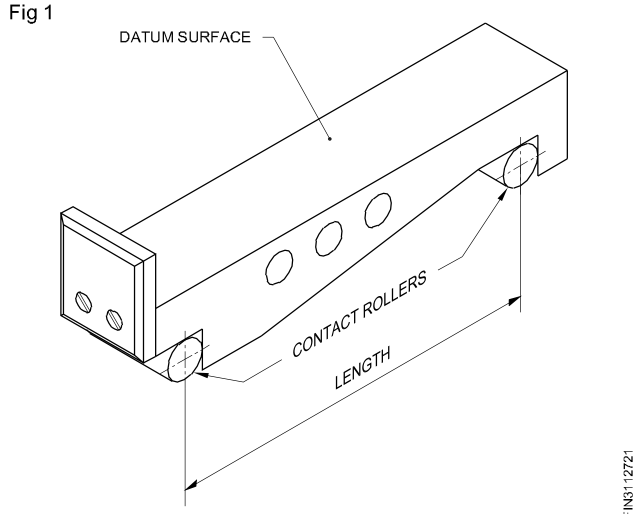
Sine bar principle application and specification

Objectives : At the end of this lesson you shall be able to
- **state the principle of a sine bar**
- **specify the sizes of sine bar**
- **state the features of sine bars**
- **state the different uses of sine bar using slip gauges.**

A sine bar is a precision measuring instrument for checking and setting of angles. (Fig 1)

Fig 1

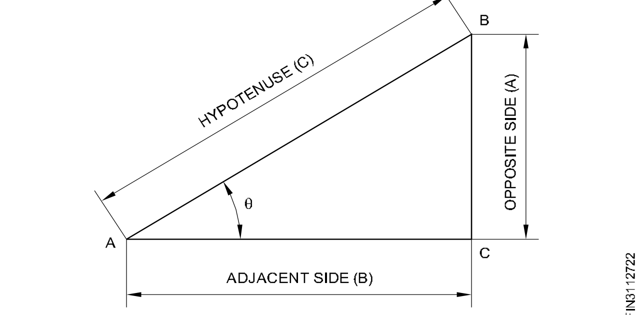


The principle of a sine bar

The principle of a sine bar is based on the trigonometrical function.

In a right angled triangle the function known as Sine of the angles is the relationship existing between the opposite side to the angle and the hypotenuse. (Fig 2)

Fig 2

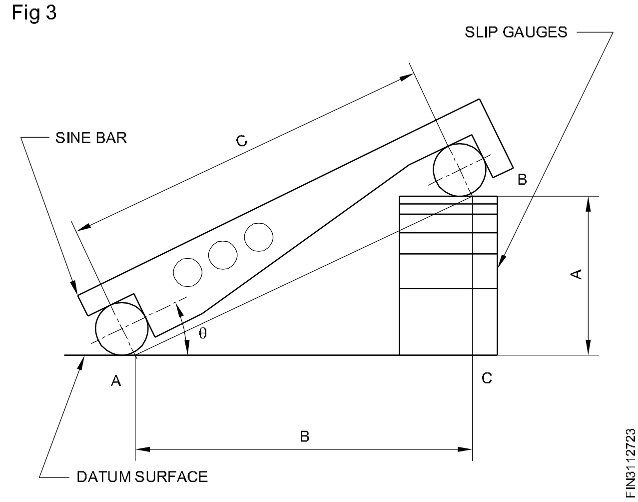


It may be noted that for setting the sine bar to different angles, slip gauges are used.

A surface plate or marking table provides the datum surface for the set up.

The sine bar, the slip gauges and the datum surface upon which they are set form a right angled triangle. (Fig 3) The sine bar forms the hypotenuse (c) and the slip gauge stack forms the side opposite (a).

Fig 3



$$\text{Sine of the angle } \theta = \frac{\text{Opposite side}}{\text{Hypotenuse}}$$

$$\text{Sine } \theta = \frac{A}{C}$$

Features

This is a rectangular bar made of stabilized chromium steel.

The surfaces are accurately finished by grinding and lapping.

Two precision rollers of the same diameter are mounted on either end of the bar. The centre line of the rollers is parallel to the top face of the sine bar.

There are holes drilled across the bar. This helps in reducing the weight, and also it facilitates clamping of sine bar on angle plate.

The length of the sine bar is the distance between the centres of the rollers. The commonly available sizes are 100 mm, 200 mm, 250 mm and 500 mm. The size of a sine bar is specified by its length.

Uses

Sine bars are used when a high degree of accuracy to less than one minute is needed for

- measuring angles (Fig 4)
- marking out (Fig 5)
- setting up for machining. (Fig 6)

Fig 4

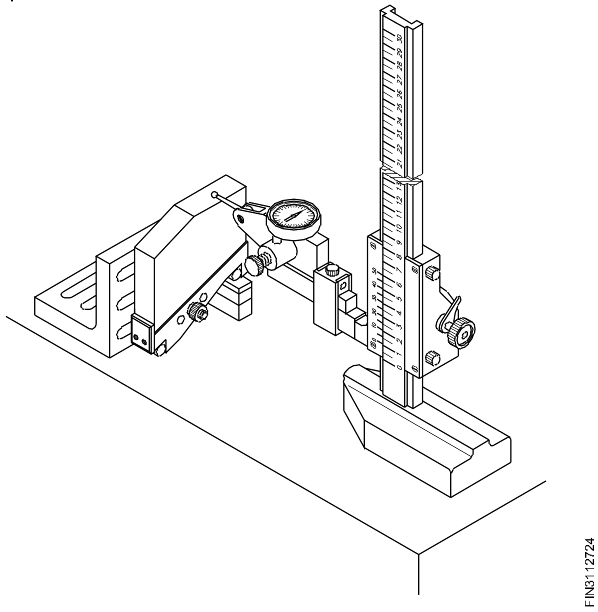


Fig 6

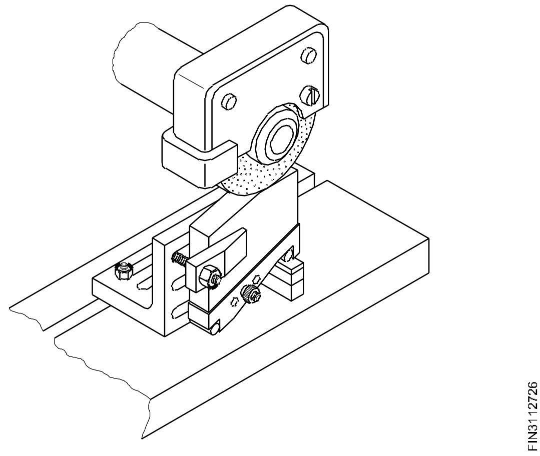
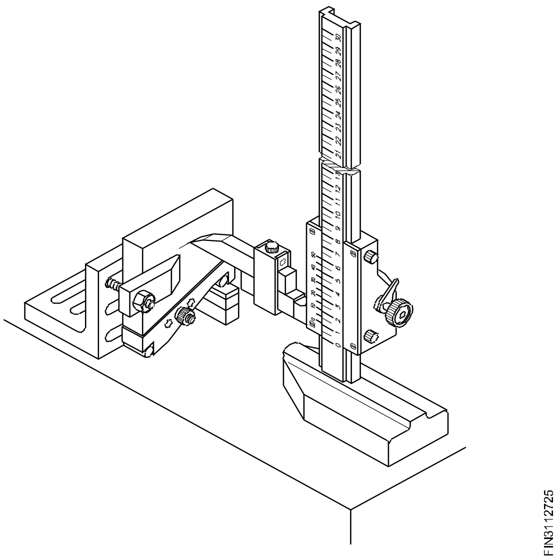


Fig 5



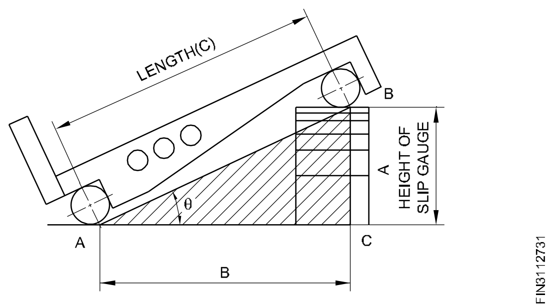
Determining taper using sine bar and slip gauges

Objectives: At the end of this lesson you shall be able to
- **determine correctness of a known angle**
- **calculate the height of slip gauges to a known angle.**

Sine bars provide a simple means of checking angles to a high degree of accuracy of not less than one minute upto 45^0.

The use of a sine bar is based on trigonometric function. The sine bar forms the hypotenuse of the triangle and the slip gauges the opposite side. (Fig 1)

Fig 1



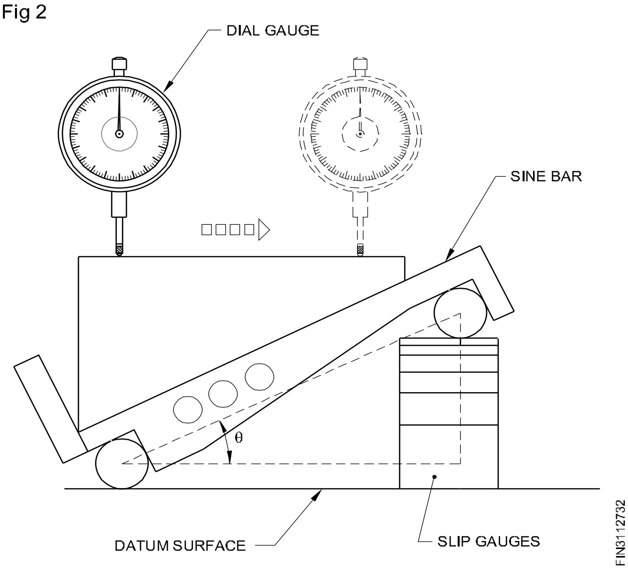
Checking the correctness of a known angle

For this purpose first choose the correct slip gauge combination for the angle to be checked.

The component to be checked should be mounted on the sine bar after placing the selected slip gauges under the roller. (Fig 1)

A dial test indicator is mounted on a suitable stand or vernier height gauge. (Fig 2) The dial test indicator is then set in first position as in the figure and the dial is set to zero.

Fig 2

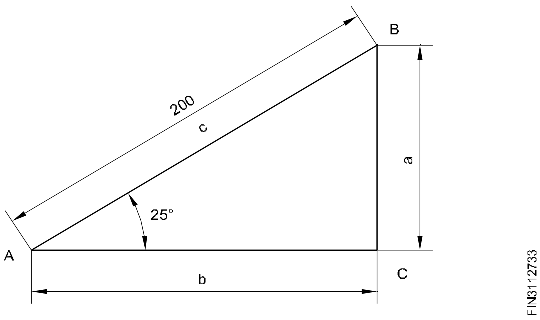


Move the dial to the other end of the component (second position). If there is any difference then the angle is incorrect. The height of the slip gauge pack can be adjusted until the dial test indicator reads zero on both ends. The actual angle can then be calculated and the deviation, if any, will be the error.

Method of calculating the slip gauge height

Example (Fig 3)

Fig 3



Exercise 1

To determine the height of slip gauges for an angle of 25^o using a sine bar of 200 mm long.

$$\text{Sine } \theta = \frac{a}{c}$$

θ = 25^0

a = C Sine θ

= 200 x 0.4226

a = 84.52 mm

The height of the slip gauge required is 84.52 mm.

The value of sine θ can be obtained from mathematical tables. (Natural trigonometrical functions)

Tables are also available with readily worked out sine bar constants for standard sine bar lengths.

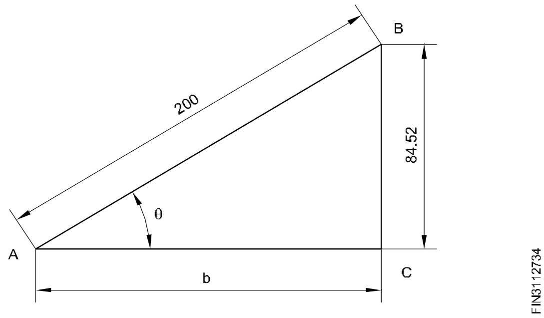
Calculating the angle for tapered components

Exercise 2

The height of the slip gauge used is 84.52 mm. The length of the sine bar used is 200 mm.

What will be the angle of the component? (Fig 4)

Fig 4



The angle whose sine value is 0.4226 is 25^0. Hence the angle of tapered component is 25^0.

$$\text{Sine}\theta = \frac{a}{c}$$

$$= \frac{84.52}{200}$$

sine θ = 0.4226

The angle whose sine value is 0.4226 is 25^0. Hence the angle of tapered component is 25^0.

Classroom Assignment

1 What will be the angle of the workpiece if the slip gauge pack height is 17.36 mm and the size of the sine bar used is 100 mm? (Fig 5)

Answer ________________________

2 Calculate the height of the slip gauge pack to raise a 100 mm sine bar to an angle of 3^0 35'.

Answer ________________________

Fig 5