounted in base enables headstock to be tilted from 5º below horizontal to 10º beyond vertical

• Spindle
  – Mounted in swiveling block with 40-tooth worm wheel, meshes with worm

• Worm
  – Right angle to spindle, connected to index crank

• Direct indexing plate
  – Engaged by pin and attached to front of spindle
Head stock

Universal chuck
- Threaded onto end of spindle
Foot or tail stock

Footstock

- Used in conjunction with headstock to support work held between centers or in chuck
- May be adjusted longitudinally, raised or lowered off center, and tilted out of parallel
Centre rest

Adjustable center rest

– Holds long, slender work between centers
See it at work

USE OF DIVIDING HEAD AND ROTARY TABLE:

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Methods of Indexing

1. **Direct**
2. **Simple**
3. **Angular**
4. **Differential**
Direct Indexing

Simplest form of indexing

• Performed by disengaging worm shaft from worm wheel by means of disengaging the drive gear
  – Spring-loaded tongue lock engages numbered slots in index plate

• Used for quick indexing of workpiece when cutting flutes, hexagons
Direct Indexing
Simple Indexing

• Work positioned by means of crank, index plate, and sector arms

• Worm attached to crank must be engaged with worm wheel on dividing head spindle: 40 teeth on worm wheel which means:

  – One complete turn on index crank causes the spindle and work to rotate one-fortieth of a turn
Simple Indexing

Calculating the indexing or number of turns of crank for most, simply divide 40 by number of divisions or flats to be cut.

Meaning:

\[ \text{Turns of the crank} = \frac{40}{\text{No of flats needed}} \]
Angular Indexing

One complete turn of index crank turns work 1/40 of a turn

– 1/40 of 360° equals 9 degrees

**Turns of the crank = \( \frac{\text{Angle required}}{9} \)**
Differential indexing

Sometimes the plates you have will not have the combinations you need to arrive at your particular angular spacing.

In this case you use *Differential Indexing*
Instead of relying on the 40:1 worm assembly, you drive the indexing plate via a bevel gear system.

The Index plate moves as the Index Crank is turned.
Milling on a dividing head

You can carry out a number of specialized milling operations on using a dividing head. Examples are:

- Spiral (helix) or worm milling.
- Gear cutting
- Cam milling
Spiral (helix) milling
Spiral (helix) milling

- dividing head spindle
- wormshaft
- leadscrew
- worm shaft
- leadscrew
- guard plate
Spiral (helix) milling
Spiral (helix) milling
Gear cutting
Gear cutting
Cam milling
Cam milling

The cam after one complete revolution

Blank at the start of the cut
Assessment for learning

You need to be able to know how to describe how to use a dividing head.

Completing MILL WS042 will help reinforce your knowledge on the topic?