Experiment No. 5

Title :- Measurements machine parts using toolmaker's microscope

Specific Outcomes:- Students will able to

1) To appreciate the importance of precision measurement.
2) To know the working principle of Tool Maker microscope.
3) To know the field of application of this instrument.

Instruments/ Equipment with Specifications:-

Tool Maker microscope.

Magnification : X

Light Connections:

Materials:

1) A rectangular M.S. piece with two marked points
2) A threaded bolt with standard thread form

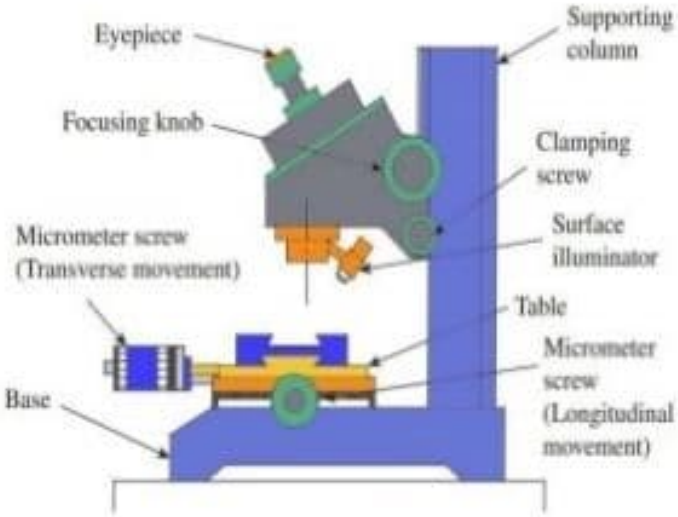

Fig. 5.1 (a)Tool Maker Microscope

Image Source:
https://extrudesign.com/tool-makers-microscope/

Fig. 5.1 (b) Tool Maker Microscope

Image Source:
https://www.indiamart.com/proddetail/tool-makers-microscope-9449639362.html

Brief description of instrument:-

It consists of a optical head which can be adjusted vertically along the ways of vertical column and can be clamped in any position. The working table is secured on a heavy hollow base. The table has a compound slide to give longitudinal and lateral moments actuated by accurate micrometer screws having thimble scales and Vernier. At the back of the base is a light source which provides a horizontal beam of light reflected upwards by 90 degrees towards the table. This beam of light passes though a transparent glass plate on

which flat parts to be checked are placed. A shadow image of the outline of the contour passes the objective of the optical head and is projected by a combination of three prisms to a ground glass screen. Observations are made through the eye piece of the optical head.

Cross lines are engraved on the glass screen which can be rotated through 360 degrees and the measurements are made by these lines. The angle of rotation of screens can be read on the optical head. The eye piece field of view contains and illuminated circular scale with a division value of one minute. Focusing is performed by adjusting optical head tube.

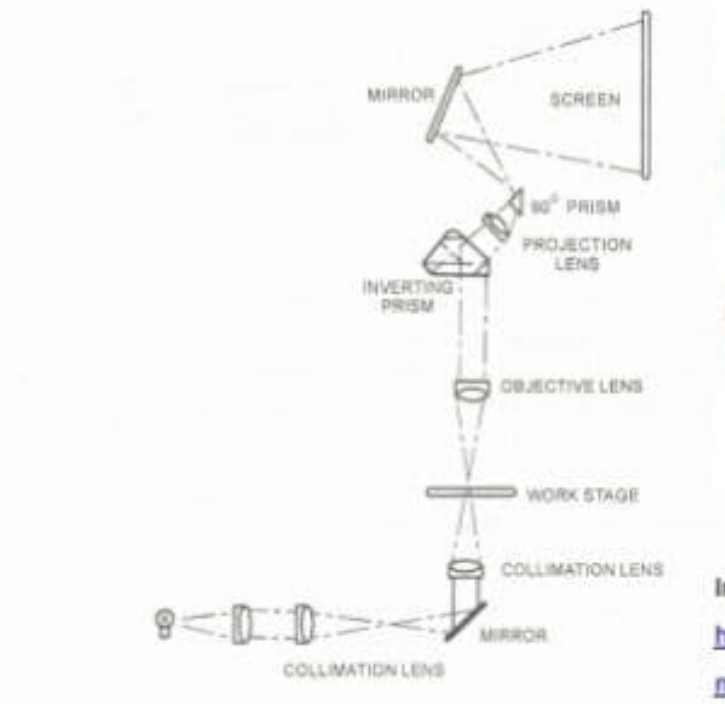

Fig. 5.2 Optical System of Toolmaker's Microscope

Image Source:

http://engineeringdev.blogspot.com/2015/12/autocollimator-and-tool-makers-micro.html

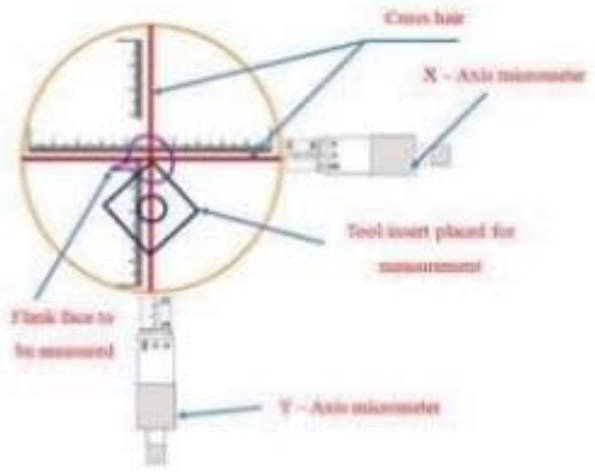

Fig. 5.3 Tool Maker Microscope

Image Source:

https://www.researchgate.net/figure/Tool-makers-microscope-measuring-of-flank-wear_fig1_331087871

Diagram of Work piece

Fig. 5.4 Work piece 1 -

Fig. 5.5 Work piece 2 -

Observation Table

Work piece 2				Work piece 2			
Parameter to be Measure	Initial Reading (R1 Unit)	Final Reading (R2 Unit))	Dimension of Parameter |R2 –R1| Unit	Parameter to be Measure	Initial Reading (R1 Unit)	Final Reading (R2 Unit))	Dimension of Parameter |R2 –R1| Unit

Procedure:-

1) Determination of the relative position of two or more points on a piece of work:
   This is measured by measuring the travel of the work table necessary to transfer a second point to the position previously occupied by the first and so on.
2) Measurement of angles:
   Angles are measured by successively setting fiducial line situated in the focal plane of the eye piece along with arm of the image of the angle, or through points indicating the angle and noting from a protractor scale the angle, through which the fiducial line has been turned.
3) Comparison of thread forms with respect to outlines on a glass template situated at the focal plane of the microscope eye piece and measurement of discrepancies therefrom.
4) Comparison of the enlarged projected image with a tracing drawn on exact number of times full size and affixed to the projection screen.

Sources of error:-

Precautions:-

1) While measuring, to avoid backlash error the table screws must be moved in one direction only.
2) Before measurements, fiducial line must be set parallel with the axis of movement of table.

DATE:

Experiment no.5

Title:- Measurements of machine parts using toolmakers microscope

Observation table:-

	Reading	Trial No.	Main Scale Reading	Thimble Scale Reading	Total Reading	Difference	Average
Pitch	Initial	1	13	194	13.97	1.01	1.0025 mm
	Final	2	12	192	12.96		
	Initial	1	13	190	12.95	0.995	
	Final	2	14	189	14.945		
Major Diameter	Initial	1.	18	181	18.905	5.995	5.995 mm
	Final	2.	12	182	12.91		
	Initial	3.	18	175	18.865	5.995	
	Final	4.	12	174	12.87		
Thread Angle	Initial	1.	112°	0'	112°	59°	4.705 mm
	Final	2.	117°	0'	171°		
	Initial	1.	114°	8X6'	114°48'	39°42'	
	Final	2.	174°	5X6'	174'80'		
Minor Diameter	Initial	1.	18	31	18.155	4.715	59°21'
	Final	2.	13	88	13.44		
	Initial	1.	18	48	18.24	4.7	
	Final	2.	13	108	13.54		

DATE:

Source of Error :-

1. Error Caused by temperature
2. Error caused by material Deformation.

Precautions :-

1. While measuring error the table screws must be moved in one direction only.
2. Before measurement fiducial must be set parallel with axis of movable of table

Conclusion :-

1. Average pitch of given screw thread = 1.0025 mm
2. Average Major Diameter = 5.995 mm
3. Averageminor Diameter = 4.7075 mm
4. Average of Thread angle = 59° 21'

Assignment:-

1) What are the specifications of Toolmakers Microscope?
2) List the accessories required for Toolmakers Microscope?
3) What are the applications of Toolmakers Microscope?
4) Explain how thread angle can be measured with the help of Toolmakers Microscope?
5) How centre distance between two holes can be checked?

References

Title of Article	Web Link
Toolmaker's Microscope | Measurements & Metrology Lab | MechLabVideos	https://www.youtube.com/watch?v=BdKiYrwCyV0
Tool Makers Microscope	https://www.youtube.com/watch?v=ttvuS3AlE6g
Toolmakers Microscope	https://www.youtube.com/watch?v=kX4aPWxvgcM
Thread Measurement Using Profile Projector	https://www.youtube.com/watch?v=OL80Kg_pmyc

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Assignment

1- What are the specification of Toolermakers Microscope?

Answer:- 1. Eyepiece = Standard : WF is x (with cross hair optional of WF 10 x WF 20

2]. Optical Head = Monocular (Binocular for camera attachment).

3]. Measuring Range = 50 mm x 50 mm x 10 mm

4]. Following Range = 100 mm

5] Measurement method = Micrometer/software.

2. List the accessories required for toolmakers microscope?

Answer:- A hollow ballon base, which accommodates the illumination unit underneath

A circular stage surface (upper part of the base) - It is made up of transparent glass and can be rotated 360° an objective lense

An objective lense

Two micrometer screws.

3. What are the applications of tool makers microscope?

Answer:- The large tool micrometer in suitable for the following feild of applications.

1]. length measurements of tools in cartesian and polar co-ordinates.

2]. Angular Measurements of tools threadings, tools punches and gauges templates etc.

3]. Comparison between centres and drawn position and drawings or projected profiles.

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4. Explain thread angle can be measured with the help of di tadmotor microscope?

Answer:- Using the microscope it is possible to measure angles by using the protactor eyepiece this allows for the angles of the object to be viewed and determined.

This is where the microscope is used do comparison of the thread forms, measuring of the pitch and diameter Here microscope achieves the using the manator profiles Engravings in the eyepeice.

5. How centre distance between two holes can be cheaked.

Answer:- The distance between the centres of two holes can be cheaked with a vernier caliper in messuring the inside distance between the holes determine the secting on the caliper substract the radius of each hole (one-half the diameter) from the centre distance the hole diameter, and the distance between centres for each determine.

1. The main scale setting and.
2. The vernier scale reading setting all dimension one in Inches.