International Journal of Machine Design and Manufacturing
Vol. 1: Issue 2
www.journalspub.com

Speculative Study of Ball Bearings and Its Related Parts

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ABSTRACT

A bearing is a mechanical device used to enable rotational or linear movement, while reducing friction and handling stress. A bearing is easier to move both in rotary and linear, and it has a simple structure with internal and external smooth metal surfaces.

Keywords: angular contact, ball bearing, cap

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INTRODUCTION

Although the concept of the ball bearing dates back at least to Leonardo da Vinci, their design and manufacture has become remarkably sophisticated. This technology was brought to its present state of perfection only after a long period of research and development. The benefits of such specialized research can be obtained when it is possible to use a standardized bearing of the proper size and type. However, such bearings cannot be used indiscriminately without a careful study of the loads and operating conditions.[1–10]

BEARING WITH BEARING CAP

The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing is made upon steel material and bearing cap is mild steel. Ball and roller bearings are used widely in instruments and machines in order to minimize friction and power loss. In addition, the bearing must be provided with adequate mounting, lubrication and sealing.[11–17]

Design engineers have usually two possible sources for obtaining information which they can use to select a bearing for their particular application:

a) Textbooks
b) Manufacturers

Catalogs textbooks are excellent sources; however, they tend to be overly detailed and aimed at the student of the subject matter rather than the practicing designer. They, in most cases, contain information on how to design rather than how to select a bearing for a particular application. Manufacturers' catalogs, in turn, are also excellent and contain a wealth of information which relates to the products of the particular manufacturer. These catalogs, however, fail to provide alternatives – which may divert the designer's interest to products not manufactured by them. Our Company, however, provides the broadest selection of many types of bearings made by different manufacturers.

For this reason, we are interested in providing a condensed overview of the subject matter in an objective manner, using data obtained from different texts, handbooks and manufacturers' literature. This information will enable the reader to select the proper bearing in an expeditious manner. If the designer's interest exceeds the scope of the presented material, a list

of references is provided at the end of the Technical Section. At the same time, we are expressing our thanks and are providing credit to the sources which supplied the material presented here.[18–23]

CONSTRUCTION AND TYPES OF BALL BEARINGS

A ball bearing usually consists of four parts:

- An inner ring
- An outer ring
- The balls
- The cage or separator

To increase the contact area and permit larger loads to be carried, the balls run in curvilinear grooves in the rings. The radius of the groove is slightly larger than the radius of the ball, and a very slight amount of radial play must be provided. The bearing is thus permitted to adjust itself to small amounts of angular misalignment between the assembled shaft and mounting.

The separator keeps the balls evenly spaced and prevents them from touching each other on the sides where their relative velocities are the greatest. Ball bearings are made in a wide variety of types and sizes. Single-row radial bearings are made in four series, extra light, light, medium, and heavy, for each bore, as illustrated in Figure 1.

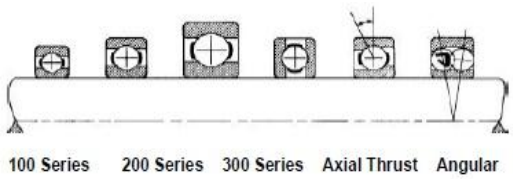

Fig. 1. *Types of ball bearings.*

Contact Self-aligning Bearing

The heavy series of bearings is designated by 400. Most, but not all, manufacturers use a numbering system so devised that if the last two digits are multiplied by 5, the result will be the bore in millimeters. The digit in the third place from the right indicates the series number. Thus, bearing 307 signifies a medium-series bearing of 35-mm bore. For additional digits, which may be present in the catalog number of a bearing, refer to manufacturer's details.

Some makers list deep groove bearings and bearings with two rows of balls. For bearing designations of Quality Bearings & Components (QBC), see special pages devoted to this purpose. The radial bearing is able to carry a considerable amount of axial thrust. However, when the load is directed entirely along the axis, the thrust type of bearing should be used. The angular contact bearing will take care of both radial and axial loads.

The self-aligning ball bearing will take care of large amounts of angular misalignment. An increase in radial capacity may be secured by using rings with deep grooves, or by employing a double-row radial bearing. Radial bearings are divided into two general classes, depending on the method of assembly (Figure 2).

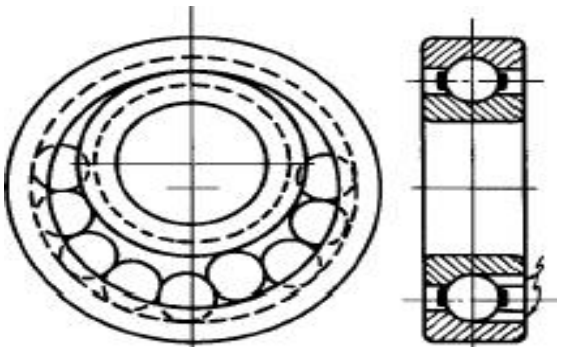

Fig. 2. *Ball bearing.*

These are the Conrad, or non-filling-notch type, and the maximum, or filling-notch type. In the Conrad bearing, the balls are placed between the rings as shown in Figures 1–4.

Then they are evenly spaced and the separator is riveted in place. In the

maximum-type bearing, the balls are (a–f) 100 Series Extra Light 200 Series Light 300 Series Medium Axial Thrust Bearing Angular Contact Bearing Self-aligning Bearing Figure Types of ball bearings figures: methods of assembly for ball bearings, (a) Conrad or non-filling notch type and (b) maximum or filling notch type.[11–16]

DESIGN SPECIFICATIONS OF BALL BEARING

Bearing No. 6202
Outer Diameter of Bearing (D) = 35 mm
Thickness of Bearing (B) = 12 mm
Inner Diameter of the Bearing (d) = 15 mm

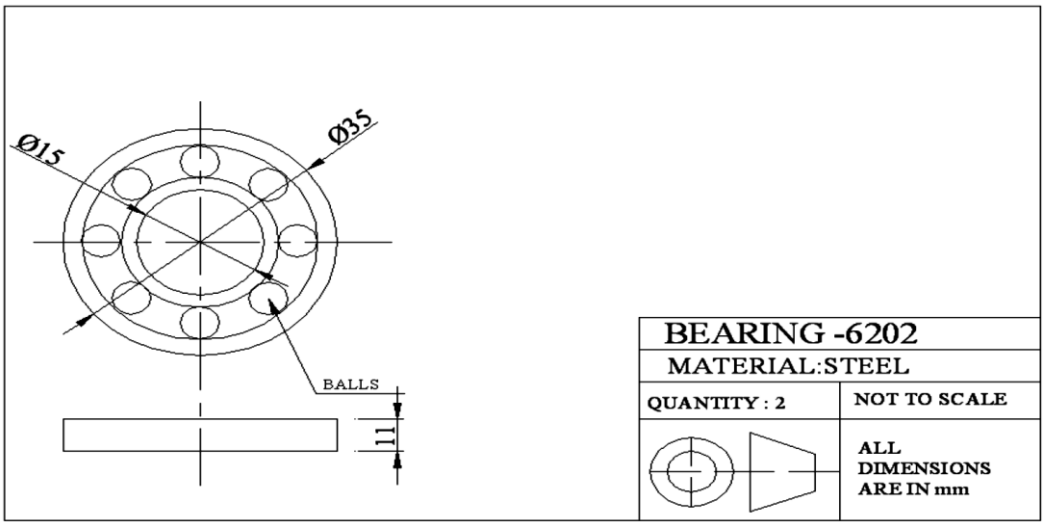

Fig. 3. *Ball bearing.*

r_1 = Corner radii on shaft and housing
r_1 = 1 (From design data book)
Maximum speed = 14,000 rpm (from design data book)

Mean diameter (dm) = (D + d)/2
= (35 + 15)/2
dm = 25 mm

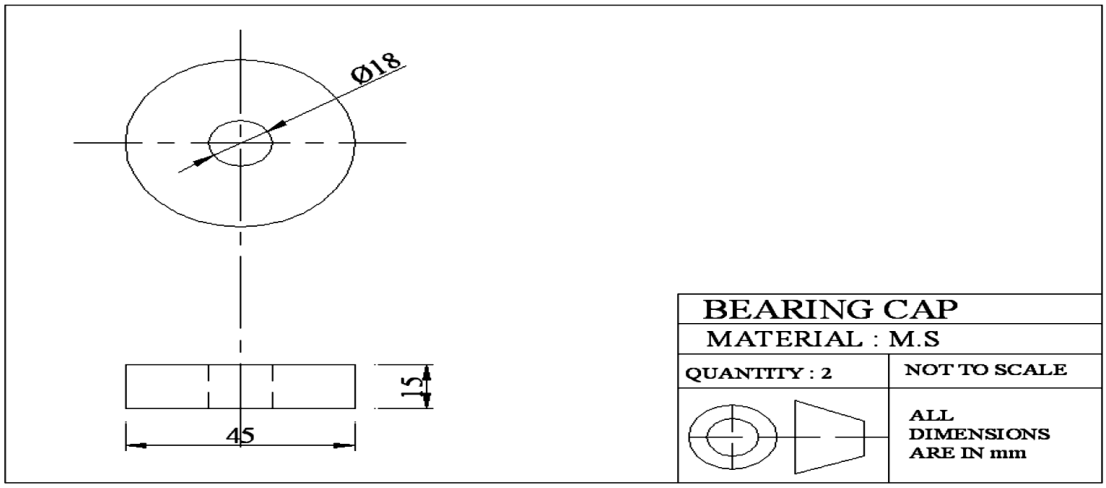

Fig. 4. *Bearing cap.*

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