Weight Lifting Bar with Integrated Safety Locks

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Abstract

The flaw in current weight bar systems lies in the removable safety clamps, which are inconvenient and often neglected. This results in unsafe recreational weight training. Our design of a weight lifting bar with an integrated locking system provides a more convenient alternative with the same level of safety.

Benchmarking

Our benchmark is the Quicklee weight collar. It is a removable collar for bars with detachable weights. Its main features include:

• Defaults to its locked position
• When locked, allows users to slide the collar onto the bar, but not off the bar

Figure 1. Current Bar (bottom) and our proof of concept bar (top).

Final Design

• Three circumferential rows of steel balls
• Knob on the end of the bar rotates inner cylinder which locks and unlocks the balls
• When locked, balls apply radial pressure to the inner wall of the plate
• When unlocked, balls retract into the bar, allowing weights to be removed

Design Development

We first started our design by analyzing the main flaws of current products. We then sketched various concepts until we decided on our current design. From there, we created a CAD model (Figure 5), conducted finite element analysis (Figure 4), and built a proof of concept model (Figure 3).

Figure 2. Benchmark design: Quicklee Clamp.

Figure 3. Our locking mechanism made of PVC.

Engineering Challenges

• Weights being placed on the bar without disengaging the safety mechanism
• Developing a safety mechanism which allows for any combination of weight plates
• Creating an easy and reliable locking mechanism to provide feedback response to user

Figure 4. FEA of distributed load to ensure deformation does not affect the mechanism.

Figure 5. CAD drawings of external shell with sample weight (left), and of locking mechanism in its unlocked position (right).

Conclusion

After a rigorous and iterative design process, we’ve developed a bar that provides the same amount of safety and security as a removable safety clamp without the inconvenience, while reducing the cost to consumers.

Acknowledgments

Steve Laguette

References

• http://quicklee.com/