UNIVERSAL MEASURING MICROSCOPE

The Universal Measuring Microscope (UMM) can be used for a variety of linear and angular measurements like thread measurements, pitch diameters, shape of thread etc., angle measurements – flank angle of thread cutters, hobs and chasers, profile angle and of contoured mills, angles of templates, section, gauges etc. and shape test-measurements of profile gauges, templates, form cutters and mills, cutting dyes etc.

The major components of the UMM are the basic bed, carriages for X and Y movements, columns with carrier arm, sighting microscope and the main lighting unit. The schematic diagram of the equipment is shown in the Fig. 1.

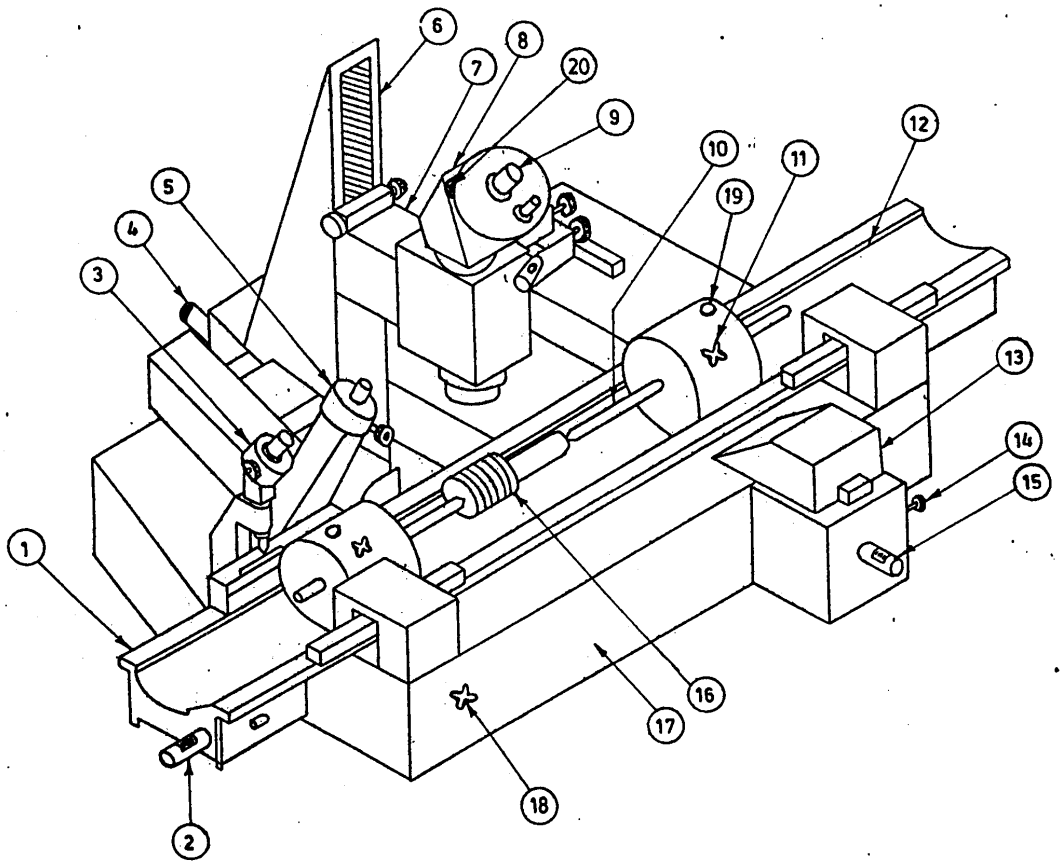


Fig. 1 UNIVERSAL MEASURING MICROSCOPE

1. X-carriage; 2. head for sensitive adjustment of X-movement; 3. reading microscope for X-movement; 4. lighting unit; 5. reading microscope for Y- movement; 6. column; 7. carrier arm for sighting-microscope; 8. sighting microscope; 9. eye piece; 10. centre support; 11. lock for centre support; 12. cylindrical guide; 13. Y-carriage; 14. knob for arresting coarse Y-movement; 15. head for sensitive adjustment of Y-movement; 16. test object; 17. basic bed; 18. knob for arresting coarse X-movement 19. centre lock; 20. head for sighting microscope.

The two measuring carriages have precision ball bearings by which they move on lapped steel rails on the bed. Both the carriages X and Y are positively connected with the basic bed. Each of them has a lighting unit of it's own. Center supports and V-bearings for test objects are fitted in the cylindrical guide of the X-carriage. The Y-carriage carrier carries the sighting microscope with it's various moving elements and lighting unit.

Measuring principle

Measurements on this equipment means comparison with precision glass scales; in the X direction by shifting of the test object relative to a line mark in the field of vision of the stationary sighting microscope and in the Y direction by shifting of the sighting microscope relative to the stationary test object. The glass scales follow the displacement in either case so that the size of shifting can be reckoned as equal to the difference in readings. The field of vision of the sighting microscope and a typical image of the test object as seen in the field of the sighting microscope are shown in Fig. 2 and Fig.3.

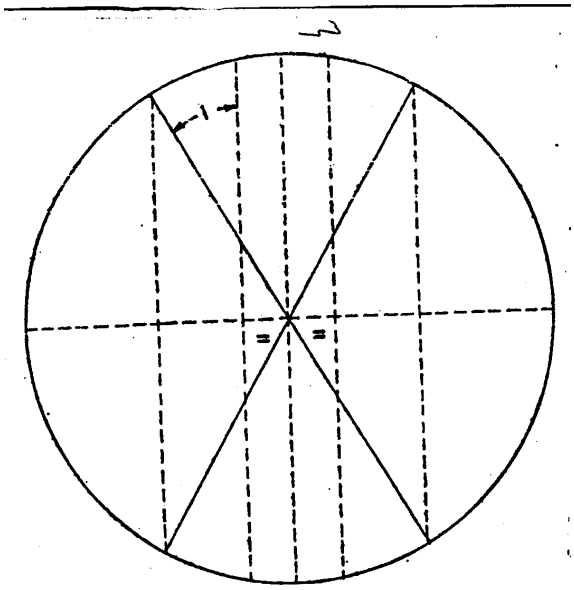


Fig. 2 Field of vision of sighting microscope
1- hair line

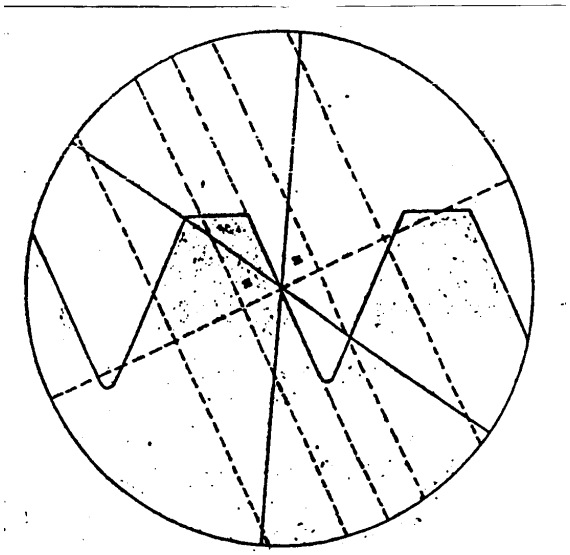


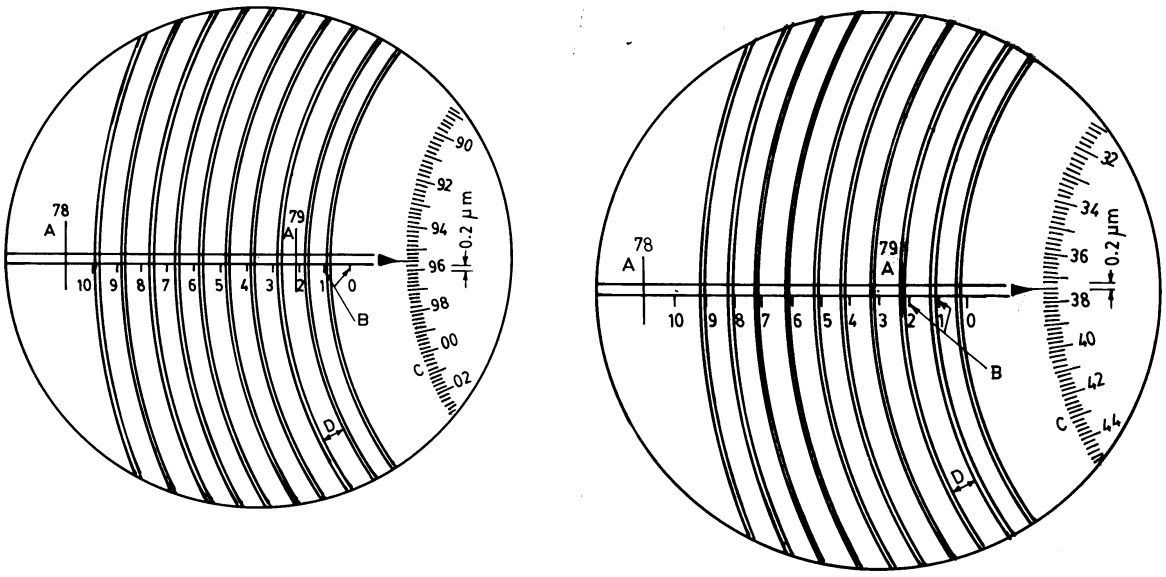
Fig. 3 Image of the test object as seen in the field of sighting microscope

Methods of Measurements

The UMM can be used to measure thread pitch, thread angle, taper angle, external and core diameter of the thread, etc. For measuring thread pitch, the test object is mounted between the centres on the center support on X carriage. The sighing microscope is focused on the specimen and it's image is brought to the field of view. The vertical hairline in the sighting microscope is made to coincide with the crest or valley of one thread and the reading on the X carriage is noted down. Now the carriage is shifted slowly to bring the crest of the adjacent thread into the field of view and the final reading is taken. The difference between the two gives the pitch of the thread. For fine adjustments, the micrometer head on the X carriage is used. A typical example is narrated in the Fig.4.

For measuring the external and core diameter of the thread

Adjustments in the Y movement carriage are done in these cases. The cross wires and horizontal hairline is made to coincide with the crest of one thread. Now, by moving the Y carriage, the same hairline is made to coincide with the diametrically opposite crest. For core diameter measurement, the hairline is made to coincide with the root of the thread.



(a) before adjustment (b) after adjustment > indicating reading = 79.2374 mm

Fig. 4 Field of vision of sighting microscope with graduation lines

A- graduation lines of main scale; millimeters B-graduation lines for tenths of millimeter C- spiral microscope graduations for 2nd, 3rd and 4th decimals of a millimeter D- Twin spiral lines to be positioned symmetrically about a millimeter line by turning of the control knob

To measure the thread angle

Any of the inclined cross wires is made to coincide with one flank of the thread. The reading on the angle scale is recorded as the initial reading. Now the same cross wire is made to coincide with the adjacent flank of the same thread and the final reading is taking is taken. The difference gives the thread angle.

For measuring taper angle

Of the tapered section the carriage is positioned at any point of the section and the diameter D of that position is noted. Similarly a smaller diameter 'd' on the same section at the separation of 'L' units is taken in a similar manner. Now taper is obtained from simple trigonometry as

$$\alpha = \tan^{-1}\left((D-d)/2L\right)$$