Playstation 3 CD Release Mechanism: Deformation Of CD Release Button Due To Bending

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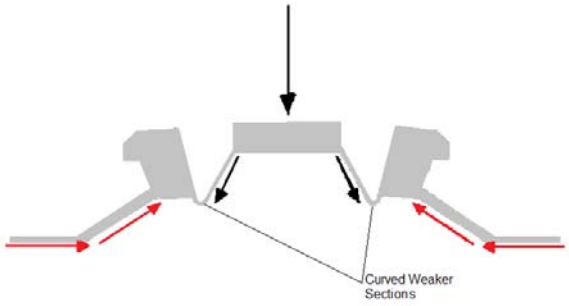
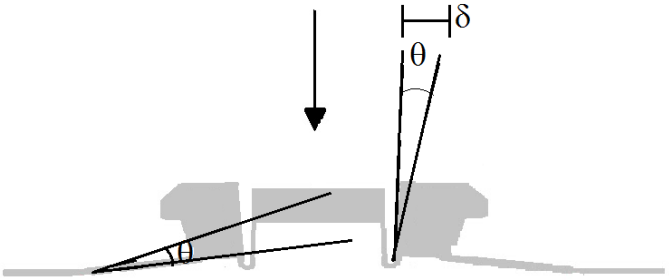
Background Information: A vertical force applied to a structure, and due to these forces, the structure deforms under bending. Upon rest the structure remains rigid, when the load is applied along with reactions they induce horizontal deflections due to bending of the weakest part of the structure.
Example: CD Button Release


Here you can see the button at rest, with no load applied, the material used has highly elastic properties and is therefore perfect for this type of mechanism, as when the force is released the elasticity causes the structure to go back to its previous shape holding the CD again.



(Shape not representative of “true” shape, just to illustrate forces)
Before Deformation: Red show Diagonal Resistive Force (vertical and horizontal components), Black Imposed Forces



During Deformation, Imposed forces and moments are too great for the plastic material to take, so the shape collapses, allowing the CD to be released so that it may be used. During these process’s work is done.

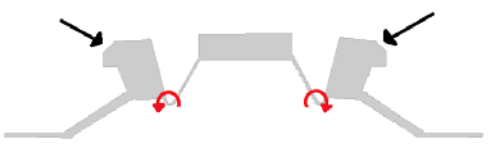
WKD = Force * (H θ)
For the work-done horizontally

Imposed forces force the structure to bend in two places, hence creating angular and horizontal/vertical deflections in the two parts of the structure. Now there is major horizontal resistive force and low vertical resistive force to the imposed load present in the structure. So as you press the button, it becomes progressively easier for the members to deflect.

The imposed load applied by a finger is the same as the reactive forces in the plastic base, but because of the shape of the structure, and the organisation of weaker, thinner parts of the plastic (less second moment of area) the structure only deflects in certain parts. Those parts therefore have weaker bending resistance and the components they are connected to deflect due to the horizontal reactive forces.

This is important for the button to work; if this was not true the structure could collapse at any part as opposed to only certain parts.
So as the bending resistance of the structure is less in the curved plastic connecting the button and CD holder, this is one of the parts that deflects, and as it is already partially bent, will be the obvious place to see the most angular deflection, as well as the horizontal deflection of the CD holder. This releases the hold on the CD and that is how it is released.

The elastic properties of the plastic allow the CD holder to spring back into place when the load is retracted and the CD can be held when it is stored. When the CD needs to be placed back into the holder the only resistive forces are that created by the bending resistance in the curved part of the structure which is very little. Black represents the force created by forcing the CD back onto the button and Red represents the bending resistance of the material.



References:
www.structuralconcepts.org
http://en.wikipedia.org/wiki/Bending
http://en.wikipedia.org/wiki/Second_moment_of_area