

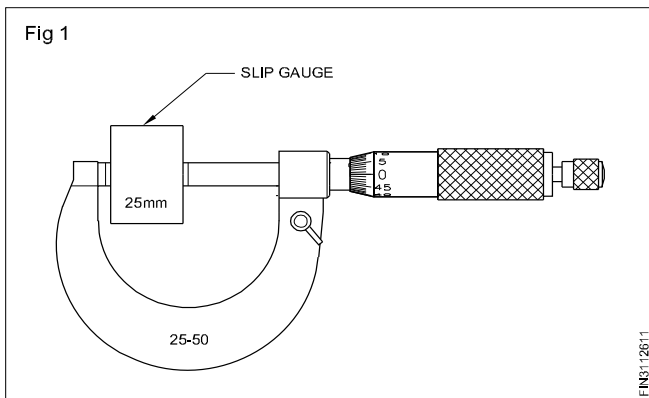
Slip Gauges

Objectives : At the end of this lesson you shall be able to

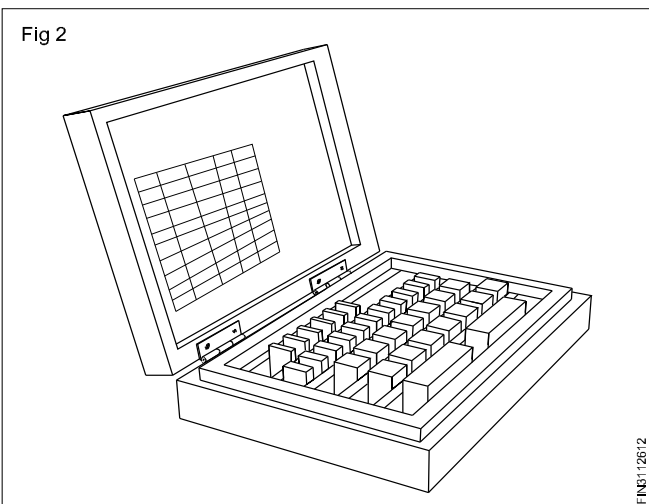
- **define the features of slip gauges**
- **state the different grades of slip gauges**
- **state the number of slips in standard**
- **state the precautions and application of slip gauges.**

Slip gauges

Slip gauges are gauge blocks used as standards for precision length measurement. (Fig 1) These are made in sets and consist of a number of hardened blocks, made of high grade steel with low thermal expansion. They are hardened throughout, and heat treated further for stabilization. The two opposite measuring faces of each block are lapped flat and parallel to a definite size within extremely close tolerances.

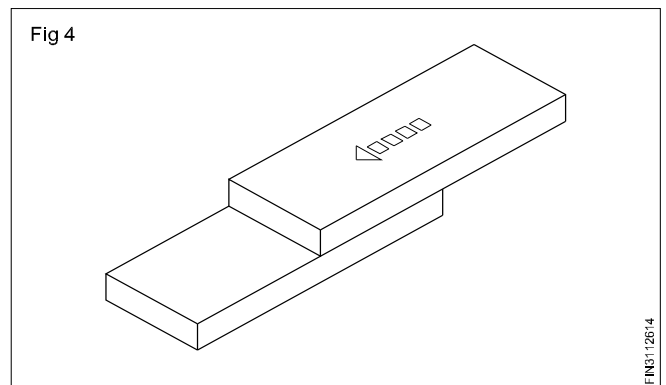
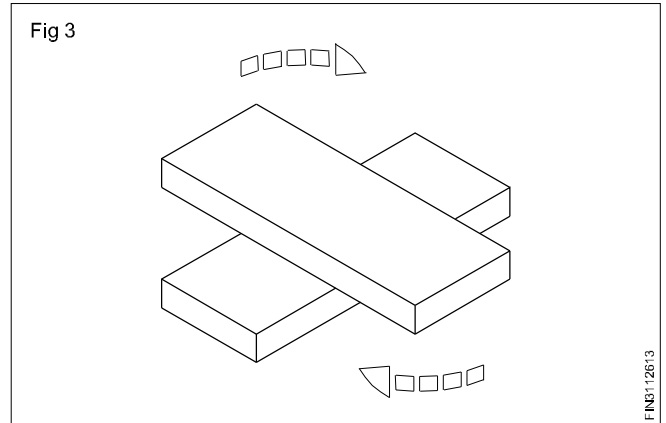


These slip gauges are available in various sets with different numbers. (Fig 2) (Ref. Table 1)



A particular size can be built up by wringing individual slip gauges together. (Figs 3 & 4)

Wringing is the act of joining the slip gauges together while building up to sizes.



Some sets of slip gauges also contain protector slips of some standard thickness made from higher wear-resistant steel or tungsten carbide. These are used for protecting the exposed faces of the slip gauge pack from damage.

Grades

Grade '00' accuracy

It is a calibration grade used as a standard for reference to test all the other grades.

Grade '0' accuracy

It is an inspection grade meant for inspection purposes.

Grade I accuracy

Workshop grade for precision tool room applications.

Grade II accuracy

For general workshop applications.

B.I.S. recommendations

Three grades of slip gauges are recommended as per IS 2984. They are:

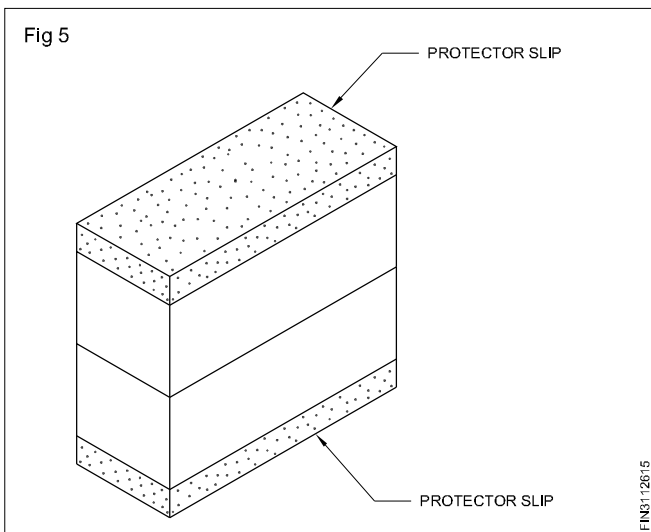
- Grade '0'
- Grade I
- Grade II.

Care and maintenance points to be remembered while using slip gauges.

- Use a minimum number of blocks as far as possible while building up a particular dimension.
- While building the slip gauges, start wringing with the largest slip gauges and finish with the smallest.

While holding the slip gauges do not touch the lapped surfaces.

If available use protector slips on exposed faces. (Fig 5)
After use, clean the slips with carbon tetrachloride and apply petroleum jelly for protection against rust.



Before use, remove petroleum jelly with carbon tetrachloride. Use chamois leather to wipe the surfaces.

TABLE 1

Different sets of slip gauges

Set of 112 pieces (M112)

Range (mm)	Steps (mm)	No.of pieces
Special piece	1.0005	1
1 st series 1.001 to 1.009	0.001	9
2 nd series 1.01 to 1.49	0.01	49
3 rd series 0.5 to 24.5	0.5	49
4 th series 25.0 to 100.0	25.0	4
Total pieces		112

Set of 103 pieces (M103)

Range (mm)	Steps (mm)	No.of pieces
1 st series 1.005	-	1
2 nd series 1.01 to 1.49	0.01	49
3 rd series 0.5 to 24.5	0.5	49
4 th series 25 to 100	25.0	4
Total pieces		103

Set of 46 pieces (M46)

Range (mm)	Steps (mm)	No.of pieces
1 st series 1.001 to 1.009	0.001	9
2 nd series 1.01 to 1.09	0.01	9
3 rd series 1.10 to 1.90	0.10	9
4 th series 1.00 to 9.00	1.00	9
5 th series 10.00 to 100.00	10.00	10
Total pieces		46

Selection and determination of slip gauges for different sizes

Objective: At the end of this lesson you shall be able to

- determine slip gauges for different sizes.

For determining a particular size, in most cases a number of slip gauges are to be selected and stacked one over the other by wringing the slip gauges.

While selecting slip gauges for a particular size using the available set of slip gauges, first consider the last digit of the size to be built up. Then consider the last or the last two digits of the subsequent value and continue to select the pieces until the required size is available.

Example (Without using protector slips)

Building up a size of 44.8725mm with the help of 112 piece set. (Table 1)

Set of 112 pieces (M112)

Range (mm)	Steps (mm)	No. of pieces
1.005	--	1
1.001 to 1.009	0.001	9
1.01 to 1.49	0.01	49
0.5 to 24.5	0.5	49
25.0 to 100.0	25.5	4
Total pieces		112

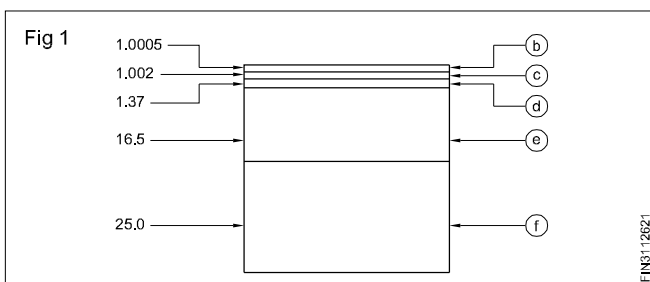


TABLE 1

Procedure	Slip pack	Calculation
a First write the required dimension		44.8725
b Select the slip gauge having the 4 th decimal place	1.005 subtract	$\begin{array}{r} 1.0005 \\ \hline 43.872 \end{array}$
c Select 1 st series slip that has the same last figure	1.002 subtract	$\begin{array}{r} 1.002 \\ \hline 42.870 \end{array}$
d Select the 2 nd series slip that has the same last figure and that will leave 0.0 or 0.5 as the last figure	1.37 subtract	$\begin{array}{r} 1.37 \\ \hline 41.5 \end{array}$
e Select a 3 rd series slip that will leave the nearest 4th series slip	16.5 subtract	$\begin{array}{r} 16.5 \\ \hline 25.0 \end{array}$
	(41.5 - 25 = 16.5)	25.00
f Select a slip that eliminates the final figure Add	25.0 subtract	25.00
		$\begin{array}{r} 25.00 \\ \hline 0 \end{array}$
	44.8725	0

Maintenance of measuring instruments

Objective: At the end of this lesson you shall be able to

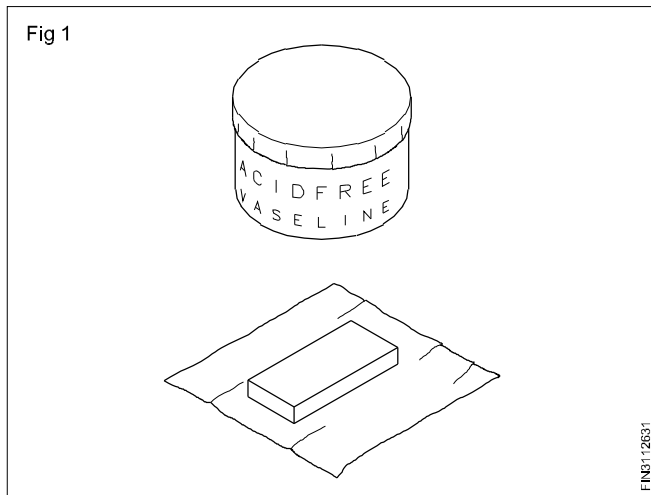
- state the preventive measures to be taken for protecting precision measuring instruments.

Precision measuring instruments play an important role in maintaining the quality of the products. Measuring instruments are also very expensive. It is important that the instruments are well looked after and maintained by the person who uses it.

Protection against corrosion

High atmospheric humidity and sweat from hands can cause corrosion to instruments. Avoid this.

Acid-free vaseline (petroleum jelly) applied lightly on the instruments can give protection against corrosion. (Fig 1)



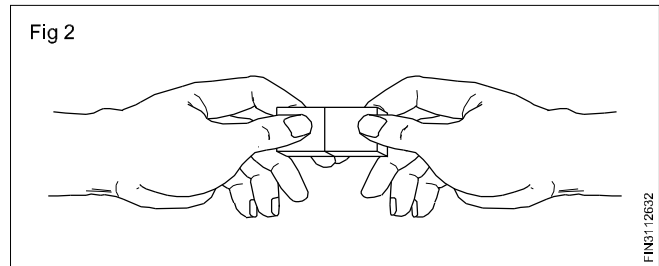
Be sure that the instruments are thoroughly cleaned and free from water or moisture before applying vaseline.

Use chamois leather for giving a light coating of vaseline.

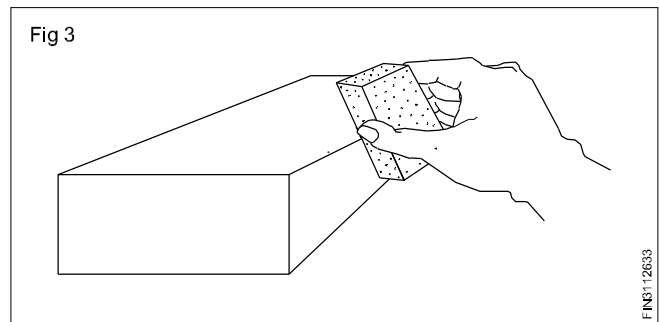
Always clean the slip gauges with carbon tetrachloride and apply petroleum jelly after use.

Remove burrs and metal particles. Burrs on workpieces can cause scratches and damages to measuring equipment. They can also damage other workpieces.

Metal or other particles between the measuring faces of slip gauges will make it impossible for them to adhere to each other. (Fig 2)



Remove burrs from the workpieces with an oilstone. (Fig 3)



Use chamois leather to wipe the carbon tetrachloride after cleaning.

Use a felt pad or rubber mat for placing the instruments while working.

Handle the instruments with care and do not allow them to mix up with other tools.

Slip gauge accessories

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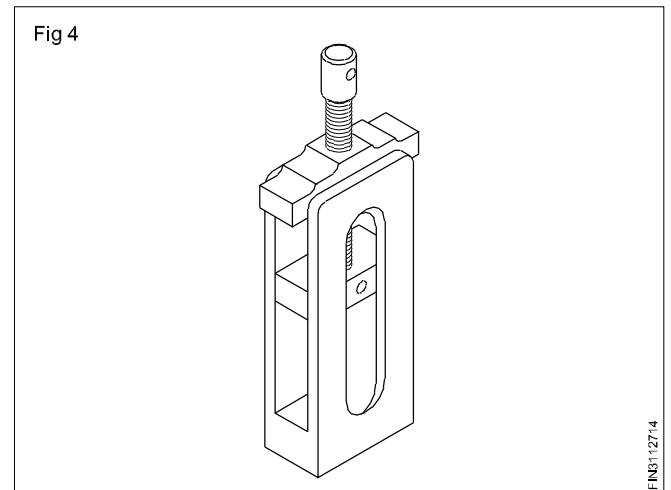
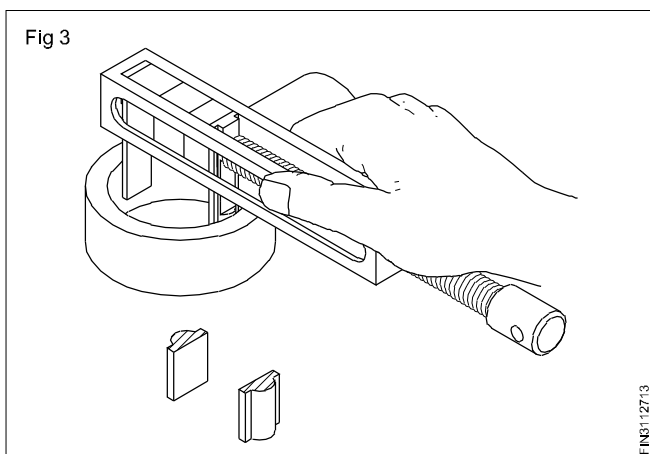
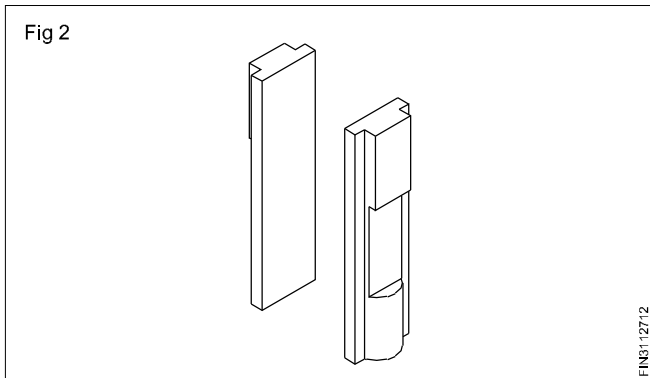
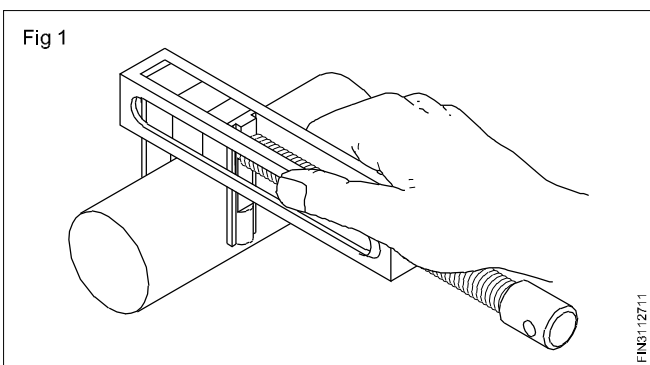
- name the different accessories used along with slip gauges
- state the uses of different accessories.

Slip gauges can be put to a variety of precision work when used along with certain special accessories.

Measuring external and internal sizes

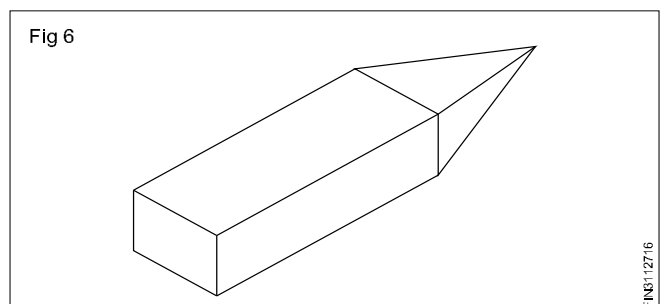
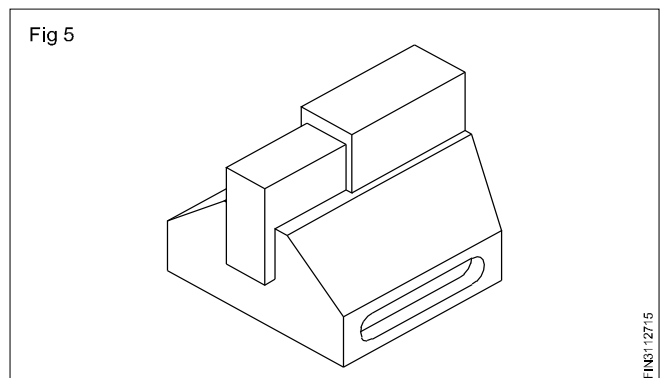
Slip gauges can be used for checking external and internal measurements. For this purpose a set of high precision special jaws are used along with a holder. (Figs 1,2 & 3)

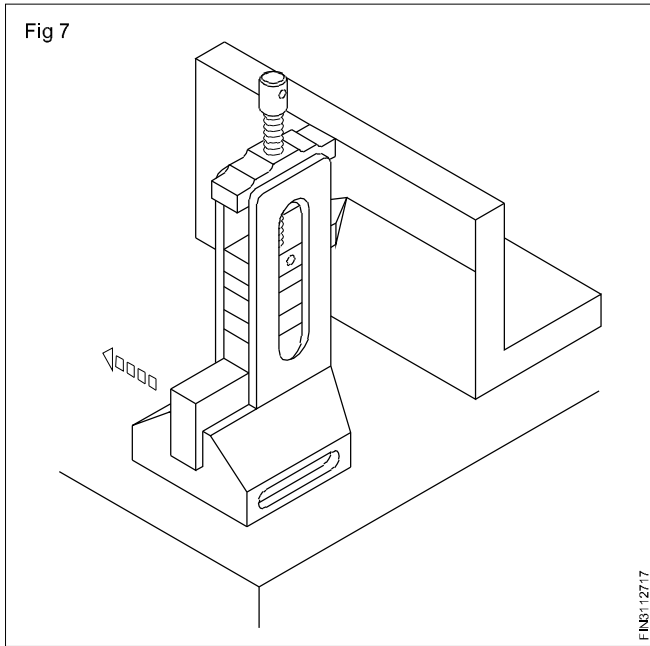
The pair of special jaws (Fig 2) will have a flat surface at one end and a curved surface at the other end to facilitate external and internal measurements. The slip gauge holder can be used for a variety of applications. (Fig 4)



Using as a height gauge

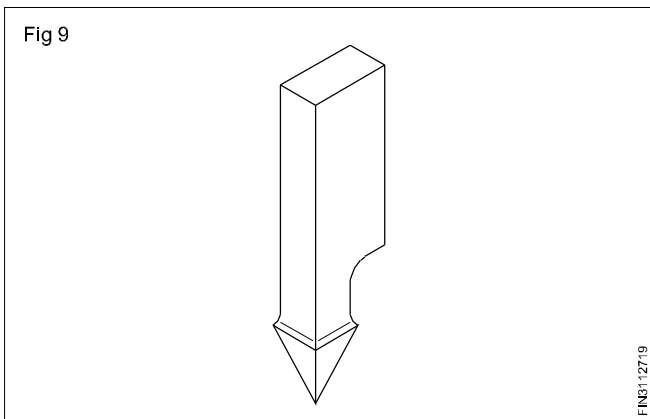
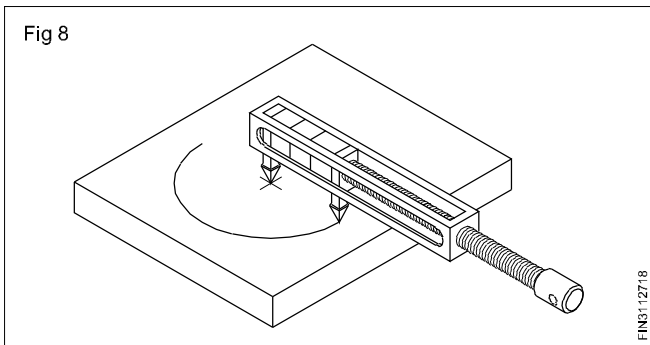
A height gauge can be built up by using a base block, (Fig 5) slip gauge holder, scriber point (Fig 6) and the required slip gauges. The height gauge (Fig 7) built up with these accessories can be used for very accurate layout work.





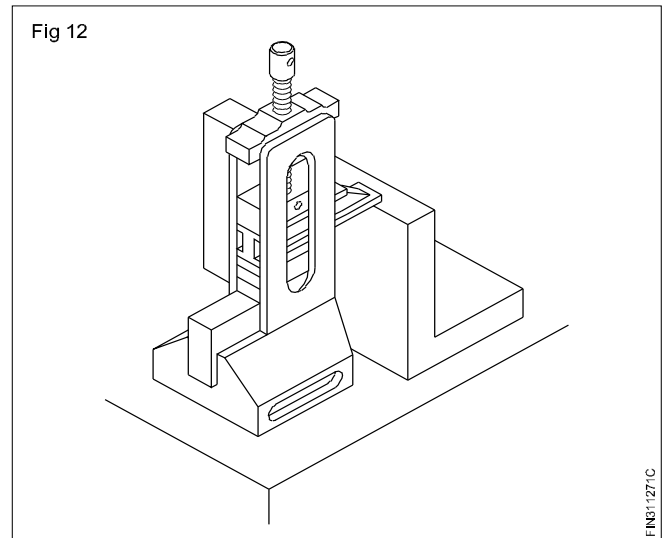
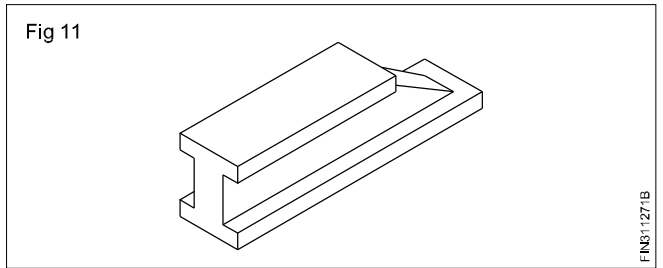
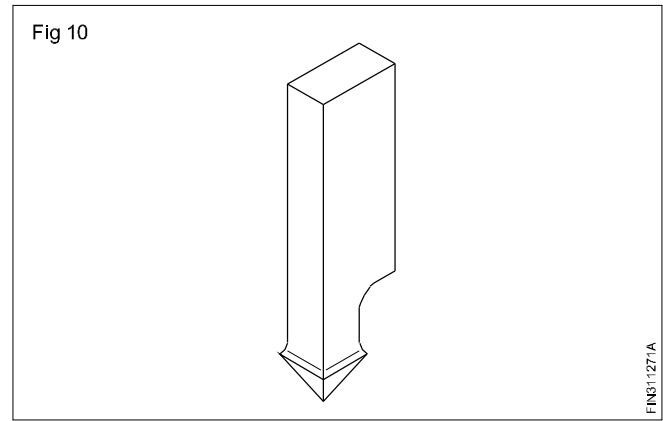
For drawing circles

Compasses (Fig 8) of different lengths can be built up using the slip gauge holder, radii scriber (Fig 9) and a centre point. (Fig 10)



Checking height

The height of surfaces can be checked by the use of a flat jaw (Figs 11 & 12) along with a base and a slip gauge holder.



Checking centre distance of holes

With the help of precision cylindrical pins, the centre distance between holes can be accurately measured. (Fig.13)

