The Adjustable Key (CAD group project)

Goal: Improve upon a previous invention

Main Contributions: Idea creation, key modeling

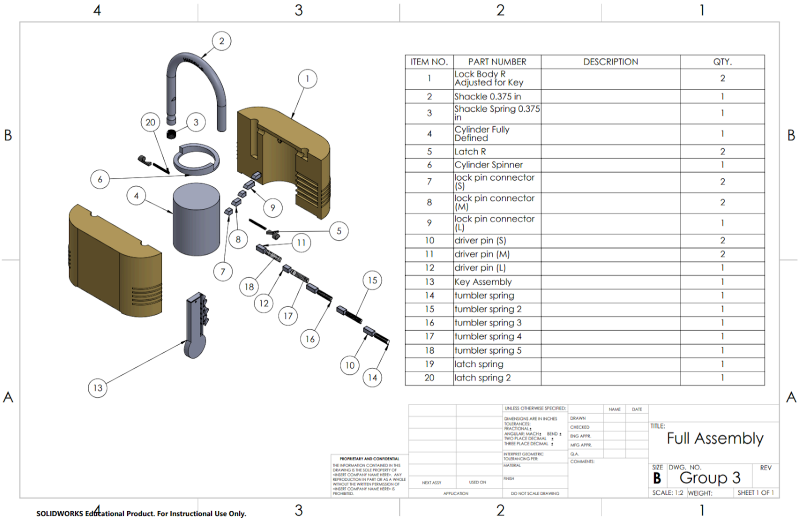
Purpose of Design Improvement: College students and apartment dwellers often lose their keys, and replacing both the key and lock can cost hundreds of dollars. By creating an adjustable key, a student can quickly replace a lost key by simply ordering the adjustable version and setting the pin heights themselves. This solution is fast, easy, and inexpensive. While making a duplicate key might seem like an alternative, finding a place to duplicate keys is often inconvenient, and many people only consider a spare key after the original is lost. This improvement addresses the common inconvenience faced by college students and the typical oversight of not preparing a spare key in advance.

Description: The project centers on a key featuring multiple pins with adjustable heights. These heights are set by inserting a rod through precisely aligned holes in each pin. The pin heads are designed with grooves that allow the lock pins to glide smoothly along the key's surface. Additionally, the key cap is engineered to securely support the cylinder rod while making the adjustment of pin heights as straightforward as possible. To demonstrate the design's functionality, a corresponding lock was also modeled to complement the key. An engineering drawing and an exploded-view animation was also created to further detail the project’s components and overall design.

Future Improvements & Lessons Learned: This project presented significant challenges in producing a physical model due to the limitations of our machinery. Even with 3D printing, small components often lacked accuracy, and we did not have access to essential materials like springs and pin heads for the lock. The primary issue is the key’s size; the unique mechanism for adjustable pin heights prevents reducing its dimensions without compromising usability. A smaller key would hinder the user’s ability to adjust the pins effectively, undermining the design's purpose.

Limited tools made it difficult to fully execute our initial plan. However, by rethinking our target market and shifting away from an ultra-low-cost approach, the product could be repositioned as a mid-priced, quality offering. This shift would allow us to explore more precise mechanisms for adjusting pin heights—such as an incremental click mechanism similar to an ice skating boot strap—which, while increasing costs, would likely enhance consumer appeal.

In essence, future efforts should focus on aligning the target market and price point to enable the development of a truly high-quality product.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Lock Body R Adjusted for Key		2
2	Shackle 0.375 in		1
3	Shackle Spring 0.375 in		1
4	Cylinder Fully Defined		1
5	Latch R		2
6	Cylinder Spinner		1
7	lock pin connector (S)		2
8	lock pin connector (M)		2
9	lock pin connector (L)		1
10	driver pin (S)		2
11	driver pin (M)		2
12	driver pin (L)		1
13	Key Assembly		1
14	tumbler spring		1
15	tumbler spring 2		1
16	tumbler spring 3		1
17	tumbler spring 4		1
18	tumbler spring 5		1
19	latch spring		1
20	latch spring 2		1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
NEXT ASSY | USED ON
APPLICATION | DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

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TITLE: Full Assembly
SIZE B | DWG. NO. Group 3 | REV
SCALE: 1:2 | WEIGHT: | SHEET 1 OF 1

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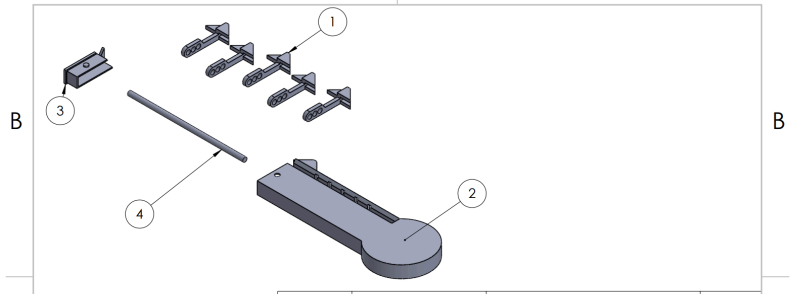

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	pin adapters assembly		1
2	Key		1
3	Key Cap		1
4	Cylinder Rod		1

UNLESS OTHERWISE SPECIFIED:
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TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
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NEXT ASSY | USED ON
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COMMENTS:		

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TITLE: Key Assembly
SIZE A | DWG. NO. Group 3 | REV
SCALE: 1:1 | WEIGHT: | SHEET 1 OF 1

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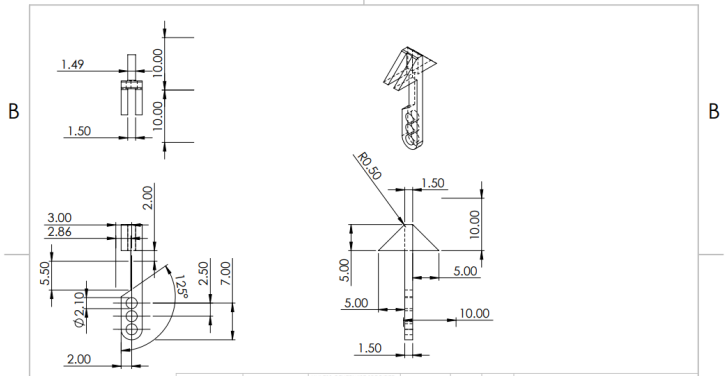

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
NEXT ASSY | USED ON
APPLICATION | DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
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COMMENTS:		

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TITLE: Pin Adapter
SIZE A | DWG. NO. Group 3 | REV
SCALE: 2:1 | WEIGHT: | SHEET 1 OF 1

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