

ME 203

"AN ADVENTURE IN PRODUCT REALIZATION"

LECTURE 1

9-25-2018

- PRODUCT REALIZATION: WEAVING THINKING + DOING
- ROSTER POSTED 9am ON WEDNESDAY
- MEET WITH DAVE 8am - 11am WEDNESDAY MORNING *
- SIGN UP FOR PRL SAFETY CLASS *
- BRING \$100 FOR LAB FEE

LECTURE 2:

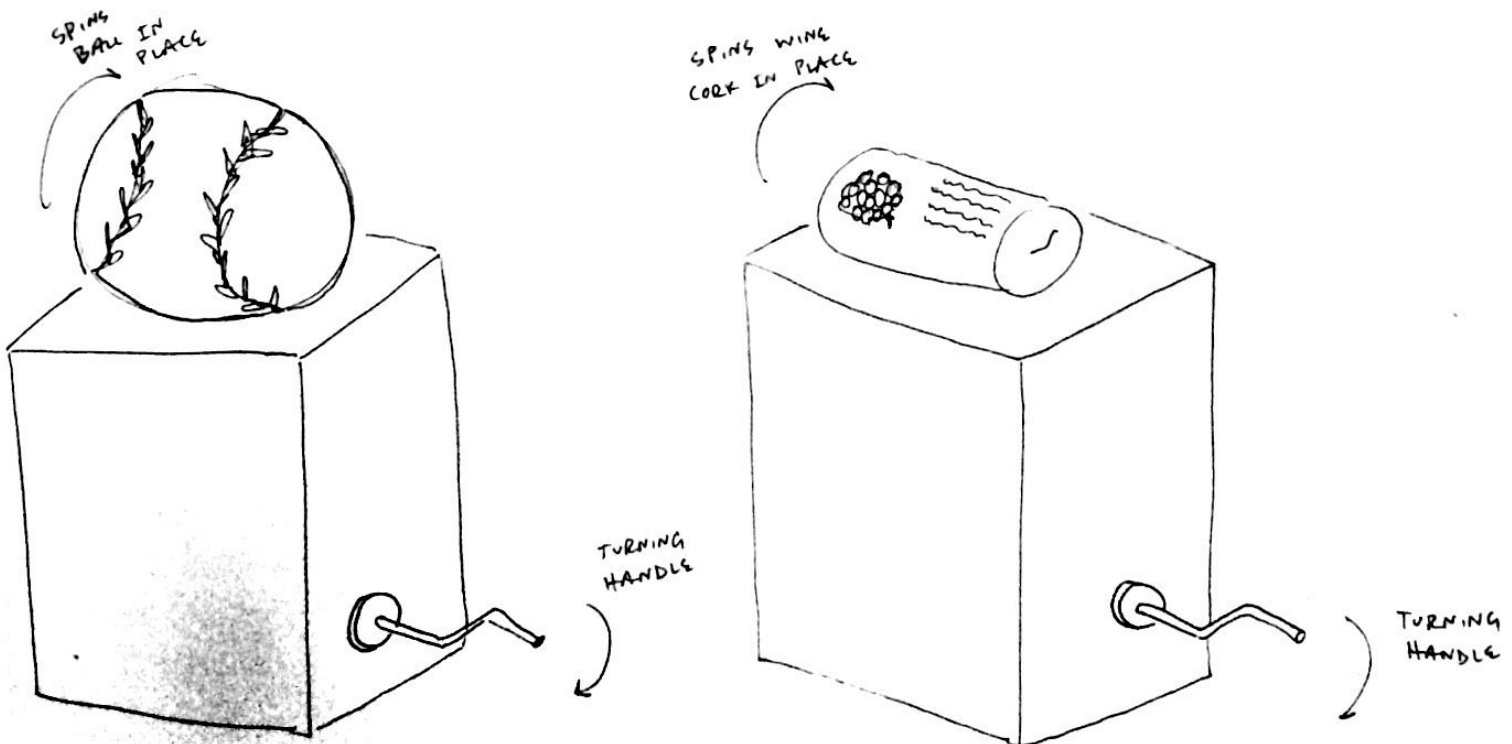
9-27-2018

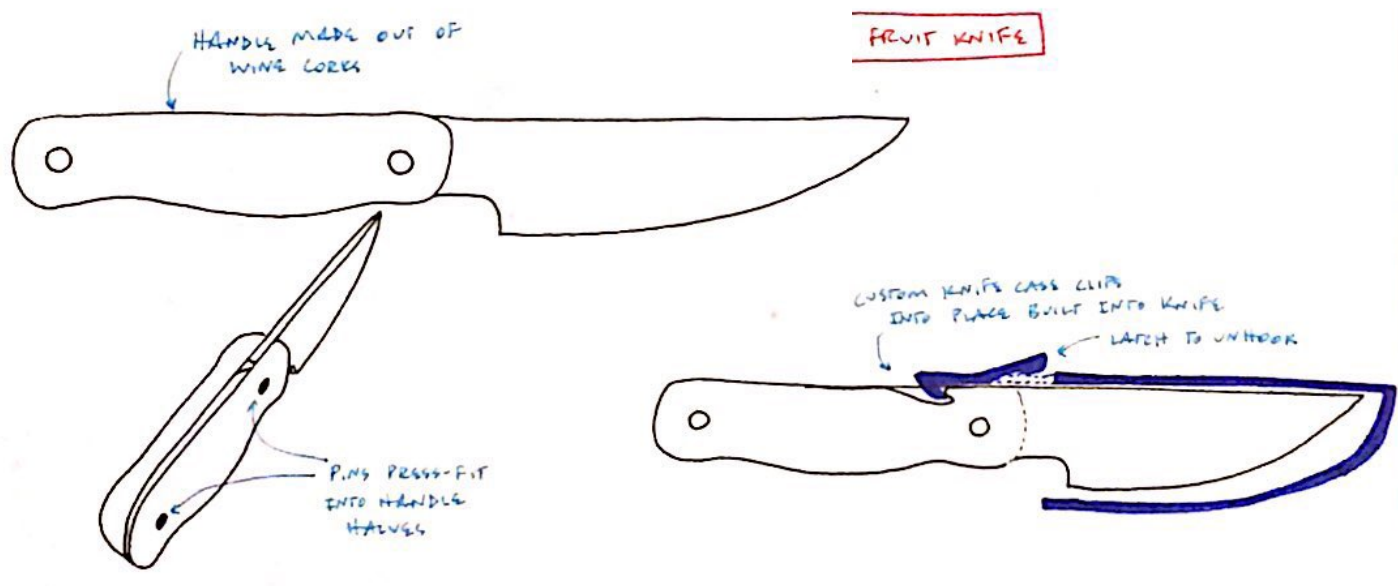
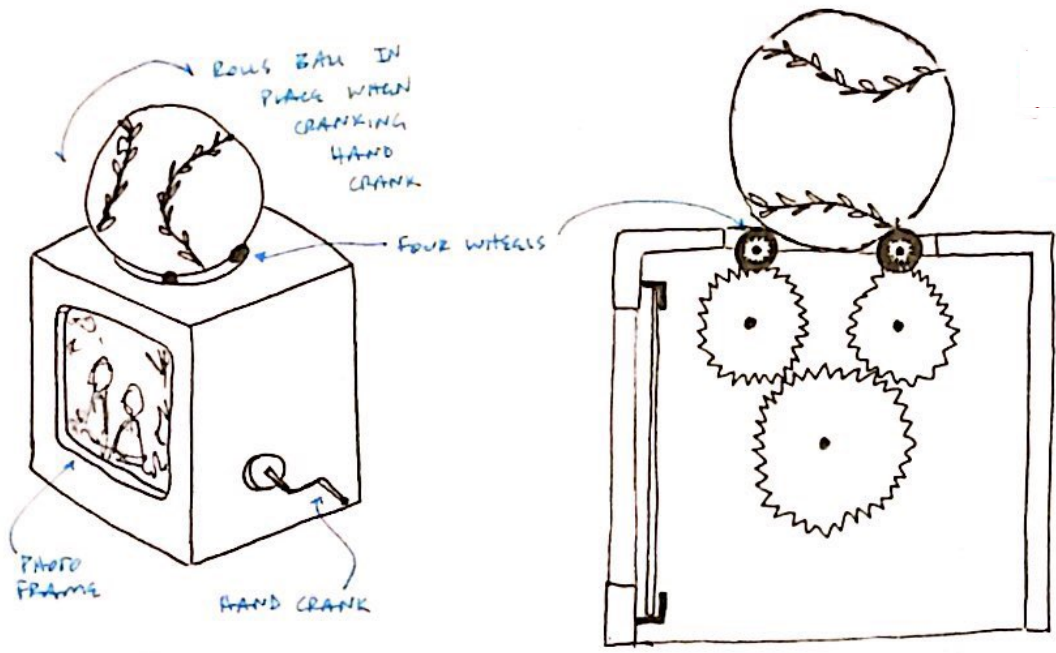
- PREVIEW COURSE INFORMATION + LAB HANDOUTS
- EVALUATING THE PRODUCT:
 - STRENGTH OF DESIGN — AESTHETICS, ERGONOMICS
 - PRODUCT FUNCTION — ACHIEVING DESIGN INTENT
 - PRODUCT BUILD QUALITY — FIT, FINISH, FEEL
- PRL PROCESS BASICS:
 - MACHINING (SUBTRACTIVE) —> SHARP + STIFF
 - FORMING (PLASTIC DEFORMATION) —> GUESS + ADJUST
 - CASTING (PHASE CHANGE) —> PATTERN
 - WELDING (CONNECTING) —> PRACTICE + WARPING

PROJECT: A BRANSTORM

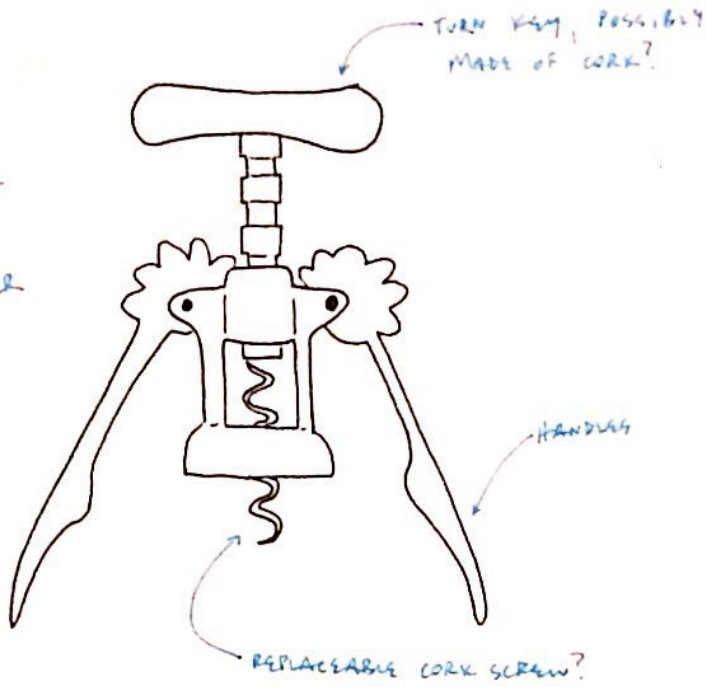
9-27-2018

- A PAIR OF FUN OBJECTS:

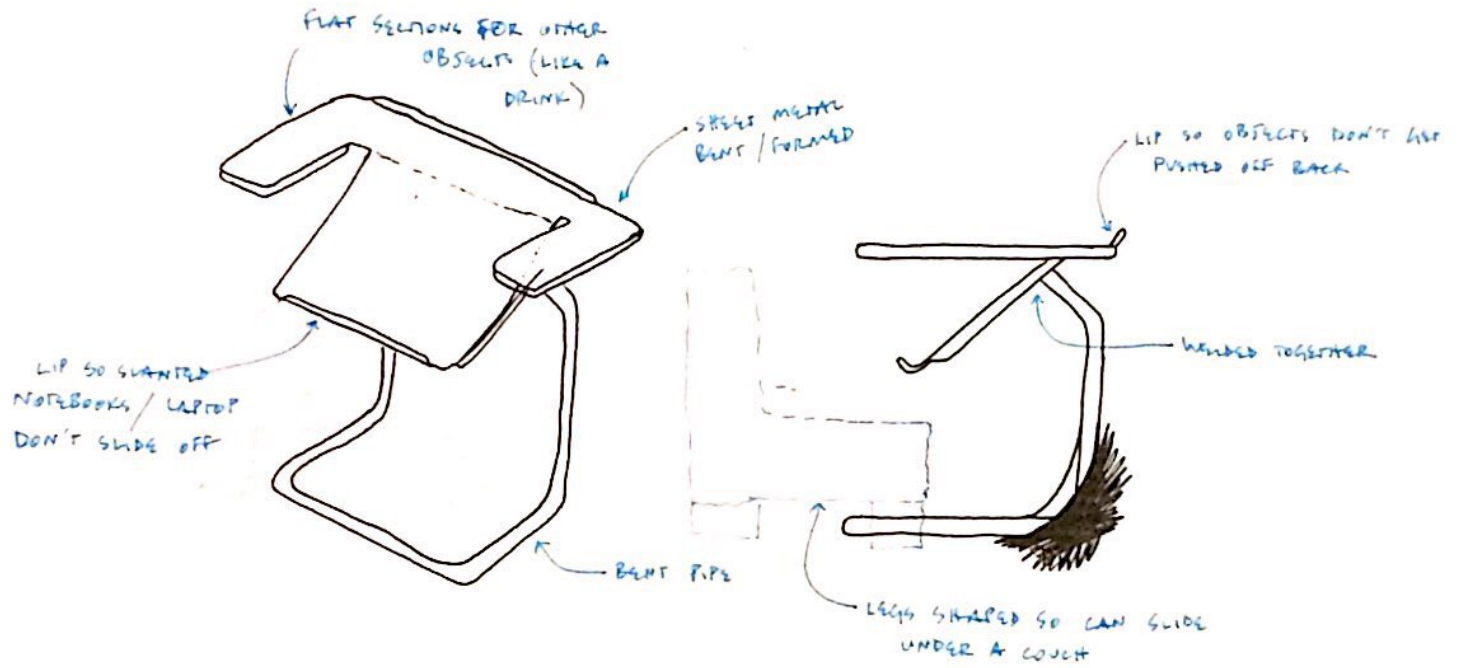




CLASSIC
WINE
BOTTLE
OPENER

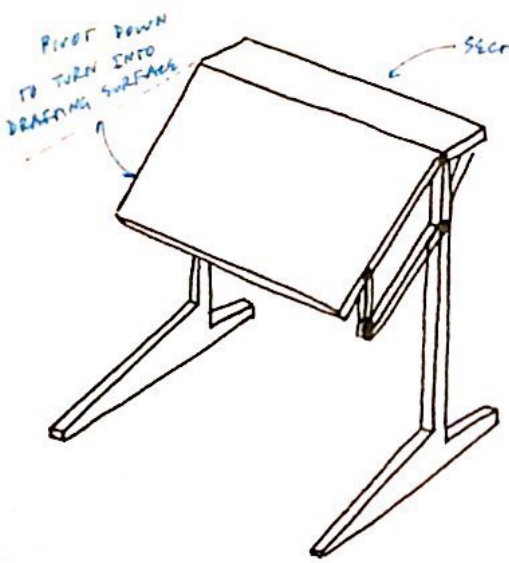
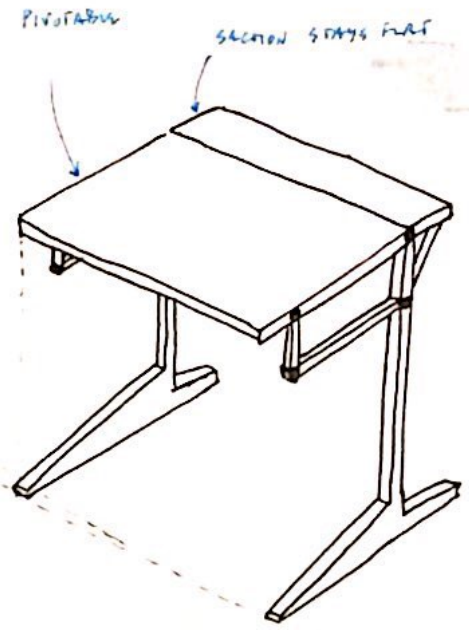
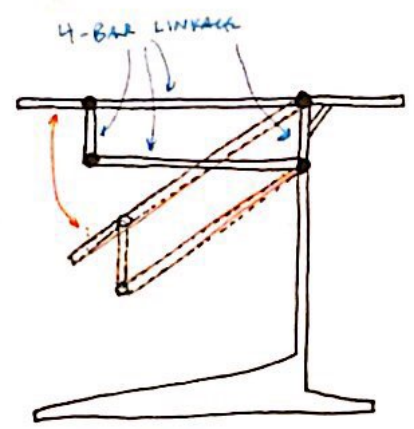
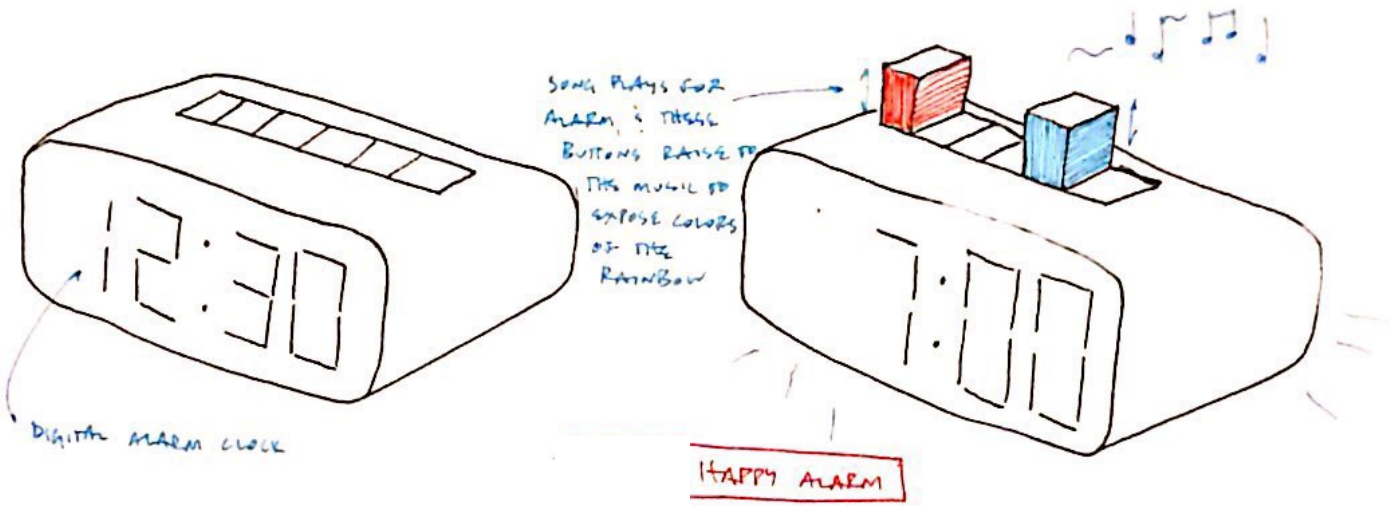


WINE BOTTLE OPENER



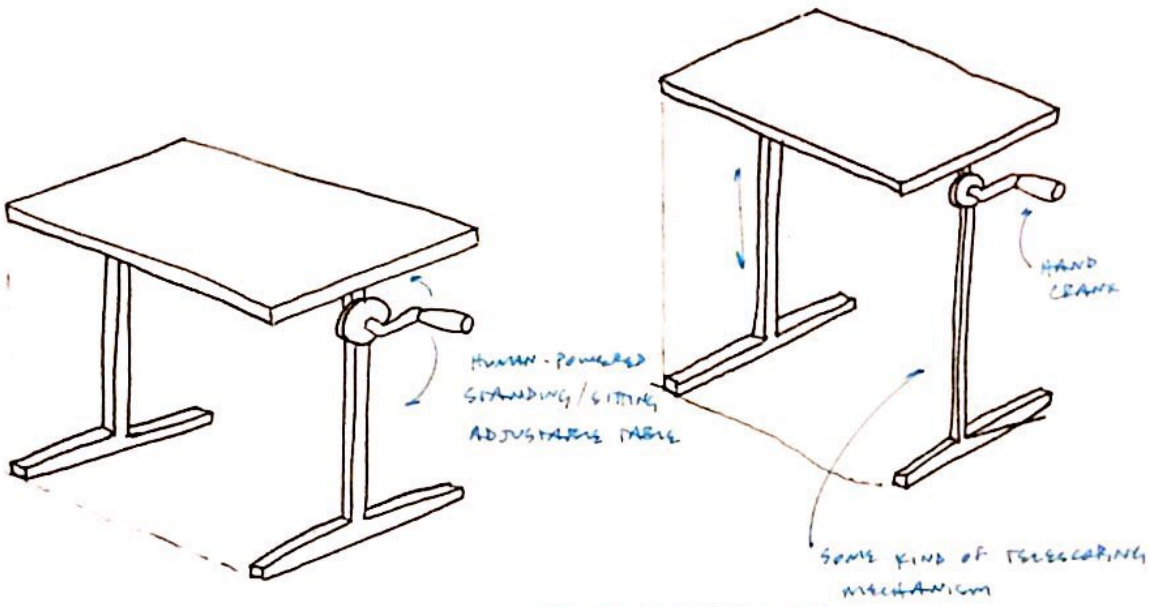
DRAFTING
COUCH / ~~ARCHITECT~~ DESK



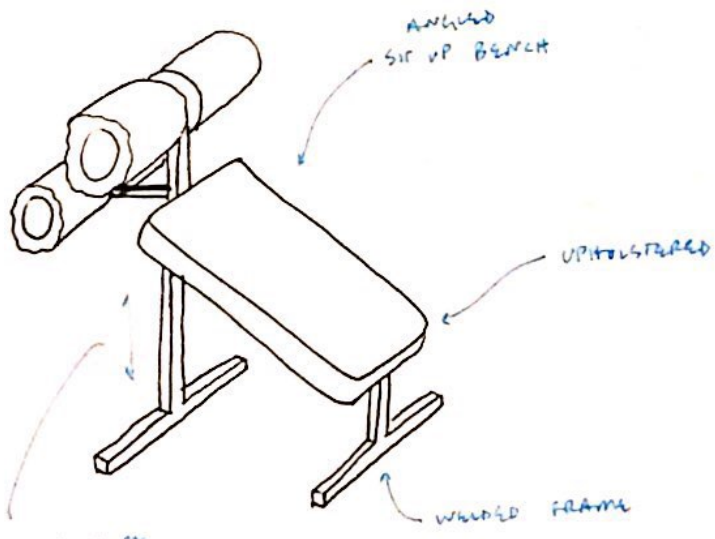


VERSATILE DRAFTING TABLE

-> THIS LOWERS THE FRONT TABLE EDGE, SO MAYBE IT'S NEED TO VERTICALLY ADJUST AS WELL ...

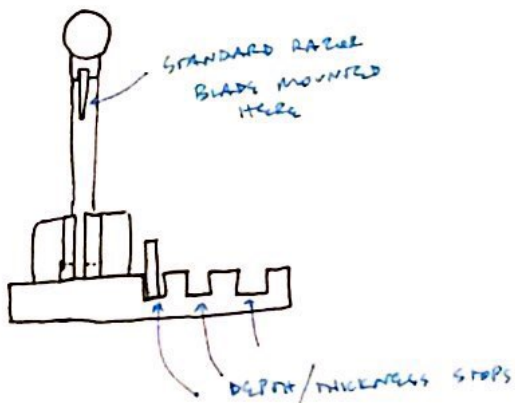
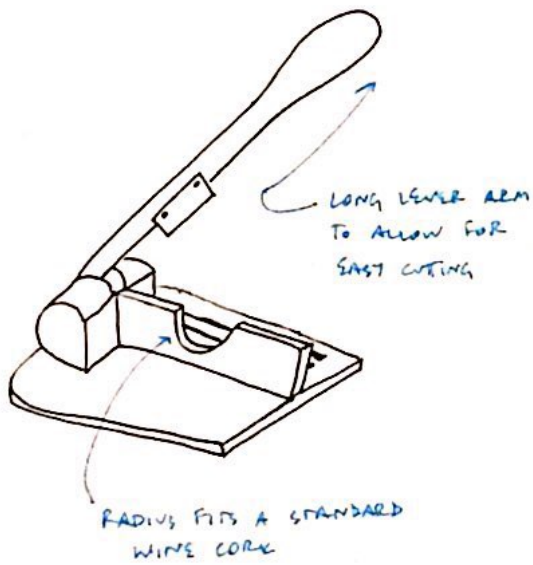
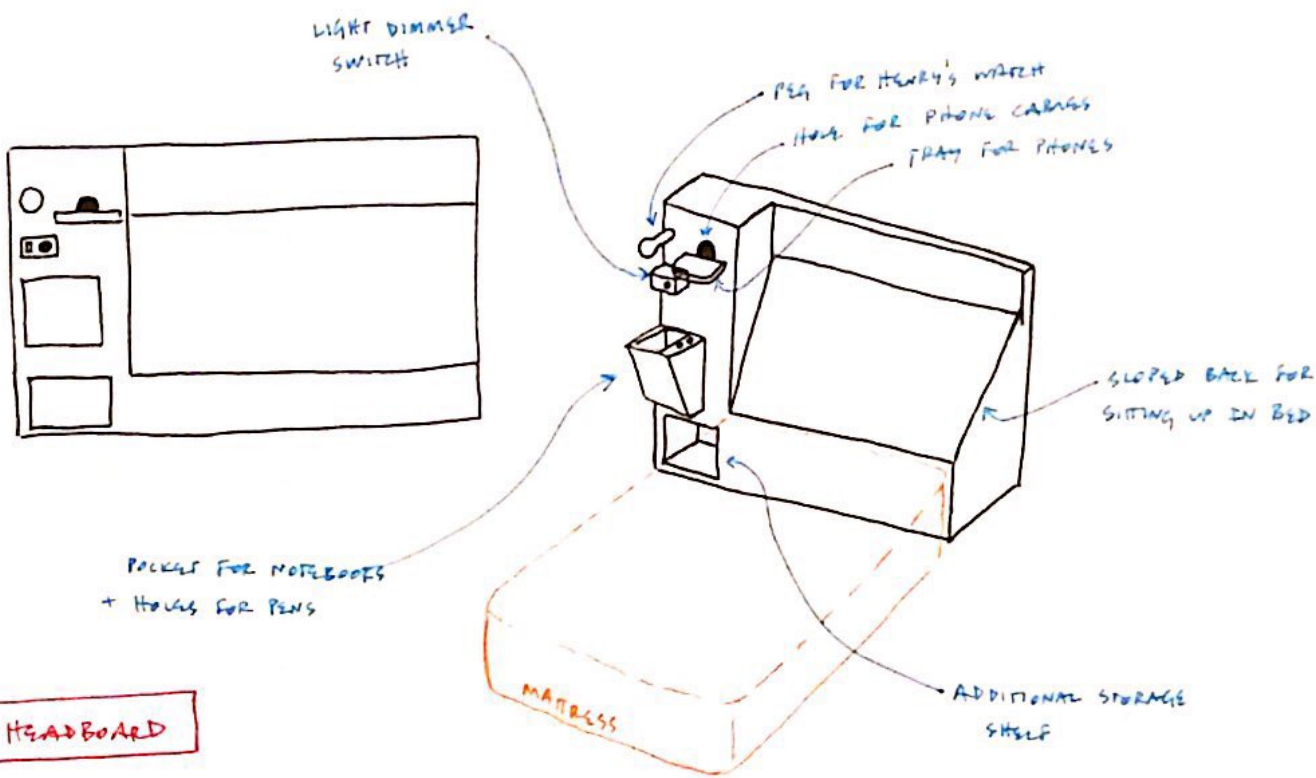


SITTING/STANDING DESK

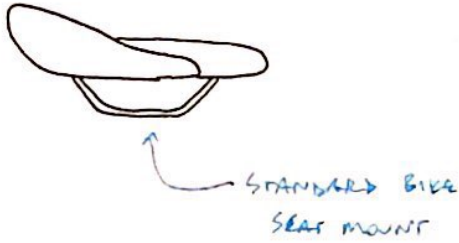
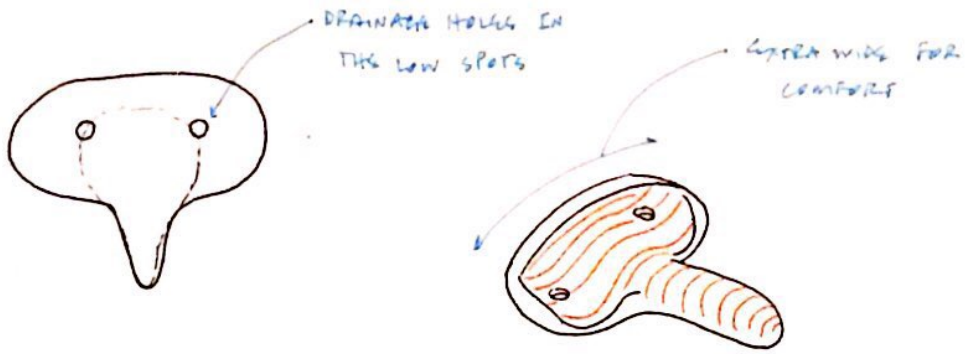


SITUP BENCH

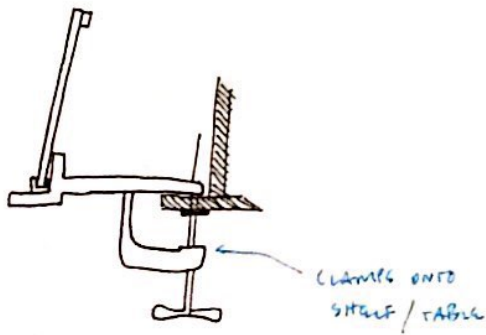
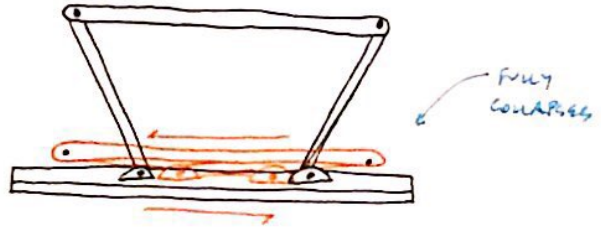
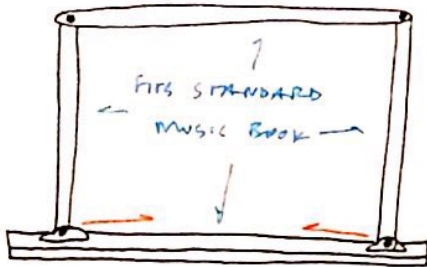
MAYBE SOME
ADJUSTABILITY



CORK GUILLOTINE



BIKE SEAT



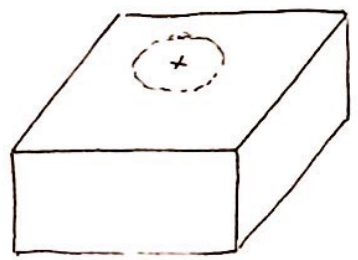
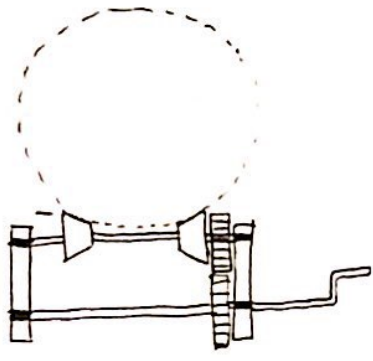
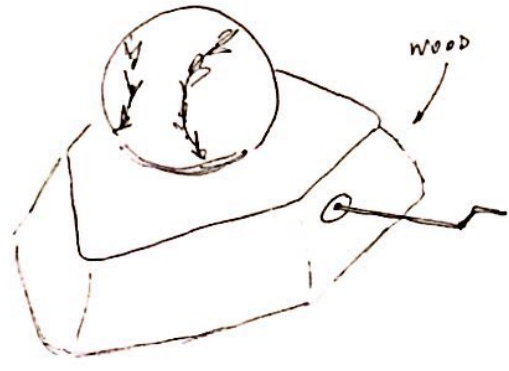
PORTABLE MUSIC STAND

MIGHT NEED SOME KIND OF VERTICAL ADJUSTMENT TOO...

- Eliot's SHOP SCHEDULE

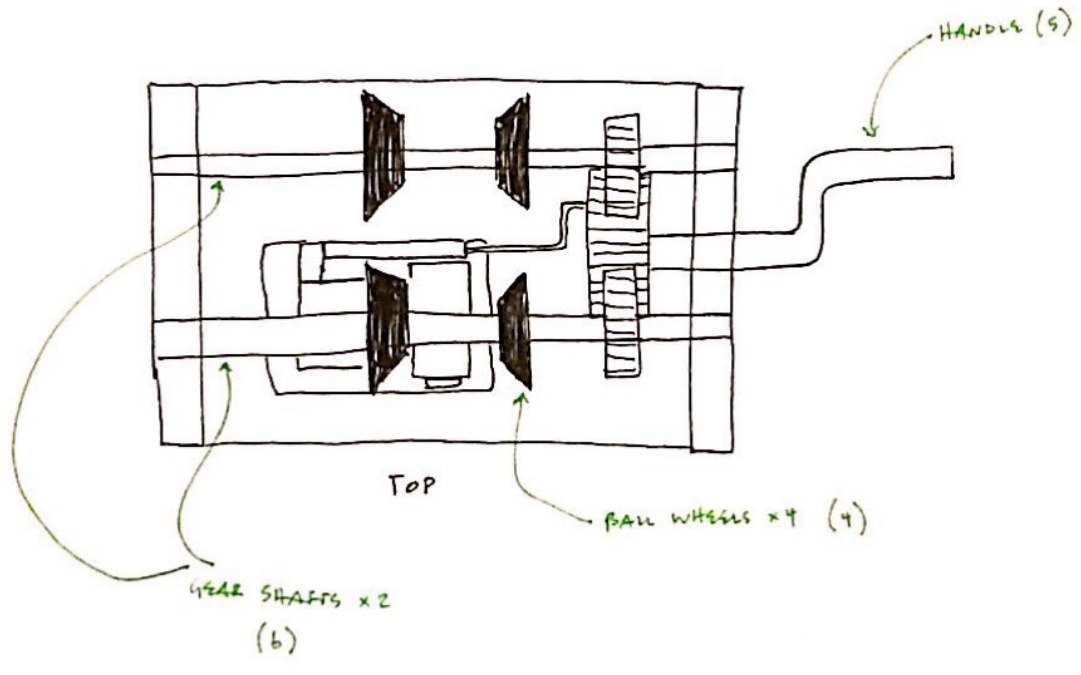
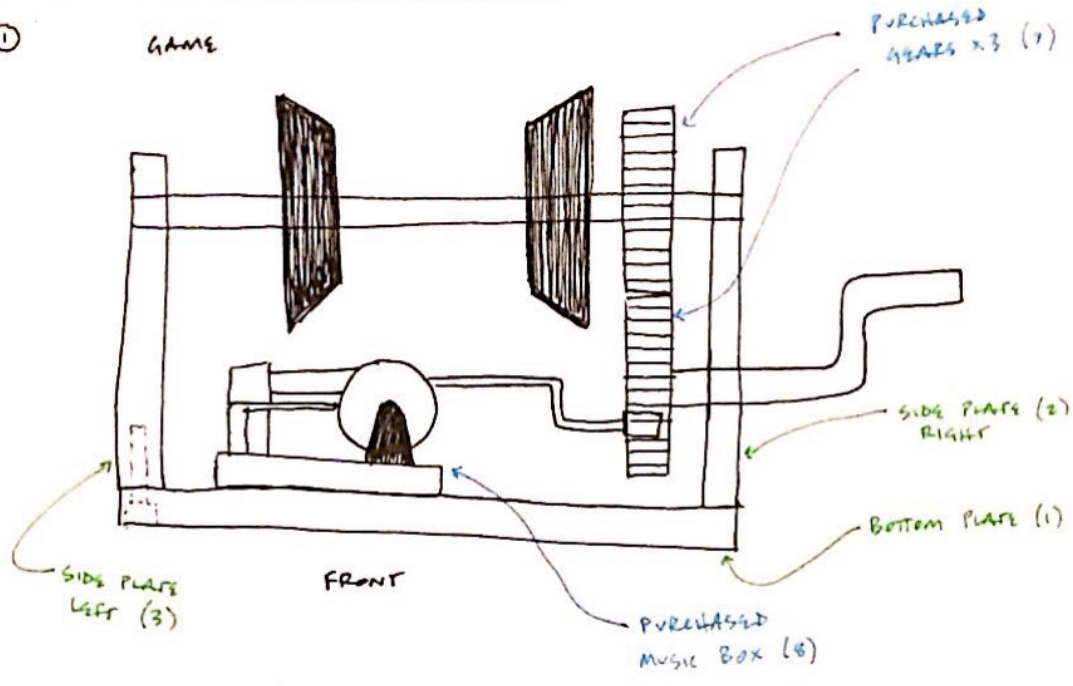
10-4-2018

- T 7-11 PM
- W 1:30-5:30 PM EN Room 36
7-11 PM
- TH 7-11 PM



①

GAME



1	BOTTOM PLATE	MILLED	x 1
2	RIGHT PLATE	MILLED	x 1
3	LEFT PLATE	MILLED	x 1
4	BALL WHEELS	TURNED	x 4
5	HANDLE	TURNED + FORMED	x 1
6	GEAR SHAFTS	TURNED	x 2
7	GEARS	PURCHASED	x 3
8	MUSIC BOX	PURCHASED	x 1
			14

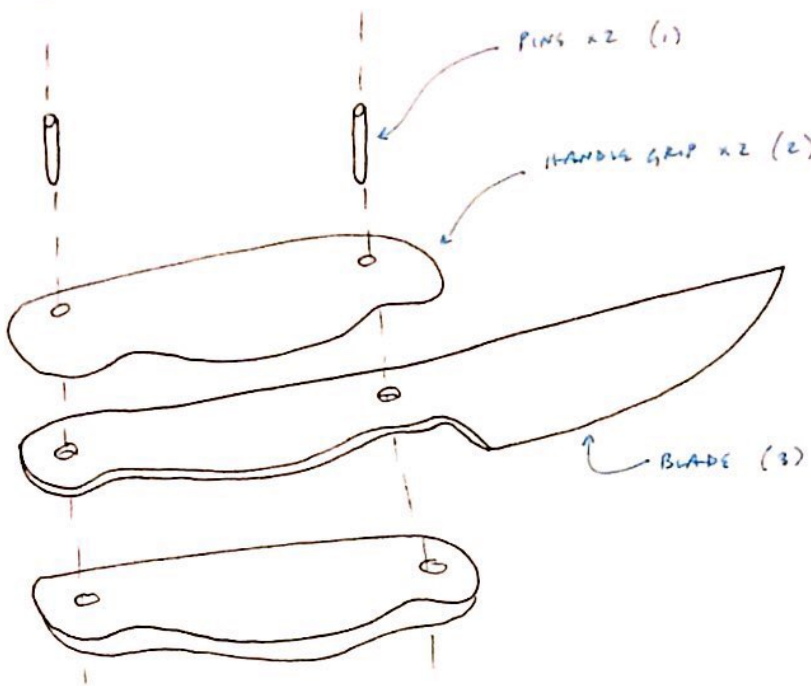
- ADD-ON FEATURES:
- A CASE/COVER (FORMED/WELDED?)
 - A HANDLE FOR THE CRANK (WOOD TURNED?)

- OTHER CONSIDERATIONS:
- FASTENER FOR MUSIC BOX
 - FIXTURING GEARS/WHEELS (E-CLIPS? PRESS-FITS? KEYWAYS?)

DASH?
SDPSI.COM

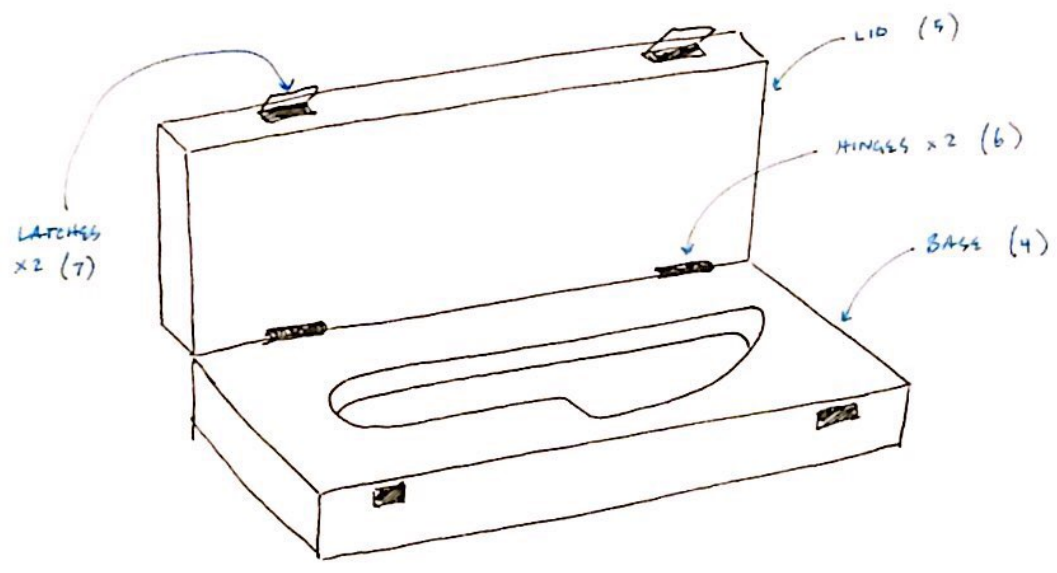
2

KNIFE



1	PINS	TURNED	x2
2	HANDLE GRIP	WOODWORK	x2
3	BLADE	PURCHASED?	x1
4	BASE	WOOD WORK/ MILGD	x1
5	LID	WOOD WORK	x1
6	HINGGES	PURCHASED	x2
7	LATCHES	PURCHASED	x2

11



ADD-ON FEATURES:

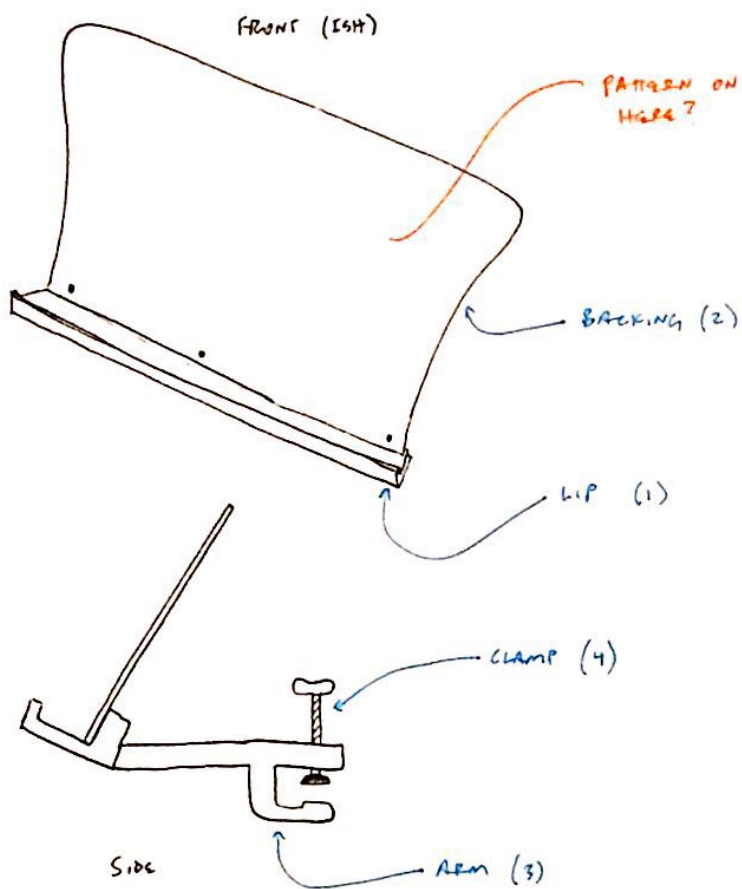
- MAGNETIC CASE ~~CASE~~ CLOSING
- WINDOW FOR VIEWING THE KNIFE INSIDE

OTHER CONSIDERATIONS:

- BUY BLADES INSTEAD OF MAKING?
- BASE MIGHT NEED TO BE MORE THAN 1 PART

3

STAND



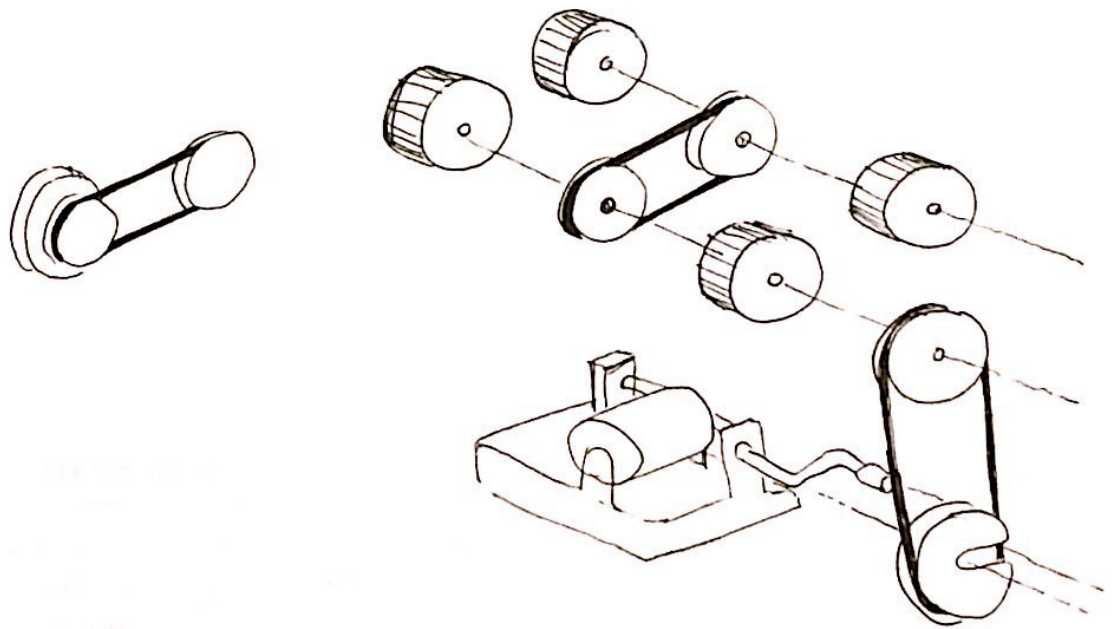
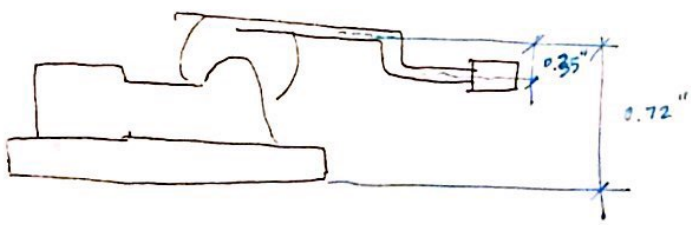
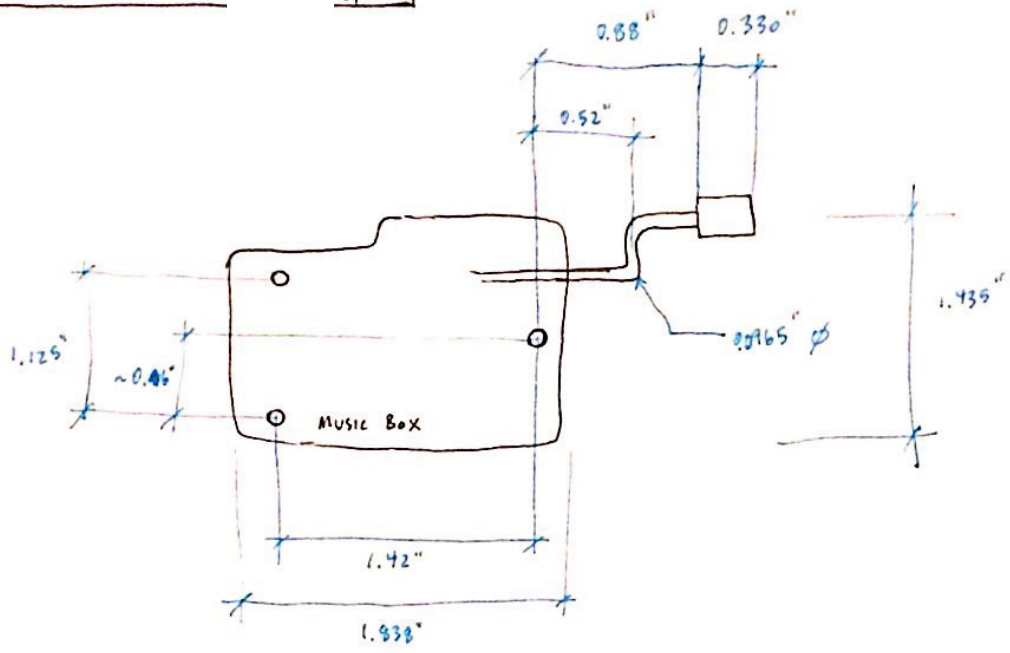
1	LIP	MILLED	x 1
2	BACKING	FORMED	x 1
3	ARM	MILLED/ CAST?	x 1
4	CLAMP	PURCHASED	x 1
			4

ADD-ON FEATURES:

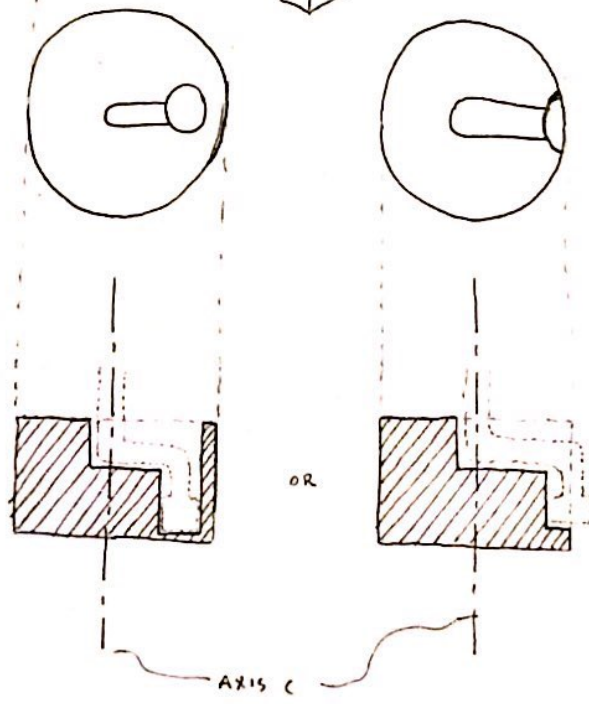
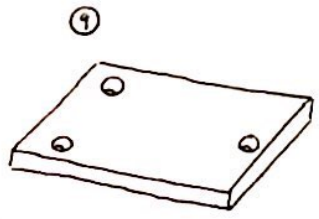
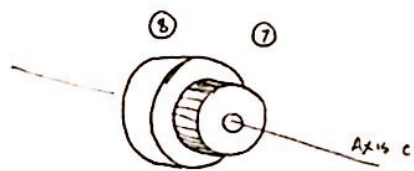
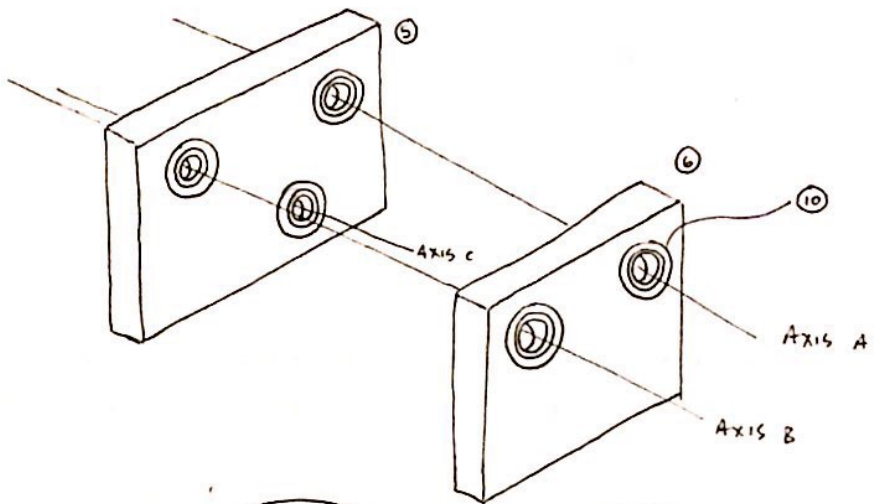
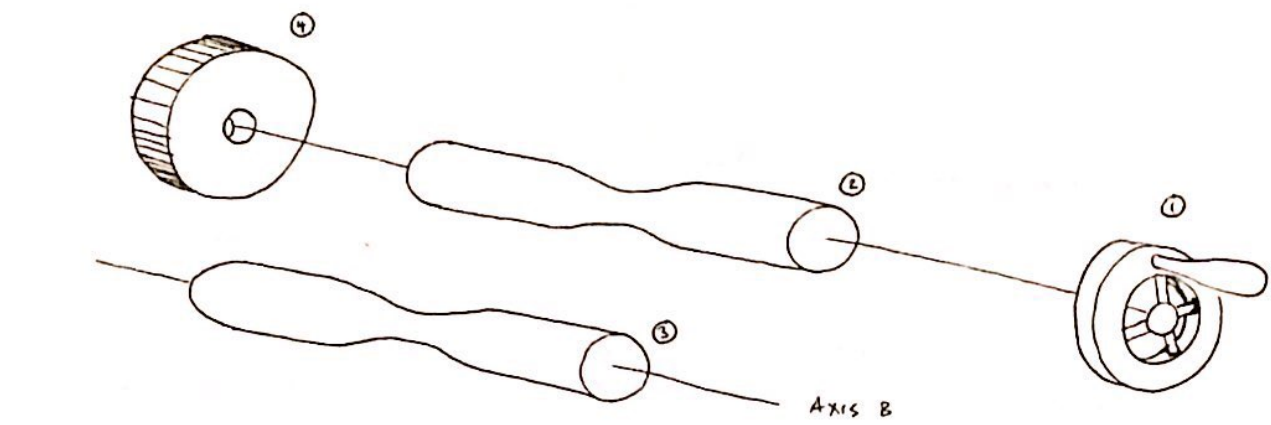
- A SMALL VERTICAL ADJUSTMENT? (WOULD ADD MORE ~~FEATURES~~ PARTS...)
- ANGLE ADJUSTMENT?

OTHER CONSIDERATIONS:

- WOULD BE NICE TO HAVE THE BACKING NOT BE SO PLAIN...
 ⇒ SOME KIND OF PATTERN/TEXTURE?
- ATTACHING THE LIP + ARM
 ⇒ WELDED?
- ATTACHING THE BACKING TO THE LIP



CUSTOM PULLEY TO FIT OVER MUSIC BOX CRANK

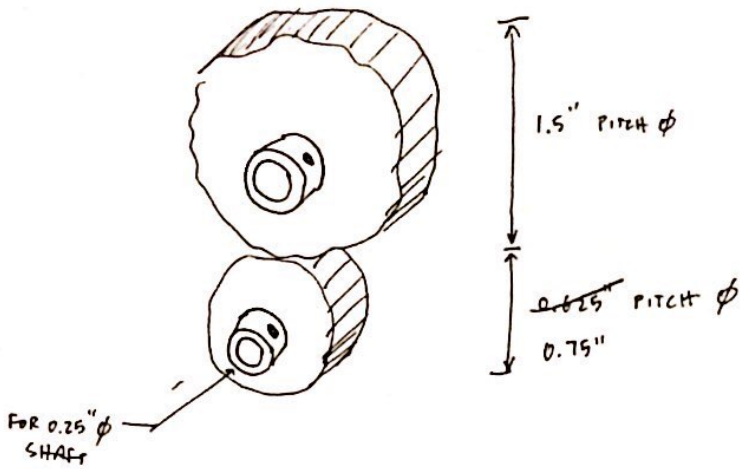


- ① HANDLE
- ② REAR ROLLER
- ③ FRONT ROLLER
- ④ ROLLER GEAR
- ⑤ LEFT PLATE
- ⑥ RIGHT PLATE
- ⑦ MUSIC GEAR
- ⑧ MUSIC COUPLER
- ⑨ MUSIC PLATE
- ⑩ BEARINGS

PURCHASED COMPONENTS: GEARS, HANDLE, BEARINGS

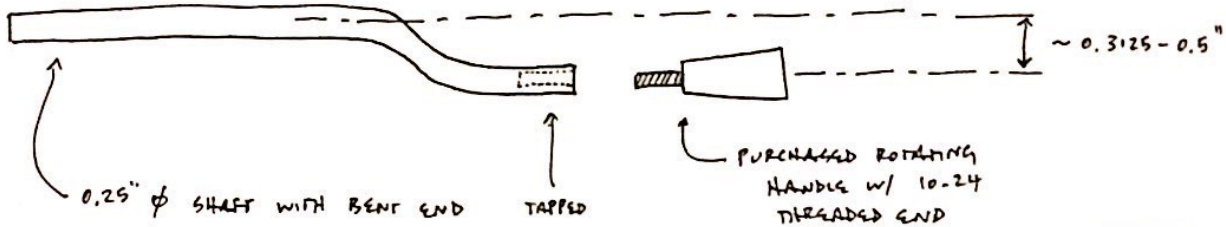
GEARS

- MODULE OR DIAMETRAL PITCH SHOULD BE THE SAME



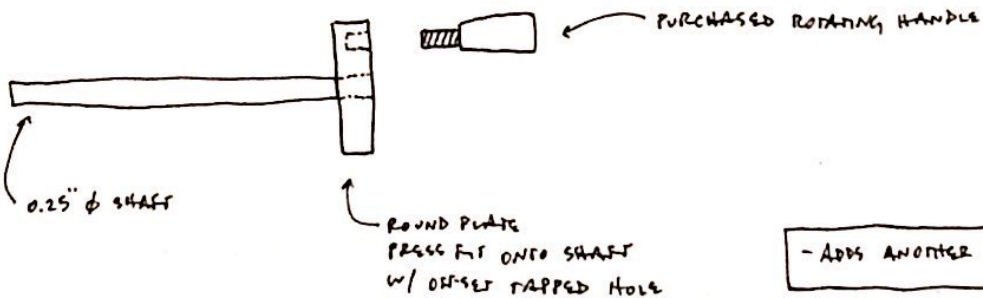
HANDLE

- NOT MANY SMALL OPTIONS \rightarrow TYPICALLY $\sim 2.5"$ ϕ
- MY PROTOTYPE HAD HANDLE AS $\sim 0.625"$ ϕ (COULD BE A BIT LARGER...)
- INSTEAD I CAN DO THIS:



- MIGHT BE TRICKY TO PERFORM THIS BEND W/ TAPPED END

- OR THIS:



- ADDS ANOTHER CUSTOM PART

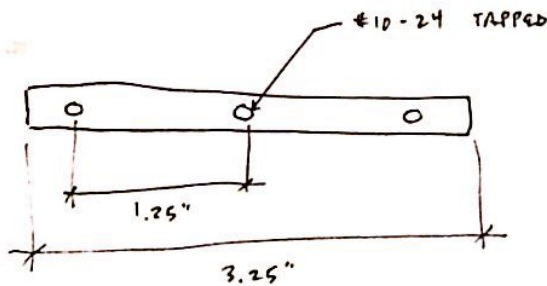
BEARINGS

- L&L's TRAY BUSHINGS

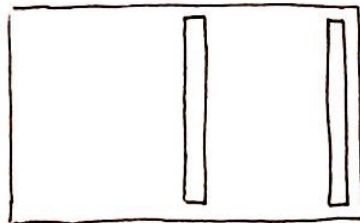
CAD

- KEY DIMENSIONS:

- BASEBALL = $\sim 2.9" \phi$
- BASEBALL WHEELS = $\sim 1.25" \phi$ $\rightarrow 1" ?$
- AXLE DISTANCE = $\sim 2"$ (COULD BE MORE)
- ALL SHAFTS = $0.25" \phi$
- BALL GEAR = $1.5" \text{ PITCH } \phi$
- MUSIC GEAR = ~~$0.625" \text{ PITCH } \phi$~~ $0.75" \text{ PITCH } \phi$
- MUSIC BOX BOTTOM TO AXIS OF ROTATION = $\sim 0.72"$
- BUSHING OD = $0.377"$
- BUSHING FLANGE OD = $0.5"$



LOCK FIT = $0.1960" \phi$ IN BOTTOM PLATE

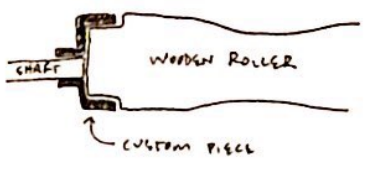


WHEELS: GUEST LECTURE FROM PLENTY, MATERIALS

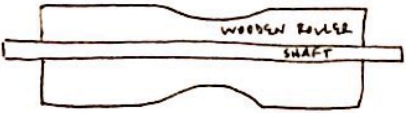
- JOHN

CONSIDERATIONS FOR CAD:

- SHAFT THROUGH WOODEN ROLLER?
- OR PRESS FIT CLAMPS ON EITHER SIDE?

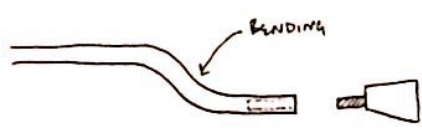


vs

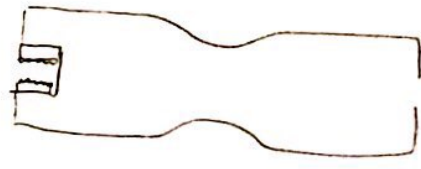
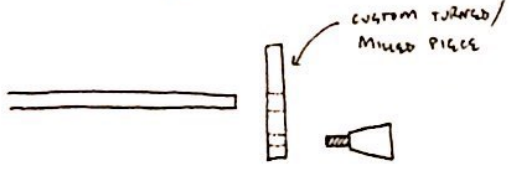


LET'S MAYBE ASK TO USE MAINSHOP LATHES FOR THIS + LET'S TRY IT!

- BENT SHAFT HANDLE?
- OR CUSTOM HANDLE PIECE?



vs



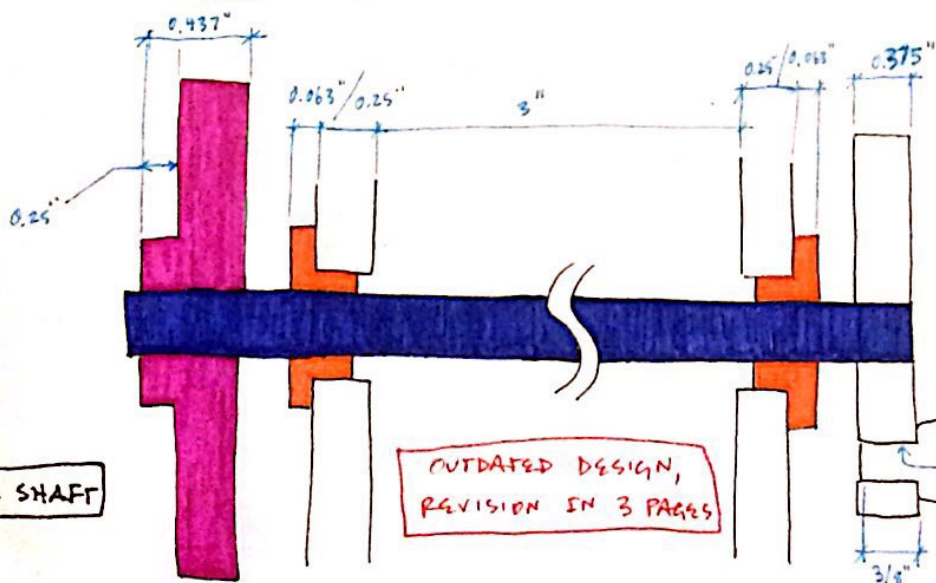
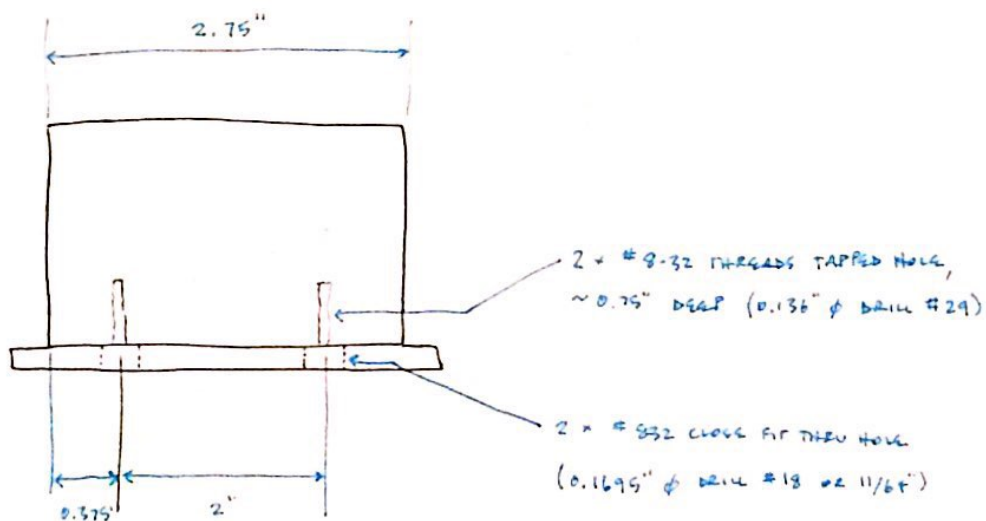
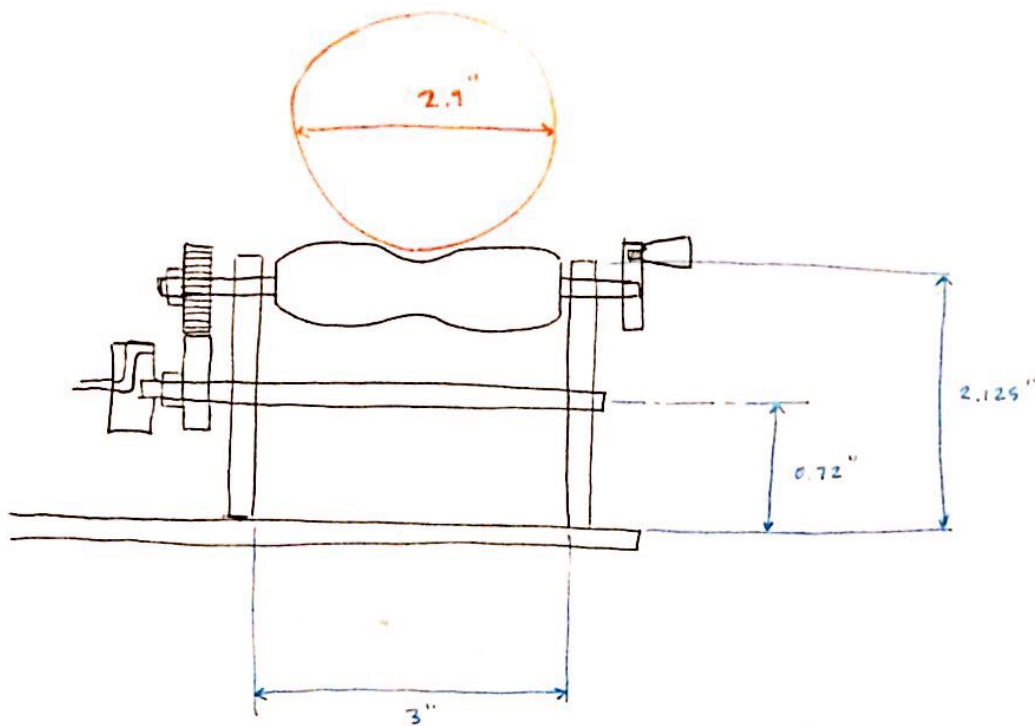
LEARNING THIS WAY

- MATERIALS FOR SHAFT: ALUMINUM OR **STEEL**?
- LESS EXPENSIVE GEAR OPTIONS?
- HOLLOW OR **SOLID** SHAFT?
- WHAT DIAMETER SHAFT SOUNDS REASONABLE?
- ANODIZING -- BLOCK HOURS?

- MIGHT BE BETTER TO DO SOLID
- 0.25" ϕ SOUNDS GOOD
- THEY'LL DO MASKING FOR US
- MIGHT NOT EVEN BE NECESSARY

- INCLUDE FASTENERS
- 1/16" ON EACH SIDE MINIMUM FOR BOLTS
 - MAYBE #6 OR #8
 - CHECK THAT WE HAVE THOSE TAPS

- SD PSI, MISUMI
- PRESSURE ANGLE 20°
- AMAZON?
- PRECISION AMOUNTS
- CHECK MATERIALS



\rightarrow SET SHAFT = 4.6"
 \therefore GAP = 0.082"

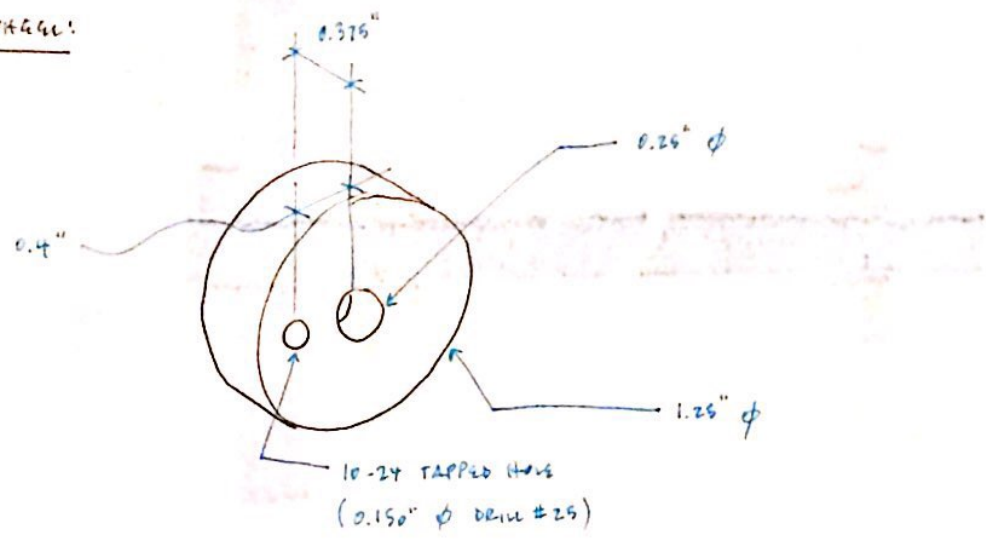
\rightarrow LENGTH OF SHAFT
 $= (3 + .437 + 2(0.063) + 2(0.25) + 0.375) + 2(\text{GAP})$
 $= 4.438" + 2(\text{GAP})$

OUTDATED DESIGN,
REVISION IN 3 PAGES

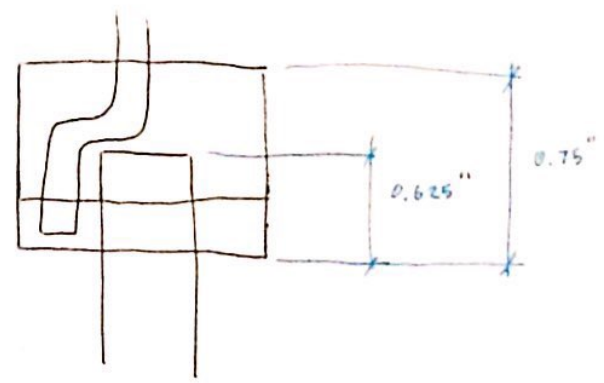
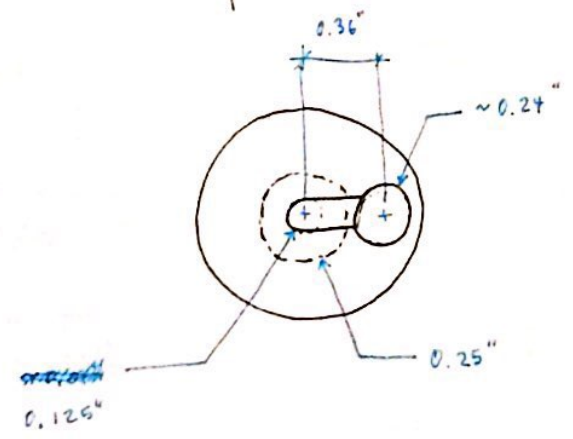
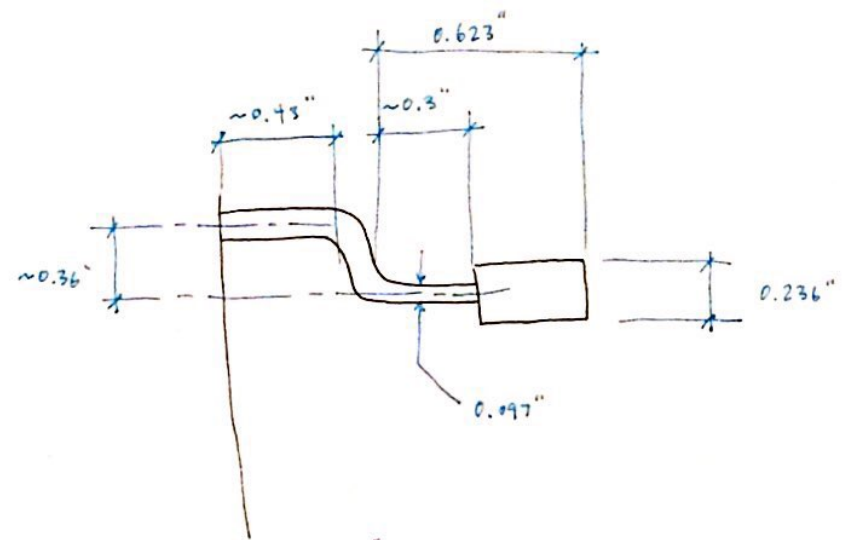
10-24 THREADS
(0.15" ϕ DRILL #25)

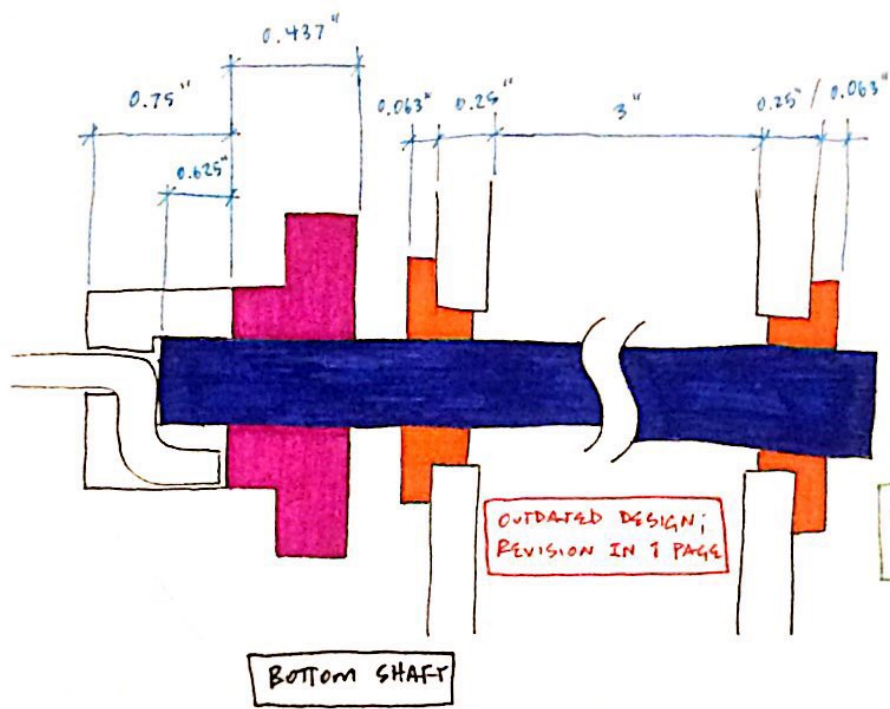
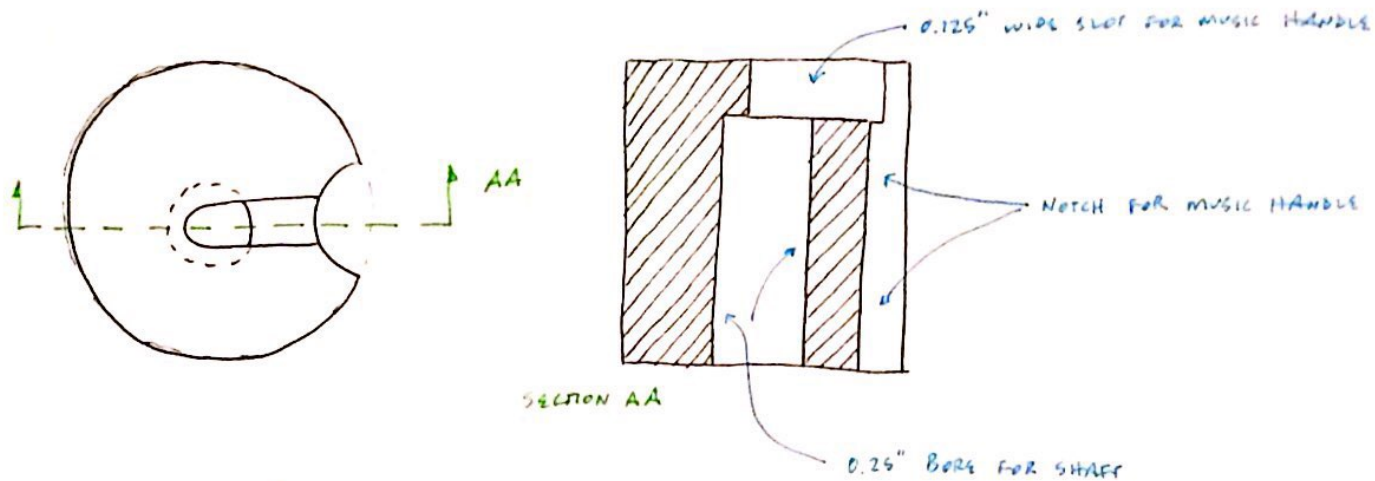
RSAR SHAFT

WITGAL:



MUSIC COUPLER:





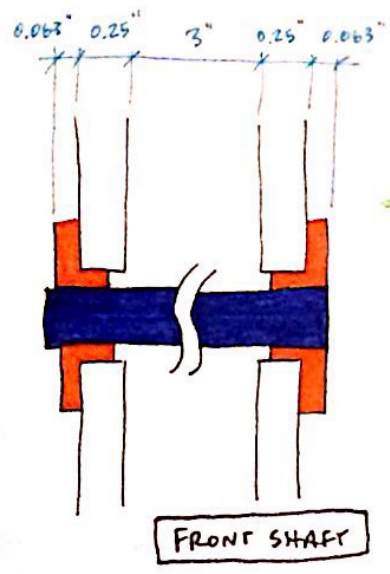
\Rightarrow LENGTH OF SHAFT
 $= (3 + .437 + 2(0.063))$
 $+ 2(0.25) + 0.625) + \text{GAP}$
 4.688
 $= ~~4.875~~ + \text{GAP}$

OUTDATED DESIGN;
REVISION IN 1 PAGE

\Rightarrow SET SHAFT = 4.75"
 $\therefore \text{GAP} = 0.062"$

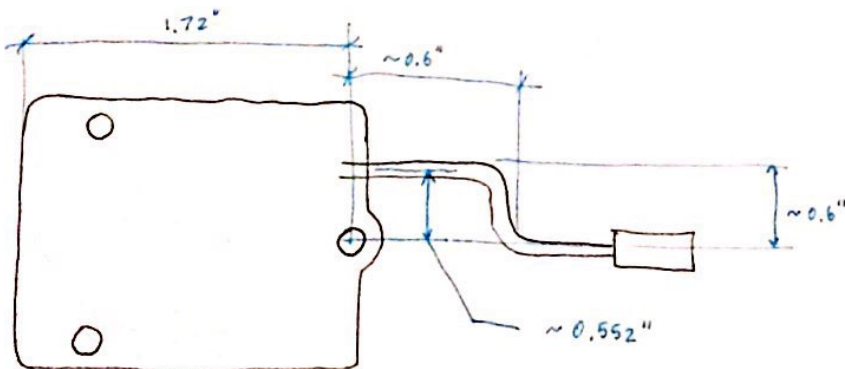
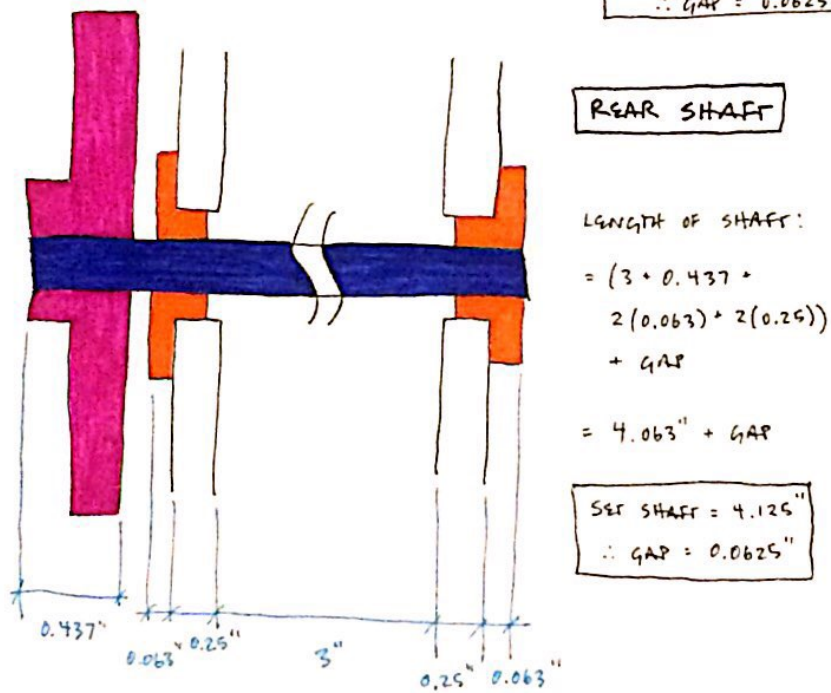
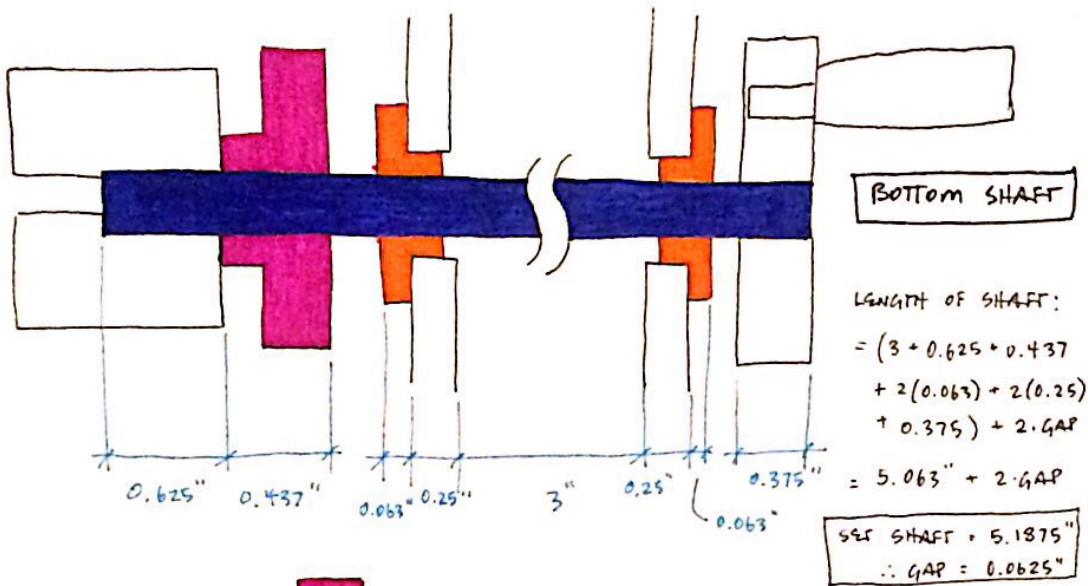
REAR SHAFT LENGTH = 4.438" + 2 · GAP
 BOTTOM SHAFT LENGTH = 4.688 + GAP

\Rightarrow IF SHAFTS ARE SAME LENGTH, GAP = 0.308" TOO LONG
 SHAFTS = ~~5.000~~
 \therefore SHAFTS WILL BE DIFFERENT LENGTHS



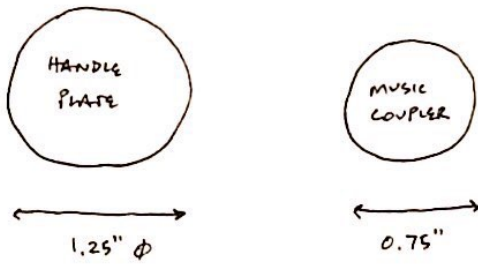
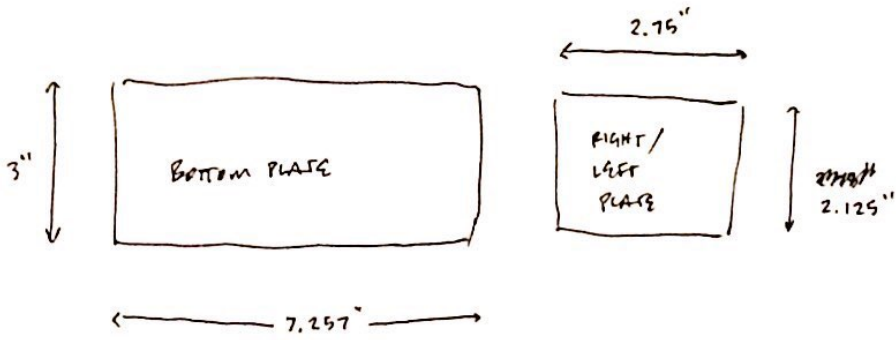
\Rightarrow SHAFT = 3.625"

CHANGE OF PLANS: I WANT TO HAVE EVERYTHING WORK WHEN I CRANK "FORWARD" AS IF THE HANDLES WERE BIKE PEDALS. WITH THE ~~CRANK~~ ^{HANDLE} ON THE TOP SHAFT, I'D HAVE TO CRANK "BACKWARDS" TO GET THE MUSIC TO PLAY (SINCE IT'S RATCHETED). THUS, I'LL MOVE THE HANDLES ONTO THE LOWER SHAFT, CO-AXIAL WITH THE MUSIC BOX ITSELF.



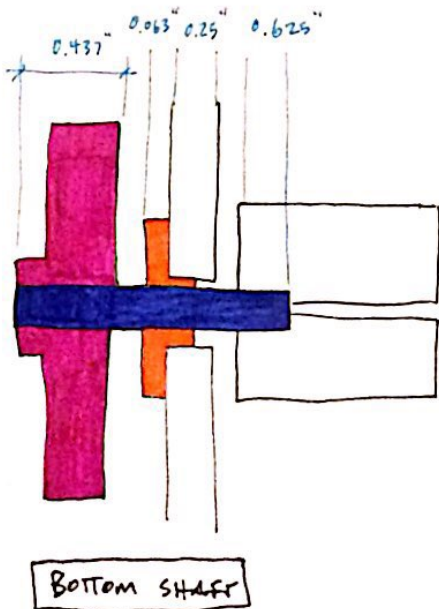
- I THINK THE MUSIC BOX BOWS ARE 4-40 \Rightarrow THRU HOLES ARE $0.116'' \phi$, #32 B.P.

PLATES:



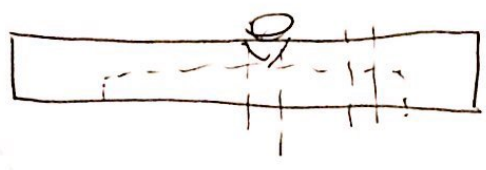
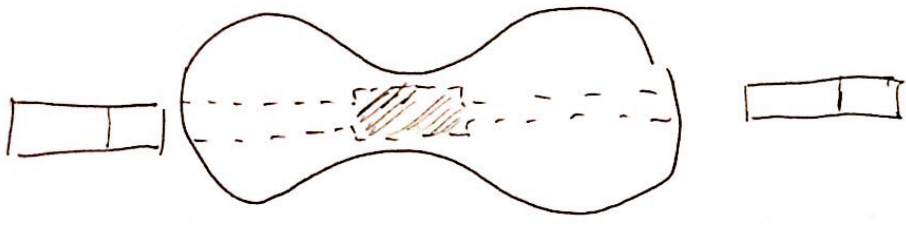
DIFFERENT DESIGN IDEA: MUSIC BOX UNDERneath?

\rightarrow USE CRANK ON TOP



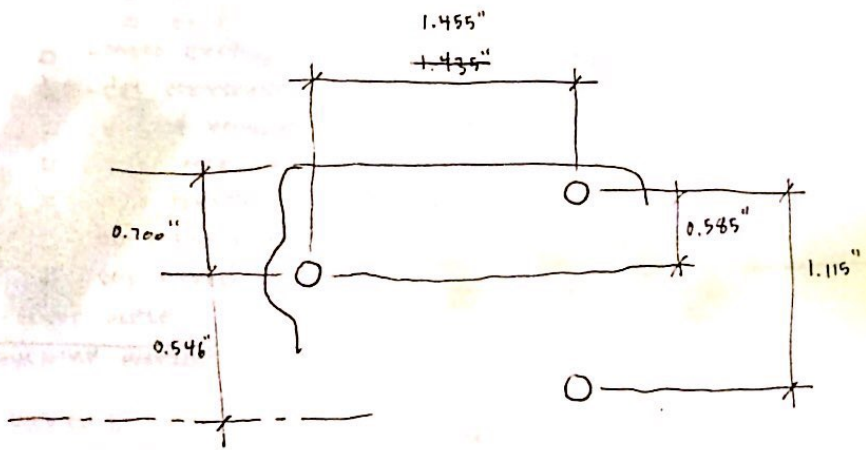
$$\begin{aligned} \text{LENGTH} &= (0.437 + 0.063 + 0.25 \\ &\quad + 0.625) + 2 \cdot \text{GAP} \\ &= 1.375 + 2 \cdot \text{GAP} \end{aligned}$$

$$\begin{aligned} \Rightarrow \text{MAKE SHAFT} &= 1.5'' \\ \therefore \text{GAP} &= 0.0625'' \end{aligned}$$



- I CAN BUY SHAFTS FROM ROOM 36!
- 1/4" ϕ D-SHAFTS -- I THINK THAT'S OKAY -- \rightarrow CONFIRMED BY ELLIOT
- BUSHINGS TOO!
- I'M BUYING THE BUSHINGS NOW, BRING #6 TO ROOM 36 W/EEZ FOR THE SHAFTS

10-29-2018



$$0.595 - \left(\frac{0.098}{2} \right) = 0.546''$$

0.049

$$\begin{array}{r} 0.720 \\ - 0.135 \\ \hline 0.585 \end{array}$$

$$1.730 > 1.455''$$

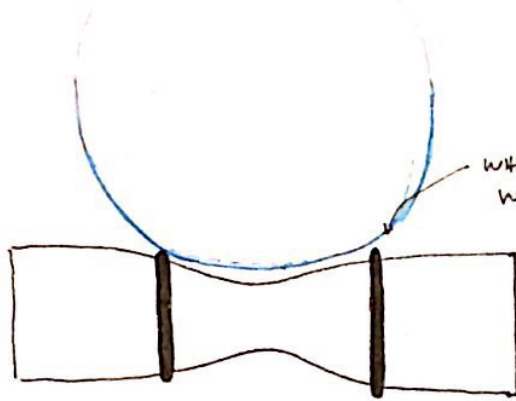
THE BALL FREQUENTLY SLIPS + DOESN'T ROLL

- TOO MUCH FRICTION IN FRONT ROLLER?

- I DO NOTICE THAT THE SHAFT IS CONSIDERABLY LOOSE IN THE BUSHING

- TOO LOW OF FRICTION BETWEEN BASEBALL + ROLLER?

- IT HAS BECOME MORE OF A PROBLEM LATELY, MAYBE BECAUSE ROLLER KEEPS GETTING SMOOTHER...



WHAT IF I PUT A GROOVE FOR O-RINGS AT THE SPOTS WHERE THE BASEBALL WOULD CONTACT? ①

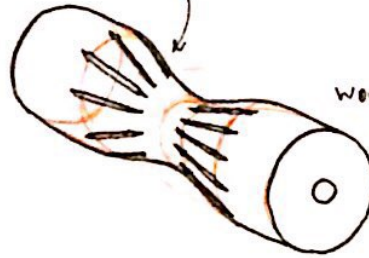
② REPLACE BUSHINGS, REAM JUST ONCE

- TO HOPEFULLY ELIMINATE SOME OF THE WIGGLE ROOM OF SHAFT IN BUSHING

③ APPLY GROOVES TO ROLLER



GROOVES FOR EXTRA GRIP

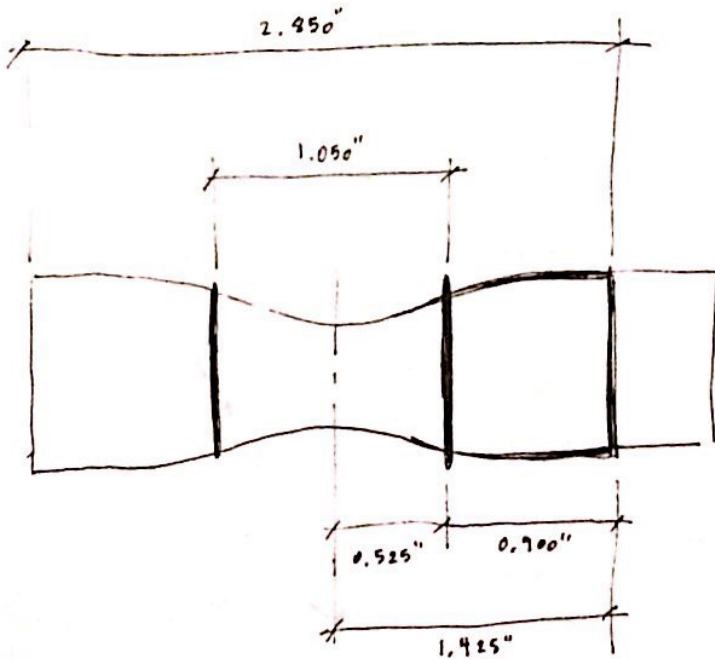


WOULD PROBABLY LOOK MORE LIKE THE ONE SO IT'S AFFECTING THE SPOT WHERE THE BALL CONTACTS

④ APPLY SOME GRIPPY SURFACES TO THE ROLLER

- POLYURETHANE?

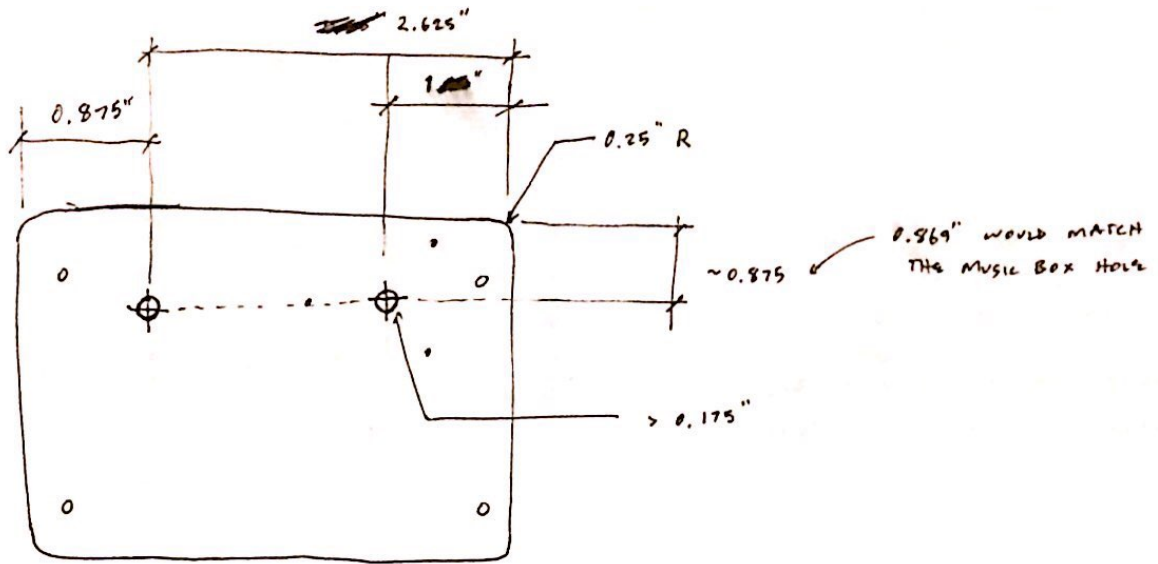
- POLYURETHANE + LOW GRIP SANDPAPER?



AFTER QUICK PROTOTYPE TESTING, THE O-RING METHOD WORKS!

THESE ARE THE DIMENSIONS I'LL USE.

PUNGE AS LITTLE AS POSSIBLE AT FIRST.

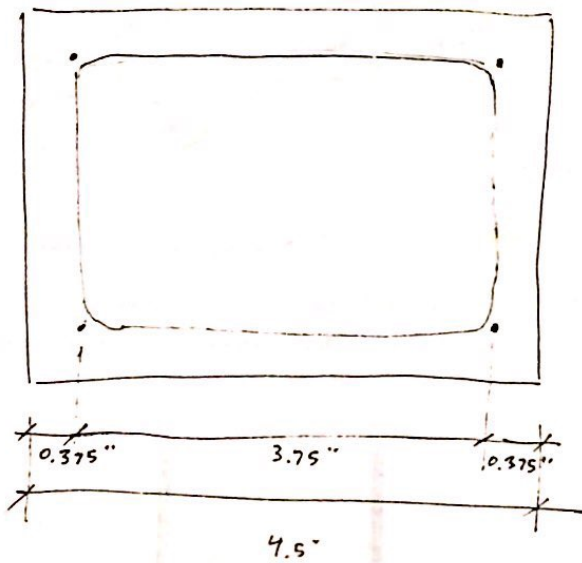


WOOD BASE

11-20-2016

I'M USING AN OTTOMILL (A DESKTOP CNC MILL) TO SHAPE THE PIECE, INCLUDING ROUTING THE POCKET FOR THE BOTTOM PLATE.

→ JK, THE WOOD IS TOO THICK. I'LL USE A MILL.



Holes:

(0.25, -0.500)

(1.620, -0.869)

(3.075, -0.284)

(3.5, -0.500)

(3.075, -1.399)

(3.5, -2.5)

(0.25, -2.5)

(0.875, -2.5)