

Railway Motor Bearings

Railway motor bearings are of the ball, roller or sleeve type, the latter having been used almost entirely in the past.

BALL BEARINGS

A ball bearing consists of a train of hardened steel balls, equally spaced by a cage and mounted between inner and outer hardened steel races. The inner ball race is forced on the journal with a light press fit while the outer race engages the housing bore by merely a "sucking" fit. As the journal turns the balls rotate, making a *point contact* on the inner and outer hardened steel races. The inner race should not turn on the journal while in general it is considered desirable for the outer race to crawl in the housing seat, to distribute the wear, due to the balls, uniformly over the ring.

ROLLER BEARINGS

Roller bearings are similar in construction to ball bearings excepting that instead of balls, a train of hardened steel rollers is used, forming a *line contact* with the hardened steel races.

Both the above types of bearings are packed with a grease or lubricated with oil to reduce friction. When properly lubricated and protected from dust and dirt, both starting and running friction are reduced to a minimum and such bearings will give a long life in service, requiring little attention, providing they are not damaged mechanically.

SLEEVE BEARINGS

A sleeve or plain bearing can be either a split or solid cylinder of a hard metal lined with babbitt, or a split or solid cylinder of babbitt or bronze material not lined. It should have enough

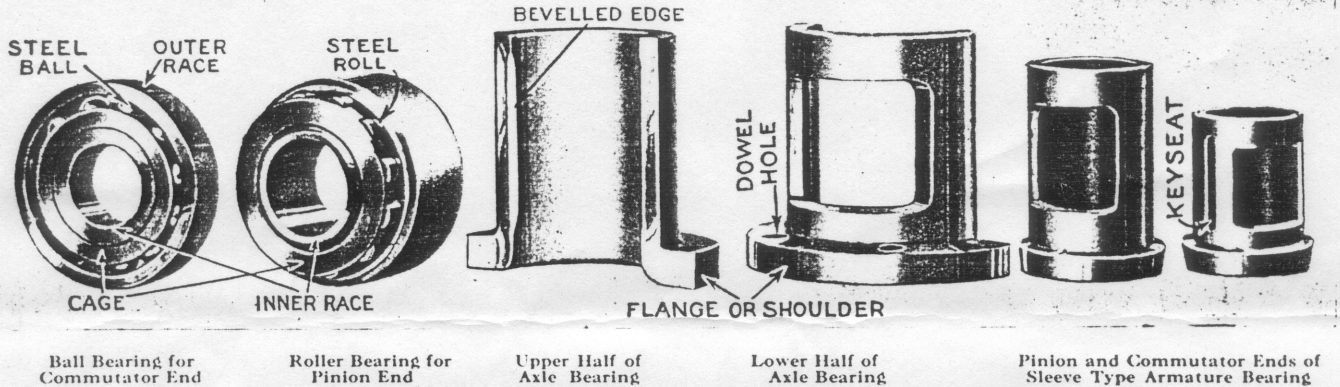
Other factors, such as first cost, cost of repair, and the experience of the operating man enters into this selection.

Babbitt metal used to line railway motor bearings consists either of a tin base or of a lead base alloy; in other words the bearing metal should be an alloy composed of at least 80 to 90 percent tin or lead respectively. Both classes give good service if properly handled during the melting and pouring process.

Finishes—Where large numbers of bearings of the same size are used, sufficient to support the expense of special tools, the surface obtained by broaching will be found most satisfactory. With most operating companies it is the common practice to machine armature bearings after re-babbitting. Some master mechanics consider this unnecessary and babbitt their bearings to exact size. Whichever method is used, it is customary to scrape the babbitt to get a uniform bearing surface.

Axle bearings, when not lined with babbitt, are given a machined finish and this surface is tinned to fill up the small irregularities thus helping the bearing seat itself while new. Some operators do not consider this tinning necessary. When axle bearings are lined with babbitt they should be machined to get best results in service, although it is the practice of some operators to babbitt to exact size and fit by scraping.

Method of Holding—In addition to a press fit of from three to five tons, keys are most commonly used to prevent the armature bearings, from turning in the housing. Most of the older motors without housings have their bearings held from turning by means of a dowel in addition to the clamping action of the frame. Depending largely upon the size and location of the



clearance over the journal to allow a thin film of oil to form between the journal and the bearing to float the journal. With this type of bearing the running friction is reduced to a minimum, if the film of oil is constantly maintained and is free from dirt, although the starting friction is comparatively high. The bearing will last for a number of years if it is not damaged mechanically. As this is the type of bearing most commonly used it will be described in detail.

Construction—To allow bearings to be removed without taking off the pinion, most of the older motors are provided with split armature bearings at both the commutator and pinion ends. Due to improved lubrication, with a resulting increased life of bearings, all modern motors use solid bearings at both ends. This gives much better mechanical design, which does not require frequent renewals. The pinion end bearings are always larger than those on the commutator end.

Axle bearings are always made in two halves, so they can be removed without taking the gear and wheels off the axle. The commutator end and pinion end bearings are of the same size and in the modern box type motors are interchangeable.

Material—The most common types of armature bearings are made of either a bronze, or a malleable iron shell lined with babbitt. The babbitt lining of a bronze shell is less than the single air-gap in thickness, so as to save the armature core from rubbing on the pole pieces, should there be excessive wear, or the babbitt melt out of the shell due to a hot bearing.

Depending primarily upon the size of the axle and the size of the axle bearing seat in the motor frame, axle bearings are made of either bronze tinned or malleable iron lined with a soft alloy.

lubricating openings, axle bearings are held from turning by a dowel or a key, as well as by the clamping fit of the axle cap. Dowels in the flange or shoulder of the bearing shell are being used successfully in the more modern motors. Special forms of lugs cast on the bearings, or the use of plates inserted between the two halves of the bearings, have given satisfactory results in service, but are difficult to manufacture.

Windows—The size and location of openings in the bearings for lubrication depend upon the method of lubrication and upon the distribution of the pressure between the journal and the bearing. It is desirable to locate these openings or windows at the point of least pressure to permit the feeding of oil between the journal and the bearing.

Clearances which are considered good practice for railway motors using grease, or oil waste lubrication, are:—

From 2 in. up to and not including 3 in.	0.006 in. min. 0.008 in. max.
From 3 in. up to and not including 4 in.	0.008 in. min. 0.010 in. max.
From 4 in. up to and not including 5 in.	0.010 in. min. 0.014 in. max.
From 5 in. up to and not including 6 in.	0.014 in. min. 0.016 in. max.
From 6 in. up to and not including 7 in.	0.016 in. min. 0.018 in. max.

Oil Grooves—Oil grooves are machined, cut or moulded in armature bearings so as to help the oil to enter and more evenly distribute itself throughout the bearing. In general they are not required in the case of axle bearings, on account of the slow speed and low pressure. The sharp edges at the split of axle bearings should be beveled to prevent wiping away of the oil film by these edges, but this bevel should not extend to the ends of bearings as it would drain off and waste too much oil. It is good practice to round off or bevel the edges of the windows in both armature and axle bearings to encourage the flow of oil into the bearing surface.