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CB5

Set of all postlab questions (For reference)

Section 1: Design tips presentation

Are there any themes that a lot of good designs have in common?

Assembly and tolerance. Assembly refers to the process of putting individual components together to form a complete product.Tolerance, on the other hand, is the permissible variation in a part's dimensions. Setting the right tolerance directly impacts manufacturing costs and how well parts fit together.

Section 2.1: Cam

Step 4.

Do you notice anything different about how the two followers move and react to the cams?

The follower with the housing move vertically, but the follower without the housin g move very randomly and not stable.

Step 5.

Do you notice any key differences?

The first design includes a housing part on the left, which allows the follower to move within a specific axis The second design does not have this housing, so the movement is more unrestricted.

How do you think such design choices may affect the operation?

The housing part acts as a constraint, guiding the follower to move in a controlled, single direction. Without this constraint, the follower in the second design will move very unstable, which can lead to unpredictable behavior.

Section 2.2: Crank Rocker

How does each crank feel?

Crank A feels unstable and experiences difficulty in maintaining stability. It struggles to rotate a full 360 degrees. In contrast, Crank B moves smoothly without issues.

What are the primary differences between 2.2a and 2.2b?

1. B add two spacers and use barrel fastener.
2. A's nuts and bots are too thin according to the whole, but B is exactly the size.

How do these differences impact the performance of the crank?

The spacers and fastners in B made it possible to rotate freely without being blocked by the nuts and the bots.

A suffers from poor tolerance, with bolts that are too thin, leading to instability and vibration during operation.

Section 2.3: Gear Train

How does each gear train feel?

Gear train B rotates smoothly, while gear train A feels stuck and is difficult to move.

What are the primary differences between 2.3a and 2.3b?

There are two main differences:
1. Shaft Material: Gear train A uses wooden dowels as shafts, while gear train B uses steel dowels.
2. Gear Teeth: Gear train A has a larger number of gear teeth, while gear train B has a smaller number.

How do these differences impact the performance of the gear train?

The wooden shafts in gear train A create much higher friction against the other components compared to the smooth steel shafts in gear train B. This increased friction makes gear train A difficult to turn.

Additionally, the greater number of gear teeth on the gears in gear train A can also contribute to more friction and potential binding, while the fewer teeth on the gears in gear train B allow for a smoother meshing action. Together, these factors explain why gear train A is stuck and gear train B rotates easily.

Section 2.4: Crank-Slider

How does each gear slider feel?

Gearslider B requires less effort to move than Gearslider A. This is because it uses materials and a design optimized for lower friction and greater stability.

What are the primary differences between 2.4a and 2.4b?

The primary differences are the material of the slider and the thickness of the slot. Gearslider B uses a special low-friction material for the slider and a much thicker slot compared to Gearslider A.

How do these differences impact the performance of the slider?

The differences significantly improve the performance of Gearslider B. The low-friction material reduces the resistance to motion, making the slider easier to move. While for A, The thicker slot provides a more stable guide, preventing the slider from wobbling or binding as it moves.

Delrin, the white plastic, is known for being a low friction material. What might this be useful for?

Its low-friction properties make Delrin useful for applications where smooth, effortless motion is required and friction needs to be minimized. Examples include gears, bearings, and sliders . In these components, Delrin helps to reduce wear and tear and improve overall mechanical efficiency.

Section 2.5: Boxes and Joinery

Step 1:

How many degrees of freedom are there in this system?

Zero, because it can't move.

Step 2:

How many sets of holes can accommodate this link?

Five. All the holes are suitable.

Does it wobble around or sit securely?

It sits securely.

How many degrees of freedom does this system have?

One. The changing degree of freedom is the distance between the two holes.

In what scenarios might this type of fitting be useful?

This fitting offers a larger error tolerance and can adjust to different sized parts.

Step 3:

List an advantage and disadvantage for each method.

1. Locknut 0.4mm Undersized

    (1) Advantage: When the hole is undersized, the locknut creates a very tight friction fit. This is great for applications where the part needs to be held securely.

    (2) Disadvantage: An undersized hole can be difficult to install, potentially damaging the plastic or the locknut if not done correctly. Additionally, it can easily wobble to the side if there are no constraints on either side.

2. Heatset Insert 3D-Printed 0.2mm Oversized

    (1) Advantage: The oversized hole allows the insert to slide in easily before being heated and melted into the plastic. This creates a durable thread in 3D-printed parts and is an excellent way to get a solid metal thread into plastic.

    (2) Disadvantage: It requires an extra heat source for installation. If not done properly, the heat can deform the plastic around the insert, which weakens the part.

3. Heatset Insert, Laser Normal

(1) Advantage: A nominal hole is the exact size recommended by the manufacturer. This allows for a perfect fit, providing the best possible strength and thread quality with minimal risk of damaging the plastic.

(2) Disadvantage: This method requires the most precise manufacturing of the hole, which can be challenging to achieve. If the laser isn't calibrated correctly, the hole may have a less-than-perfect fit. This method also costs more.