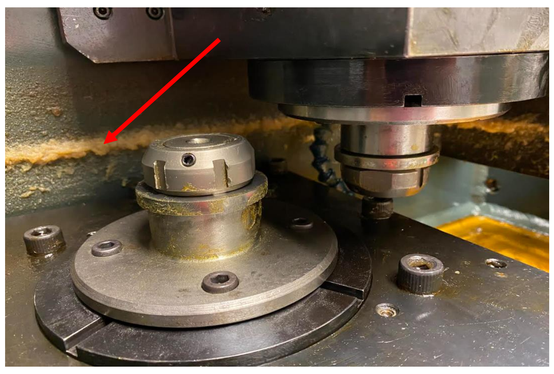
Wright State University
Mechanical & Materials Engineering
Department

Development of a Grease Lubrication Mechanism for a Two-Disk Contact Set-Up



Initial machine set-up, red arrow highlights grease build-up from original test attempts.

The two disk contact tribometer we are working on.

Objective: Design and manufacture a device which enables the two-disk contact tribometer at Wright State University to test the performance of grease lubricants.

Project Description:

- In automotive and aerospace fields, the two-disk contact set-up has been widely used for the evaluation of friction and power loss, contact fatigue failures and thermal failures of rolling mechanical elements. The contact test rig in the lab at Wright State is only equipped with jet lubrication, i.e. the lubricant is pumped and delivered to the contact through the bronze pipe. Since grease cannot flow easily, it won't be able to be applied through jet lubrication. A different mechanism that can be easily incorporated onto the machine has to be designed accordingly.

Requirements:

- Maintains grease on contact surfaces of disk, while machine is running at speeds up to 5,000 – 10,000 rpm
- Able to run tests with various sizes of disks ranging from 50mm to 100mm in diameter.
- Successful completion within given timeframe and budget

Additional Improvements:

- Minimizes wasted grease
- Easy to clean/keeps machine cleaner
- Allows user to easily monitor/add grease to system while test is running, if necessary.

Initial Designs & Decision Matrix

Our group initially considered three different designs for our project; Fully Enclosed, Partially Enclosed, and Grease Pump/Nozzle. After comparing the designs we elected to go with a combination of two of them partially enclosed design with a grease pump. Some the main parameters we used to compare our designs is shown below in the first table.

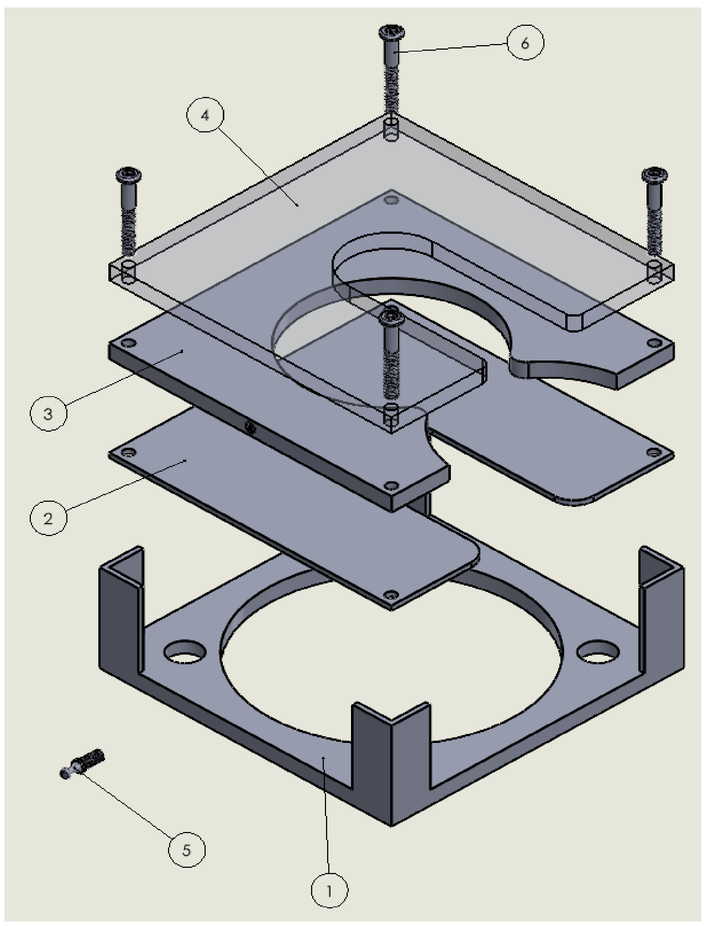
Our group also considered three different materials to construct our mechanism; Aluminum, Steel, and plastic (3D-printed). We ultimately decided to construct our mechanism out of Steel. Some the main parameters we used to compare the different material options is shown below in the second table.

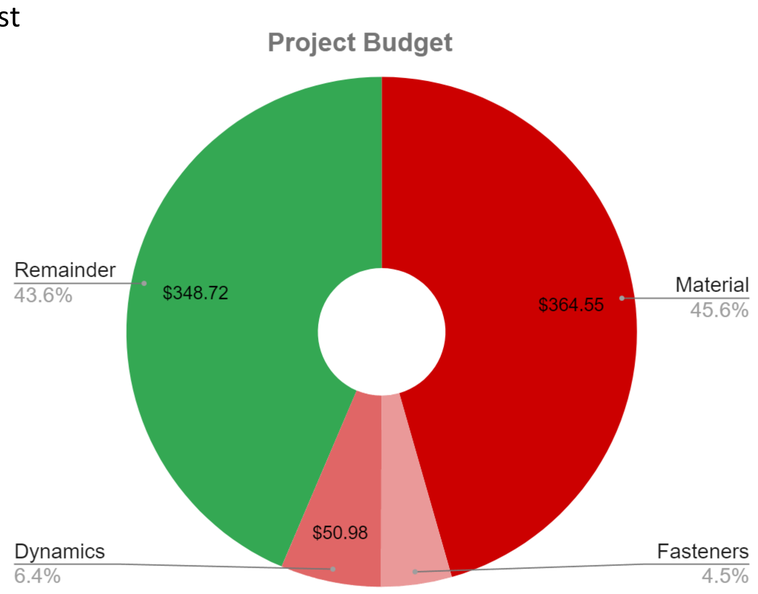
Design	Ease of Manufacture	Efficiency (Grease Loss)	Cost	Ease of Use	Total
Fully Enclosed	10	1	3	1	15
Partially Enclosed	4	3	2	2	11
Grease Pump/Nozzle	2	5	1	3	11

Material	Ease of Manufacture	Ability to clean	Weight	Durability	Cost	Total
Aluminum	6	1	3	2	6	18
Steel	6	1	4	1	4	16
Plastic (3D-printed)	2	5	1	6	2	16

Final Design/Completed Mechanism

Our completed mechanism mounted to the machine, this picture was taken before running our first test.





Part #	Part Name	Description	Quantity
1	Assembly Base	Interface between the tribometer and the assembly, contains inserts.	1
2	Bottom Insert	Steel plate with cutout for disk spindles to travel along.	1
3	Middle Insert	Steel plate with Internal cavity sized to house certain ranges of disk sizes. Interchangeable based on desired disk size.	1*
4	Top Insert	Clear acrylic top to allow for easy viewing into the grease cavity. Similar dimensions to Bottom insert.	1
5	Grease Fitting	Connection point for grease gun nozzle.	1
6	Bolts	M5x32 Socket Cap, threads into assembly base to contain the inserts.	4

Construction:

Welding/fabrication of main assembly
(Indian Creek Fabricators Inc.)

Machining of the (5) middle plates, each plate required two operations
(Material Resources LLC)

Cutting slot/ drilling holes in top plate
(Wright State Lab)

Testing Results/Future Improvements:

- Experiences minimal grease loss, even when machine is running at full speed.
- Modify grease gun to have 90 degree fitting to make it easier to pump grease while machine is running.
- Research incorporating an automated grease dispenser into our mechanism to eliminate manual grease pumping.

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Indian Creek Fabricators Inc.
MRL, Material Resources LLC

Businesses Used

Alro Steel
Lowes
McMaster-Carr
Quest Lasercut