The Universal Screwdriver

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Abstract

The goal of the Universal Screwdriver is to minimize the toolbox size of the average home improvement job. A quick fix can only be possible when the right tool is in hand, and with the Universal Screwdriver that will no longer be an issue. The Universal Screwdriver will be able to adjust to various sizes and screw types, nuts and bolts in order to cut down on the time and the number of tools required to finish the job.

Analyses, Testing and Results

Through hands on testing with a torque wrench, it was determined that the pins must have a yield stress of at least 682MPa. The material chosen, Industrial CLC 1.2312 Prehardened Mold Steel (300HB/32HRC) with improved machinability, has a transverse yield stress of 820MPa, and will therefore be able to withstand the stresses that the tool will encounter. FEA was applied to each component of the design to analyze stresses. It can be seen from each respective plot (Figure 1) that the yield stress of each material is greater than that of the maximum stress applied. This implies that the selected material will perform adequately under loads via computer simulation.

Considerations

- Cylindrical pins to allow ease of manufacturing and adaptability to different geometries.
- Square grid pin orientation for optimal load distribution.
- Individual springs behind each pin to decouple the pins and for use at all angles.
- Handle designed for comfort, grip, and durability.
- Head diameter large enough to fit a diverse set of screw sizes.

Design Objectives

The Universal Screwdriver must be able to:
- Fit and turn standard size Hex Bolts and Nuts.
- Fit and turn an array of different types of screw heads and sizes (Phillips & Flat Head).
- Withstand the force required to turn the average screw and bolt.
- Perform at different angles.
- Withstand everyday use.

Table 1: List of Performance Requirements and Values

<table>
<thead>
<tr>
<th>Performance Requirement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max torque stress applicable</td>
<td>6.25 Nm</td>
</tr>
<tr>
<td>Max size of compatible hex bolts/nuts</td>
<td>0.375&quot;</td>
</tr>
<tr>
<td>Max size of compatible Phillips screw drive types</td>
<td>0.4&quot;</td>
</tr>
<tr>
<td>Size range of compatible flat head screw drive types</td>
<td>0.4&quot;</td>
</tr>
<tr>
<td>Adjustment time between screw drive types</td>
<td>0 Seconds</td>
</tr>
<tr>
<td>Durability/Lifespan</td>
<td>15 Years</td>
</tr>
<tr>
<td>Weight</td>
<td>0.5 kg</td>
</tr>
<tr>
<td>Cost</td>
<td>$25-35</td>
</tr>
</tbody>
</table>

Conclusions

The Universal screwdriver is capable of switching between various sizes of screw types, nuts and bolts. This saves the user a significant amount of time and energy over other multi-tool screwdrivers in which individual parts can be small and difficult to locate. Further development will lead to a prototype resembling the CAD model, eventually resulting in a marketable product.

Acknowledgments

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References

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