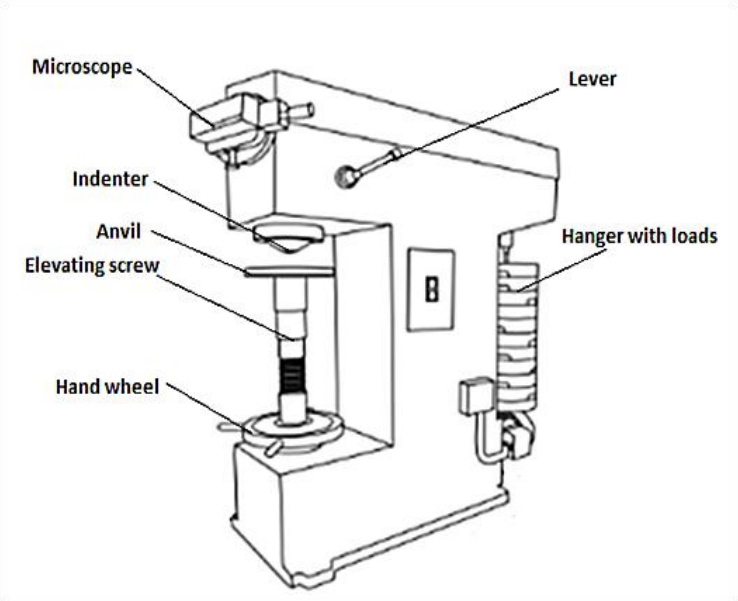
Brinell Hardness Test

Aim :- To determine the indentation hardness of mild steel, cast iron , brass, aluminum etc using Brinell Hardness Testing Machine.

Apparatus Required:- Brinell Testing Machine, hard mild steel etc.

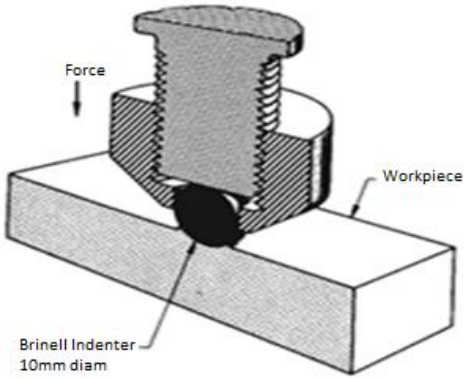
Diagram:-



Theory:-

Brinell hardness test is most commonly used to test materials that have a structure that is too rough or too coarse to be tested using other test methods, e.g., castings and forgings. In brinell testing machine the load is applied by a lever mounted on knife edges and carrying a hanger for suspending the required load. The supporting table for spacing the specimen can be raised or lowered by a steel screw by operating a large hand wheel. When testing, the load is applied and removed by hydraulic power controlled by a hand lever. The indenter used is a hardened steel ball which will have a diameter of 10mm, 5mm or 2.5mm. The reading microscopic has a 25-fold magnification. The gap between successive graduations of the scale is 0.5mm and a micrometer is arranged sideways, the eye piece of the reading microscope may be turned up by 90 degree so that the impressions of the ball can be measured in two perpendicular directions.

A well structured Brinell hardness number reveals the test conditions, i.e., "70 HB 10/500/30" which means that a Brinell Hardness of 70 was obtained using a 10mm diameter hardened steel ball with a 500 kilogram load applied for a period of 30 seconds. Highly hardened steel cannot be tested by a hardened steel ball because the ball will get flattened and become permanently deformed. The appreciable error in BHN occurs at indentation diameter less than 2.9mm and for softer materials inaccuracy is at diameter greater than 6mm. On tests of extremely hard metals a tungsten carbide ball is substituted for the steel ball (upto 444-627 HB) and a special hardened and burnished steel ball called the “Hulked” ball may be used up to 500 HB.



Compared to the other hardness test methods, the indenter used in brinell makes the deepest and widest indentation, so that test averages the hardness over a wider amount of materials which will accounts for multiple grain structures and any irregularities in the uniformity of the material.

The Brinell hardness number is defined as the ratio of test load to the surface area of indentation.

$$HBW = \frac{2P}{\pi D[D - \sqrt{(D^2 - d^2)}]}$$

Where,

P = Load in Kg

HBW = Brinell hardness number (Kg/mm2)

D = Diameter of the ball (mm)

d = Diameter of the indentation (mm)

$$HBW = 0.102 \times \frac{2F}{\pi D[D - \sqrt{(D^2 - d^2)}]}$$

Where,

Constant = 0.102 = 1/(g) = 1/9.81

g = acceleration due to gravity

F = Force in Newton

Procedure:-

1. Select the load P based on the type of material selected.

2. The specimen is placed on the supporting table, then the hand wheel below the table is turned in clockwise direction until the gap between the surface of the specimen and the indentor is 5 mm.
3. The motor is switched on. The hand lever is pulled into load position. The load is applied for a period of 10 to 15 seconds.
4. The hand lever is pulled back into unload position. The diameter of the impression is measured through a microscope attached to the apparatus.
5. Repeat the experiment at other positions of the test piece.
6. Calculate the value of HB.

Observation:-

Trial	Material	Diameter of indenter D (mm)	Load P (kg)	Average diameter d_1 (mm)	HBW (kg/mm^2)	Average HBW (kg/mm^2)
1						
2						

Results:-