Ball Nut Ball Bearing Injection System

Anthony Ward, Shannon Duffy, Stephen Dodd
Dr. YJ Lin
Client: Rockford Ball Screw
Mechanical Engineering

NORTHERN ILLINOIS UNIVERSITY
College of Engineering and Engineering Technology

Abstract

The Ball Nut Ball Bearing Injection System was proposed to the NIU senior design program by Rockford Ball Screw (RBS). The problem they sought to solve was the inefficient loading process of their ball screw products. Team 30 has designed a workstation tool that helps assemblers administer ball bearings into ball nuts in a controlled, reliable, and rapid manner.

Introduction

RBS currently has assemblers load ball bearings into ball screws by hand at the finishing stages of production. A ball screw is a mechanical actuator that translates rotational motion to linear motion using ball bearings that travel in a helical circuit through the device, this allows them to move large loads with precision and little friction. A ball screw will require a specific size and amount of ball bearings to function properly.

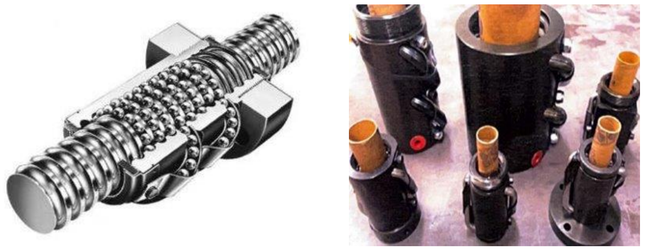

Figure 1: External circuit ball screws

Methods and Materials

After a phase of research, ideation, and conceptualization a design was settle on and modeled in Solidworks® and validated with hand calculations and software analysis. The system is made of mostly 3D printed parts and machined steel and plastic tubing. The main subsystems are a hopper, handheld dispensing unit, and control system.

Results

Team 30 has produced a functional prototype that meets the demands of the client. The system uses an actuated escapement pin and sensor for output control and interchangable components for use with a range of ball screws.

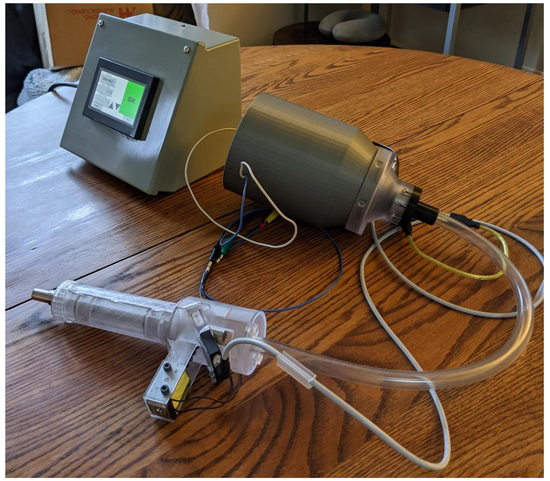

Figure 2: Ball Nut Ball Bearing Injection System

Discussion

Testing has shown that ball bearings can be dispensed with the system accurately. Some points of improvement are recommended for further iterations of the device before end product application. For example, some dimensions and geometries could be refined for a more robust build that is more appropriate for daily industrial use. Also, due to time constraints the team excluded the physical production of some components.

Conclusions

To enhance production in the assembly steps of Rockford Ball Screw's ball screw products Team 30 has designed and prototyped a novel system to meet the demands described by the client. The optimal design is a gravity fed ball bearing dispensing system that consists of hopper, nozzle, and control system subunits.

Acknowledgements

The authors would like to thank Rockford Ball Screw for sponsoring and providing the opportunity to work on this project, they have been very supportive and helpful throughout the project. Also, appreciation goes out to our faculty advisor and teacher's assistant Dr. YJ Lin and S. Chapagain.