

A REVIEW ON AIR BEARING: WORKING AND ADVANTAGES OVER TRADITIONAL BEARING

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Abstract: A bearing is a useful machine element which provides support to another machine element and permits a frictionless relative motion between them. A little consideration will show that some part of power wasted in overcoming the frictional resistance and due to the contact of surfaces large amount of wear and tear takes place between the contacted surfaces. So to avoid the wear and tear and to reduce the frictional resistance a thin layer of fluid is used which is known as lubricant. Air bearing is introduced to reduce the friction and wear and tear over sliding contact bearing. Air bearings (also named aerostatic or aerodynamically bearings) are bearings that use a thin film of pressurized air to provide low friction load-bearing interface between surfaces. There is small gap between two surfaces i.e. two surfaces do not touch. As they are contact-free, So various problems in traditional bearing like friction, wear, particulates, and lubricant handling are avoided and also advantages in precision positioning, such as lacking backlash and static friction, as well as in high-speed applications.

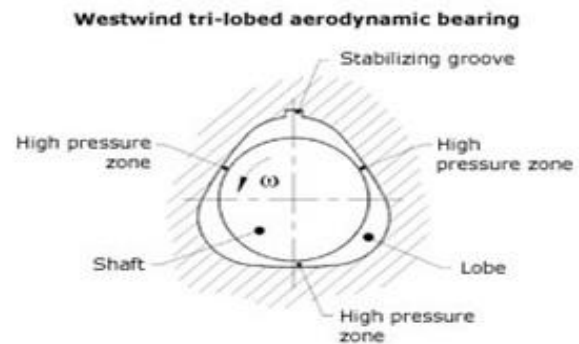
Keywords: Air Bearing, Sliding Contact Bearing.

I. INTRODUCTION

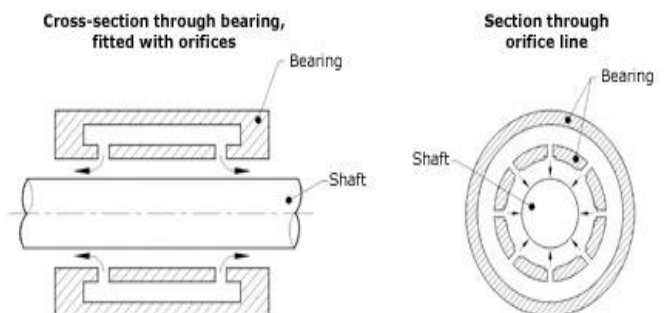
Air bearings are advanced technology in designing of bearing. Air bearings technologies are generally used coordinate measuring machines since two decades. An air bearing is such bearing which provide gas film to avoid the contact between the surfaces during their relative motion. The gas film is of air which provides lubrication between the surfaces.

Types of Air Bearings: There are two major types of air bearing which fall under the category of film lubricated bearings. These are aerodynamic bearings and aerostatic bearings. The principle of Aerodynamic bearings depends on relative motion between surfaces in contact and usually spiral groove used to draw air between the bearing lands.

Aerodynamic bearings require relative motion between the surfaces, so there is problem found when bearing surfaces comes in contact at low speed or when there is no relative motion. Another name of Aerodynamic bearings is foil bearings or self-acting bearings. The read-write head flying over a spinning disk, crankshaft journals, camshaft journals, and thrust bearings are examples of this type of bearing.



In aerostatic bearings, pressurized air is supplied between the bearing surface and precision hole, groove. The pressure of this air is maintained by external source. Since air pressure is maintained by external source so at low relative motion between the bearing surfaces or when there is no relative motion between them the air pressure is controlled.



II. WORKING

The general perception of bearing in individual mind is ball bearing i.e. everybody is familiar to only ball bearing but in air bearing there is no any contact between the bearing surfaces. In Air bearing instead balls, there is cushion of air this mean air film acts as lubrication between surfaces and friction will be reduced. The gap depends upon types of air bearing used i.e. it may be aerodynamic bearings or aerostatic bearings.

III. ADVANTAGES

There are a lot of technical advantages of air bearings such as negligible friction and wear, high speed and high precision capabilities and no oil lubrication requirements. Till now these benefits are not properly utilized due to its manufacturing difficulties. New Technologies were found in manufacturing of air bearings. The porous media technology makes air bearings robust, simple to use, inexpensive, and available off-the-shelf. Some advantages over traditional bearing are:

Greater Precision: Air bearings provide excellent precision in both directions i.e. the rotation may be in axial or radial. Since there is no physical contact, wear is minimal, ensuring accuracy remains constant over time.

High Speed: Low shear forces within the air bearing allow extremely high rotational speeds with minimal loss of power and very low heat generation. Speeds can exceed 300,000 rpm.

Tool Life: By using air bearing the life of the tool increased.

Long Bearing Life: With no mechanical contact and a clean air supply, free from oil and water, bearing life is dramatically increased.

Low Thermal Growth: Low friction, constant air flow and efficient power transmission result in minimal thermal growth.

Lack of Maintenance: Only the very minimum of maintenance is required. A regular check of air supply and coolant systems is all that is necessary to ensure complete reliability.

Large Load Capacity: Air bearings can support heavy loads, allowing them to be applied to many industrial machine tool applications.

Reduced Vibration: Only minimal levels of vibration and audible noise are produced when running an air bearing spindle. Cleanliness: Air is the only lubrication used; therefore air bearing technology is ideal where there must be no contamination of the work piece or working environment.

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Parameter	Air Bearing		Oil Bearing	Ball Bearing
			Hydrodynamic	
			Aerodynamic	
Aerostatic	less than 1000 rpm	Excellent	Excellent	Good
			Good	Fair
1000-60000 rpm	Excellent	Poor	Excellent	Fair
Greater than 60000	Excellent	Excellent	Fair	Good
Low Vibration	Excellent	Excellent	Poor	Poor
Shock Resistance	Good	Fair	Excellent	Good
Frequent Stop/Start	Excellent	Good	Excellent	Good
Low Starting Torque	Excellent	Fair	Good	Good
Long Life	Excellent	Good	Excellent	Poor
Wide temperature Range	Excellent	Good	Fair	Fair
Contamination to Surroundings	Good	Excellent	Poor	Poor
Resistance to Duct	Excellent	Fair	Good	Good
High Axial/Radial Load	Good	Fair	Excellent	Excellent
High Axial/Radial Stiffness	Excellent	Fair	Excellent	Good
Small Space Envelope	Fair	Good	Good	Excellent
Low Heat Generation	Good	Good	Fair	Fair
Low Running Cost	Fair	Good	Good	Good

IV. CONCLUSION

A lot of studies and research have been done on air bearing. there are lot of advantages of air bearing over sliding contact bearing with large applications air baring concepts are ready to solve the problem of sliding contact bearing.