Bangladesh University of Engineering and Technology

Course Number: IPE 432

Course Title: Machine Tools Sessional

Experiment Number: 2

Name of the experiment(s): **Study of Milling Machine and Dividing Head**

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SUBMITTED BY:

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IPE 492 (Machine Tools Sessional)

Experiment No.:02 (Study of Milling Machine and Dividing Head)

Student No.: 1610170 Name: Akib Abdullah Khan

Group No.: C24 Date of Submission:

Note: When answering the following questions, consider the universal column-and-knee type milling machine and the universal dividing head studied in this experiment.

1. A schematic diagram of the universal column-and-knee type milling machine is shown in Figure 1. Label the following components.

(a) Column – 7

(b) Table – 12

(c) Knee – 15

(d) Cross Slide/ Saddle – 19

(e) Swivel Plate – 13

(f) Main Motor – 1

(g) Spindle – 9

(h) Over-arm – 8

(i) Speed Gear Box – 6

(j) Feed Gear Box – 20

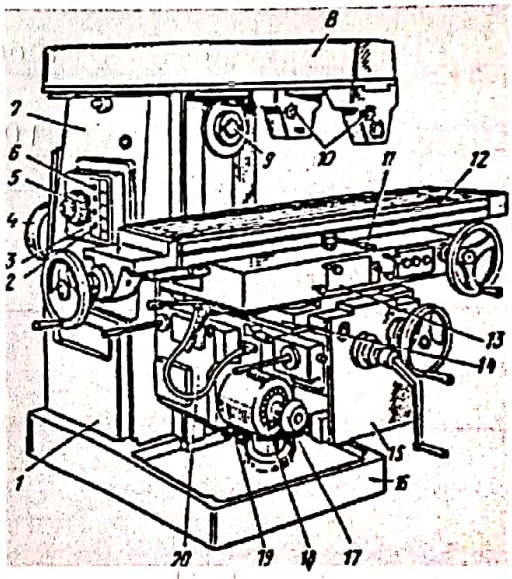


Figure 1

2. Write down the following specifications of the milling machine. (a) Dimensions of the work table working surface (in inch)

Width: 15

Length: 53

(b) Maximum table travel (in inch)

Longitudinal: 32

Cross: 15

Vertical: 12

(c) Maximum angle of table swivel: ±45°

(d) Number of spindle speed: 12

(e) Speeds, rpm: Max: 1760 rpm, Min: 68 rpm

(f) Number of table feeds: 3

(g) Feeds (in mm/min) Longitudinal: 0 – 1000

Cross: 0 – 1000

Vertical: 0 - 1000

(h) Power (in KW): 3.7

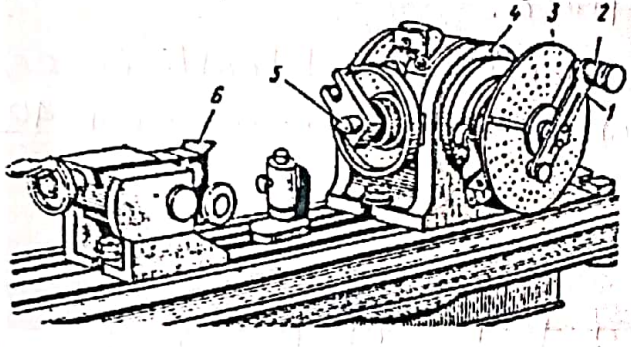
3. What are the different types of guideways present in the milling machine? Mention their locations.

Types of Guideways	Locations
Dovetail Guideways	① Between overarm and arbor support ② Between table and saddle ③ Between saddle and knee ④ Between knee and column.
Cylindrical Guideways.	Between arbor and arbor support
Rectangular or flat Guideways	① Table, stopper setting ② Saddle, stopper setting ③ Column, stopper setting

4. Why is the milling machine studied during the experiment called "Universal"?

The milling machine studied during the experiment had both swivel plate and dividing head. Hence it is called "Universal".

5. Label the schematic diagram of the universal dividing head shown in Figure 2.



1.	Index crank
2.	Crank pin
3.	Index plate
4.	Gear box
5.	Spindle
6.	Tailstock

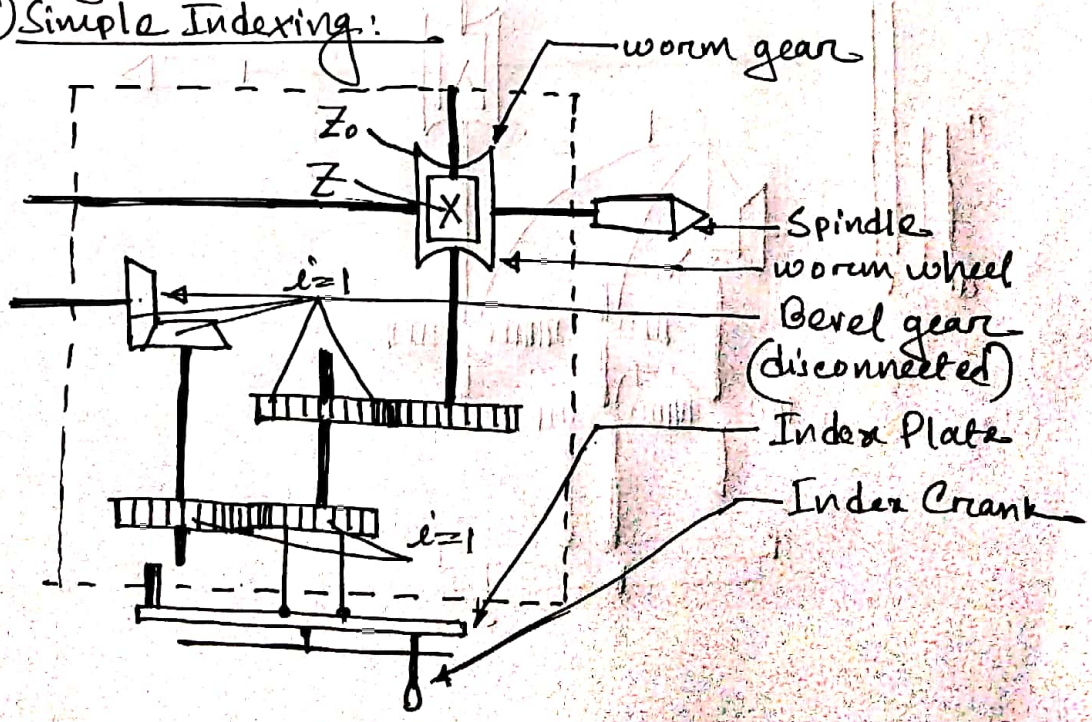
Figure 2

6. What is "indexing"? What are the types of the set up of the universal dividing heads? Explain with necessary sketches. (Please use separate A4 size paper for the answer if needed)

Indexing: Indexing is an operation of dividing the periphery of a cylindrical workpiece into equal number of divisions.

The types of the set up:

① Simple Indexing:



Simple indexing is followed when required rotation cannot be achieved by direct indexing.

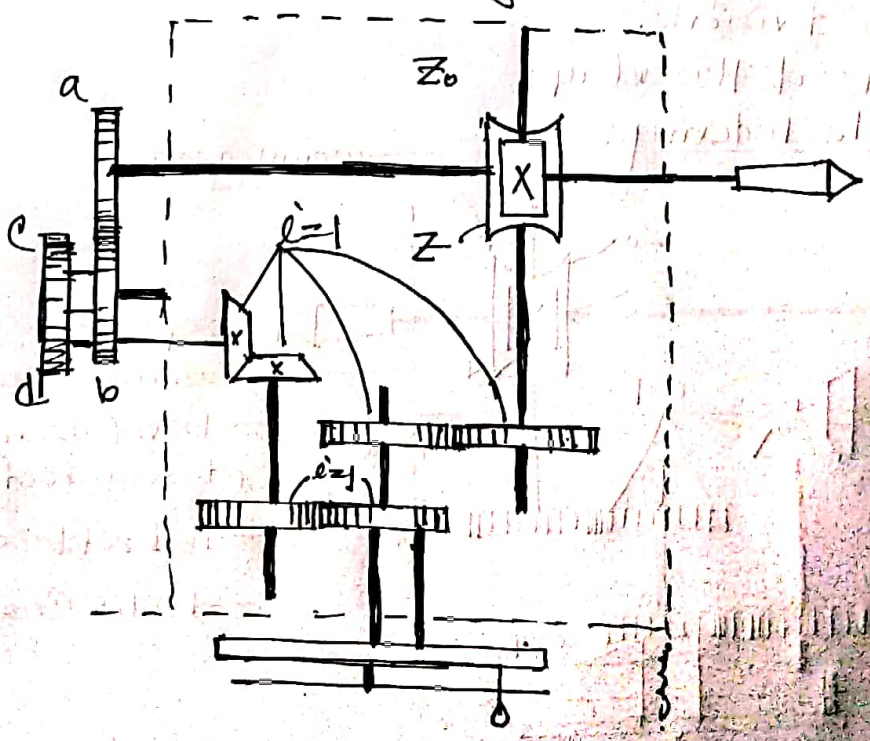
→ There are generally $Z_o = 40$ numbers of teeth on the worm gear while the worm is of single start.

→ 40 rotations of index crank gives 1 rotation to the workpiece.

→ Rotation of workpiece by 1 tooth is equivalent to $\frac{1}{Z}$ rotation of workpiece, and $\frac{40}{Z}$ rotations of the index crank.

→ There are ~~at equally spaced~~ circles with equally spaced holes on the index plate which can help in obtaining fractionals rotations.

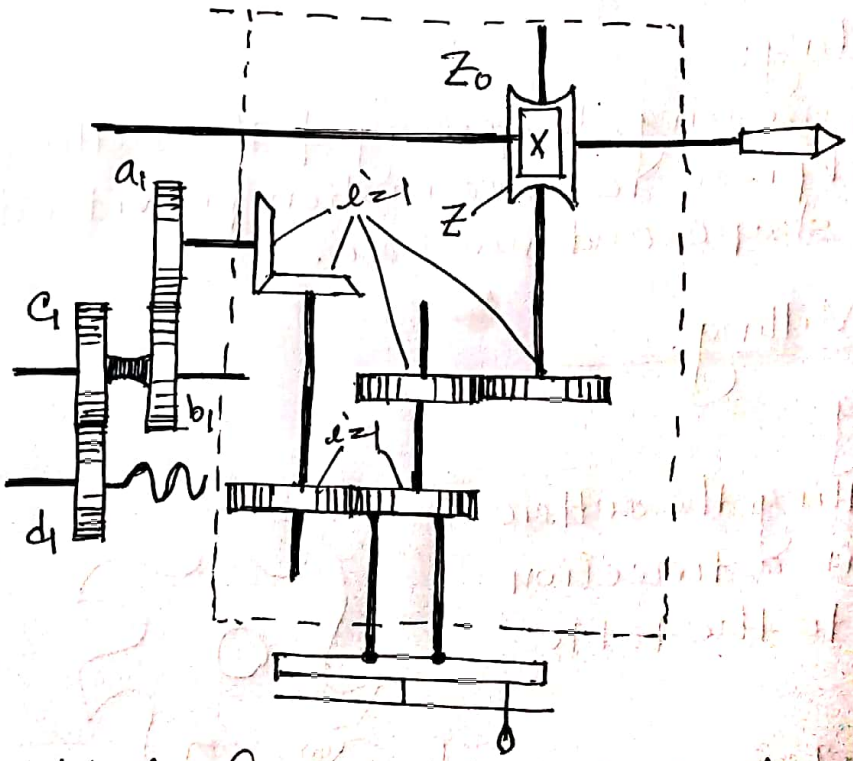
(2) Differential Indexing:



Sometimes the required hole circle is not present on the available index plate. Again there is a limit to the size of the index plate, so large numbers of hole circle are not available often.

In those cases, required rotation of index crank is achieved by rotating the index plate also with help of a gear box.

(3) Cutting Helical Grooves:



To cut helical grooves, we approach simple indexing and change gears are used to provide rotary motion to workpiece. Change gears are connected to lead screw.

ASSIGNMENTS

Gear Making Operations:

① Forming:

Forming is the metalworking process of fashioning metal parts and objects through mechanical deformation; the workpiece is reshaped without adding or removing material, and its mass remains unchanged.

② Generating:

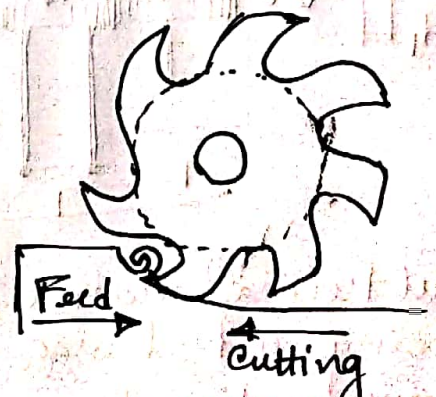
In gear generating, trajectory of the cutting tool and workpiece relative motion provides desired teeth shape and number.

Types of Milling:

Up milling:

In up milling, the cutter rotates in a direction opposite to the table feed.

It is also known an "Conventional milling."

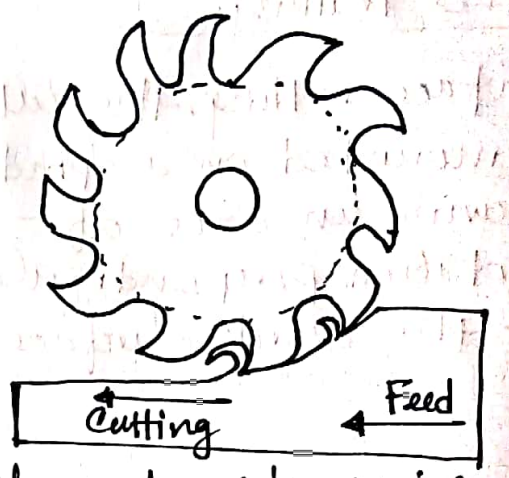


Chip formed starts out very thin and increases in thickness during the sweep of cut.

Down Milling:

In down milling, the cutter rotates in the same direction as the table feed.

It is also known as "Climb Milling".



Each chip starts out thick and reduces in thickness gradually.

The cutting force tends to hold the workpiece against the table, permitting lower clamping force.

Types of Milling Operations:

① Slab Milling:

In slab milling, periphery of cutting tool is used to remove materials.

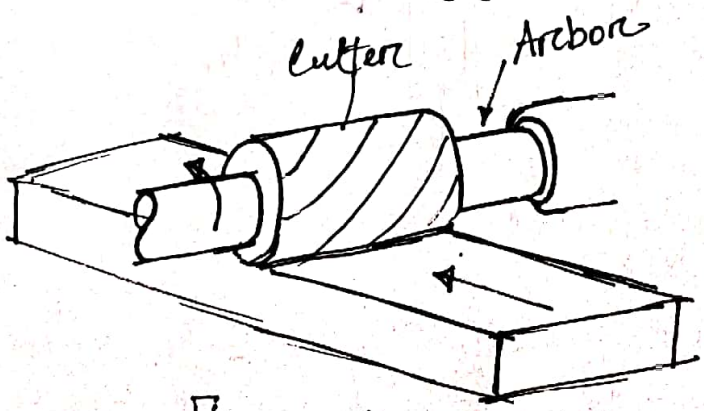


Figure: Slab Milling

② Face Milling:

In face milling, the cutter is mounted on a spindle having an axis of rotation perpendicular to the work surface.

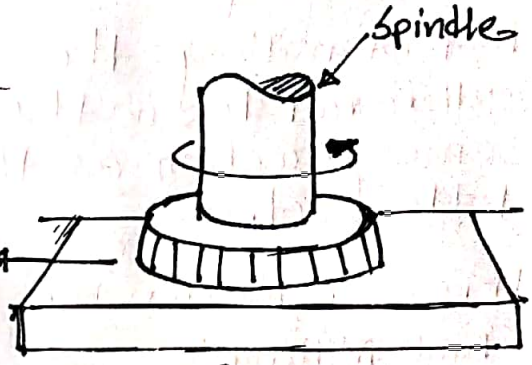


Fig: Face Milling

③ End Milling:

The cutter in end milling generally rotates on an axis vertical to the workpiece. It can be tilted to machine tapered subjects.