Assembly Optimization for Double Row Ball Bearings

by

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Thesis submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

MECHANICAL ENGINEERING

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Aug, 1998
Blacksburg, VA

Key Words: Ball bearings, Assembly, Torrington, Double Row Bearings

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Abstract

This thesis is a treatise on optimal assembly methods for double row ball bearings. As with common single row bearings, double row ball bearings, consist of four general components, namely, an inner ring, an outer ring, a complement of balls and a cage or retainer to keep the balls separate. Unlike single row bearings, however, double row ball bearings have two complements of balls in two distinct parallel races. Although this double row configuration is desirable in a number of applications, it makes the bearings more difficult and expensive to assemble. In addition, current manual assembly procedures require a great deal of digital manipulation, leading to concern about carpal tunnel syndrome and other long-term repetitive motion injuries.

This thesis attempts to develop an improved assembly process for all types of double row bearings. Although the work is intended to be general, the Torrington 5203 double row ball bearing is adopted as a specific application example. This bearing's assembly difficulties and additional cost are a result of its manual Conrad assembly method and a rubber O-ring and groove used solely for bearing assembly. In the assembly process, the O-ring supports the upper balls temporarily until the two rings can be aligned concentrically, thus snapping the balls into the bearing races. This thesis addresses the replacement of the rubber O-ring and explores opportunities for bearing assembly automation.

Design synthesis of a retractable or reusable assembly component to replace the rubber O-ring supporting the upper balls during assembly is presented. A large group of design concepts are developed and evaluated, resulting in a small group of feasible

designs. These feasible solutions are then tested, and a design that has the potential immediate implementation in an improved manual assembly process is proposed. In addition, two design concepts are presented as candidates for possible implementation in an automated assembly process.

Acknowledgements

I would like to take this opportunity to thank a few of the many people who have made my graduate studies and this thesis possible. To them and many others I am truly grateful.

- Charles Reinholtz, who came to my rescue as an advisor and friend, and took a personal interest in the success of my graduate career.

- Mary Kasarda and Robert Sturges for understanding my dilemma and very enthusiastically serving on my defense committee.

- Chris Mosby, Garrison Webb, Jim Buchanan, and all of the line workers at Torrington of Calhoun, GA for there personal support and abundant information.

- The solders on the battlefield of graduate studies, my fellow graduate students. They continued to inspire, encourage, and keep me focused, and have greatly enriched my life.

- My many friends and "family" in Blacksburg, who's many words of support and encouragement made me feel at home.

- My family, for their continuous love, guidance, prayers, and financial aid throughout my life. Without them none of my dreams would have become reality.

- The almighty God and savior Jesus Christ, from whom all blessing flow. He has set my path and has placed this opportunity and these people and others in it.

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