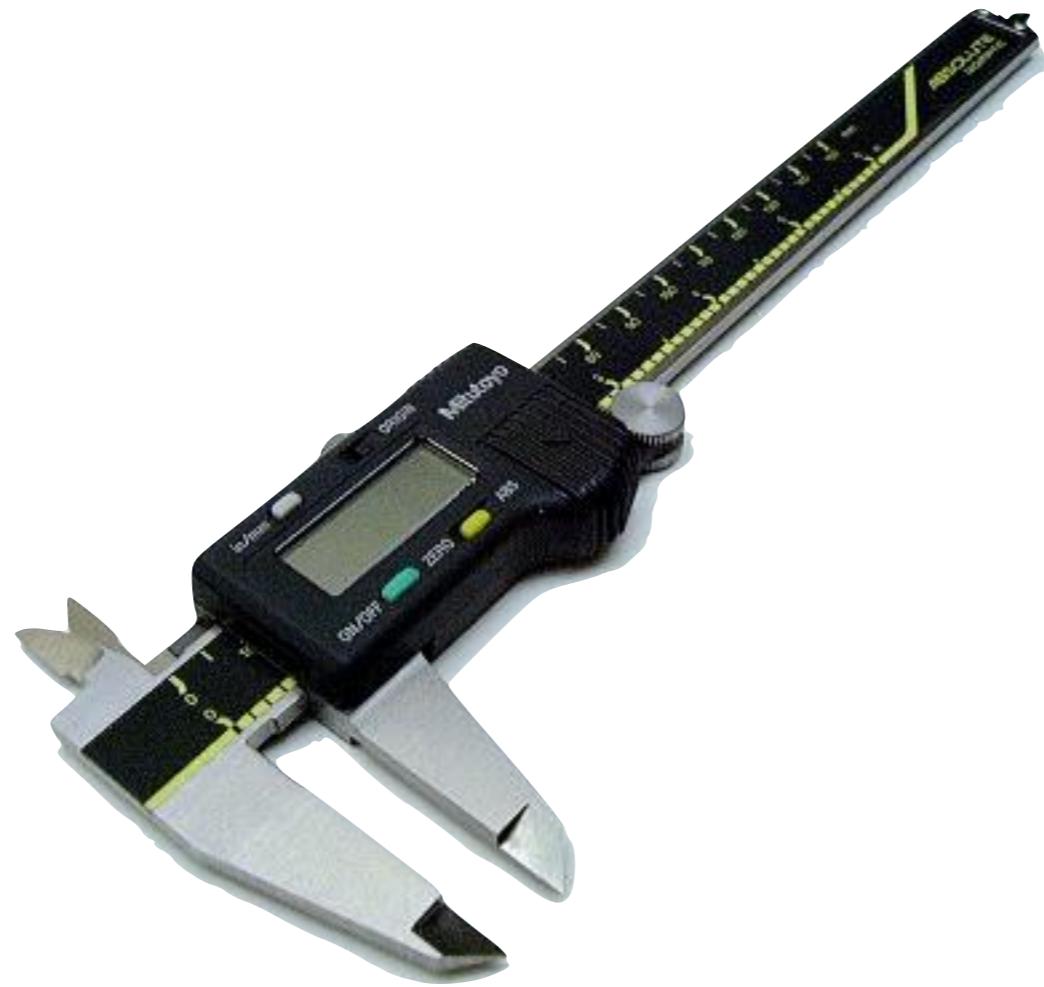


Today we will learn.....

Before we begin

Caliper



Wednesday, October 23, 13

3 measuring locations

Micrometer



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One measuring location used for thickness

JOINING

Know What Before you start



Socket Cap Screws



Cap Screws



Machine Screws



Set Screws



Shoulder Screws



Tapping, Wood, and
Drywall Screws



Thumb Screws



Captive Fasteners



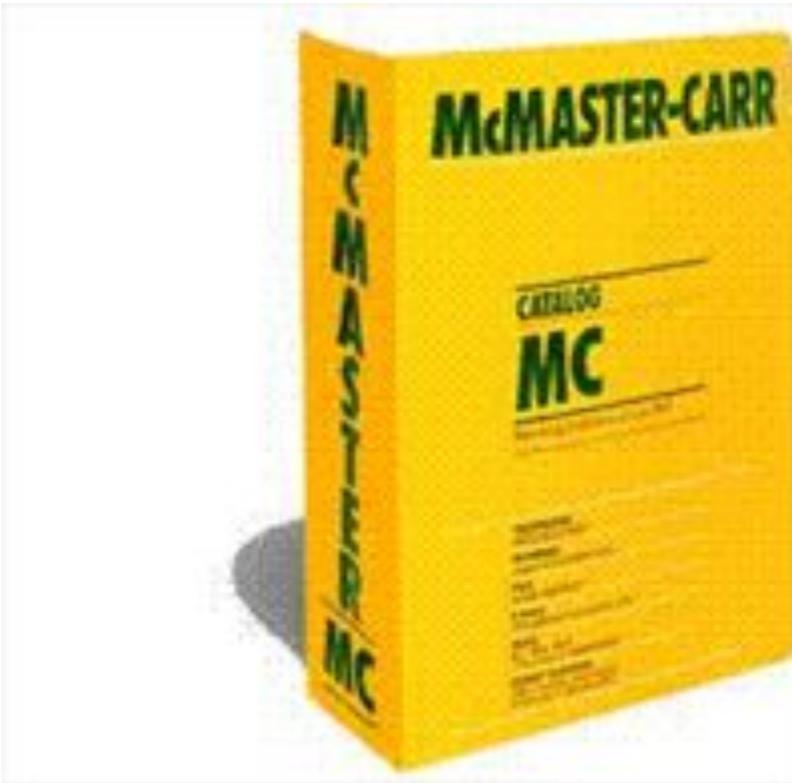
Binding Posts



Screw Nails



Hex Standoffs



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Webpage active



Thread size not head size

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Different bolts have different head sizes and config.
HEX, Phillips, flat head, TORX, Star.

U.S. Thread Chart					
Diameter of Bolt	Coarse Thread "UNC"	Fine Thread "UNF"	Diameter of Bolt	Coarse Thread "UNC"	Fine Thread "UNF"
	Threads Per Inch	Threads Per Inch		Threads Per Inch	Threads Per Inch
No. 2	56	-	7/8	9	14
No. 3	48	-	1	8	14
No. 4	40	-	1-1/8	7	12
No. 5	40	-	1-1/4	7	12
No. 6	32	-	1-1/2	6	12
No. 8	32	-	-	-	-
No. 10	24	32	-	-	-
No. 12	24	-	-	-	-
1/4	20	28	-	-	-
5/16	18	24	-	-	-
3/8	16	24	-	-	-
7/16	14	20	-	-	-
1/2	13	20	-	-	-
9/16	12	18	-	-	-
5/8	11	18	-	-	-
3/4	10	16	-	-	-

This chart lists the coarse thread and fine thread for each diameter bolt and machine screws.

Metric Thread Pitch			
Bolt Diameter	Standard Thread Pitch (mm)	Fine Thread Pitch (mm)	Extra Fine Thread Pitch (mm)
4mm	0.70	-	-
5mm	0.80	-	-
6mm	1.00	-	-
7mm	1.00	-	-
8mm	1.25	1.00	-
10mm	1.50	1.25	1.00
12mm	1.75	1.50	1.25
14mm	2.00	1.50	-
16mm	2.00	-	-
18mm	2.50	-	-
20mm	2.50	-	-
24mm	3.00	-	-

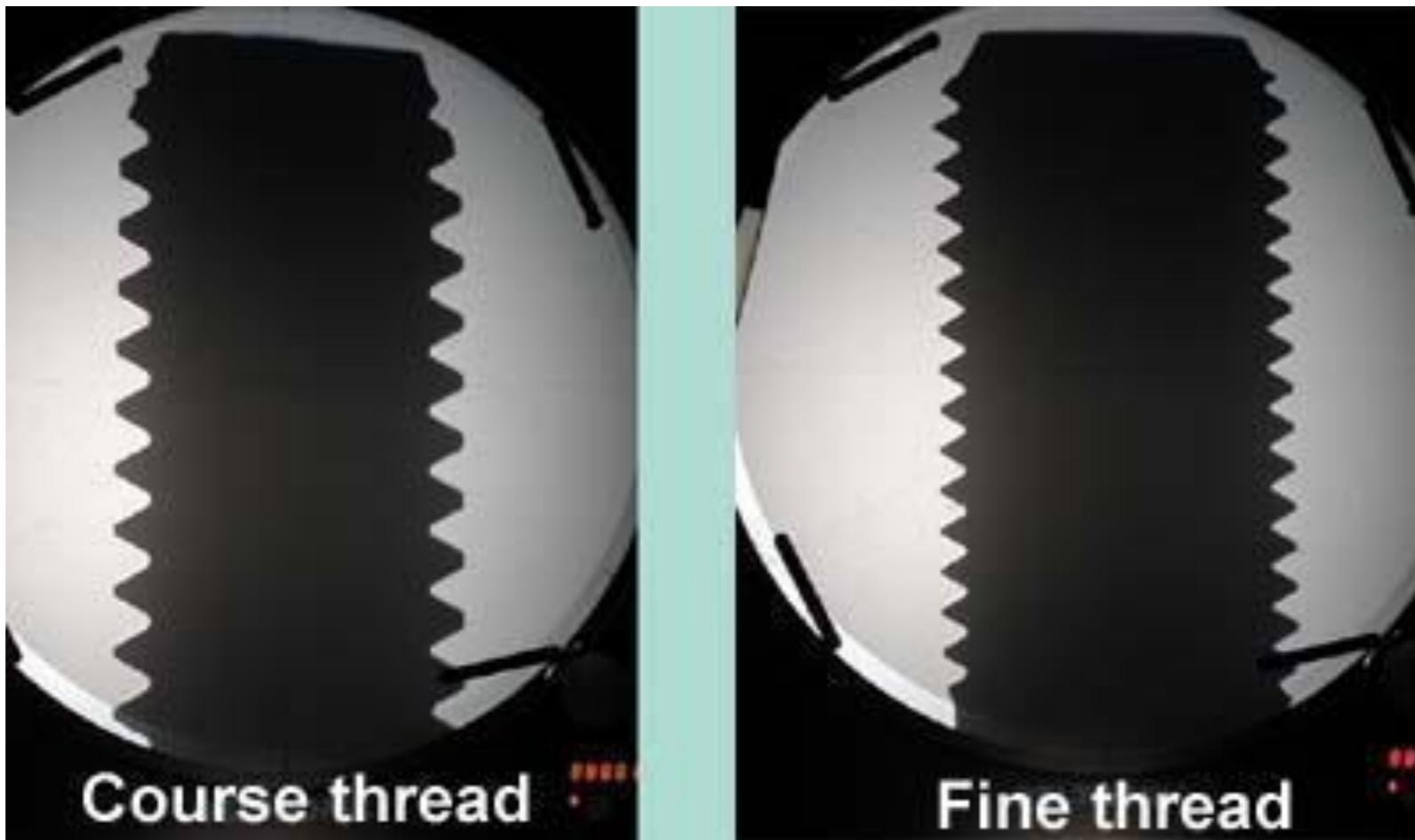
Size Identification: Metric bolts are written down as an 'M' followed by 3 numbers. For example M10x1.25x35 The first number is the diameter, the second the thread pitch, and the third the length all in millimeters. The example is therefore a 10mm diameter fine thread bolt 35mm long.

Thread pitch: The distance from one thread to the next, measured down the length of the fastener.

Size Identification:

Imperial hardware is either number or fraction and threads per inch (number is a standard agreed to by several countries in the 1940's) for instance $1/4 - 20 \times 5/8"$ or $4-40 \times 1/2"$

Metric hardware is notated with an M followed by 3 numbers for instance $M3 \times .5 \times 10$ is a 3mm screw with a 5mm pitch 10mm in length. Thread pitch is the distance from one thread to the next.



Course thread

Fine thread



Slotted



Cross Slot/
Phillips



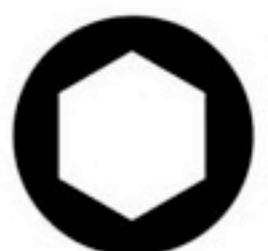
Pozidriv



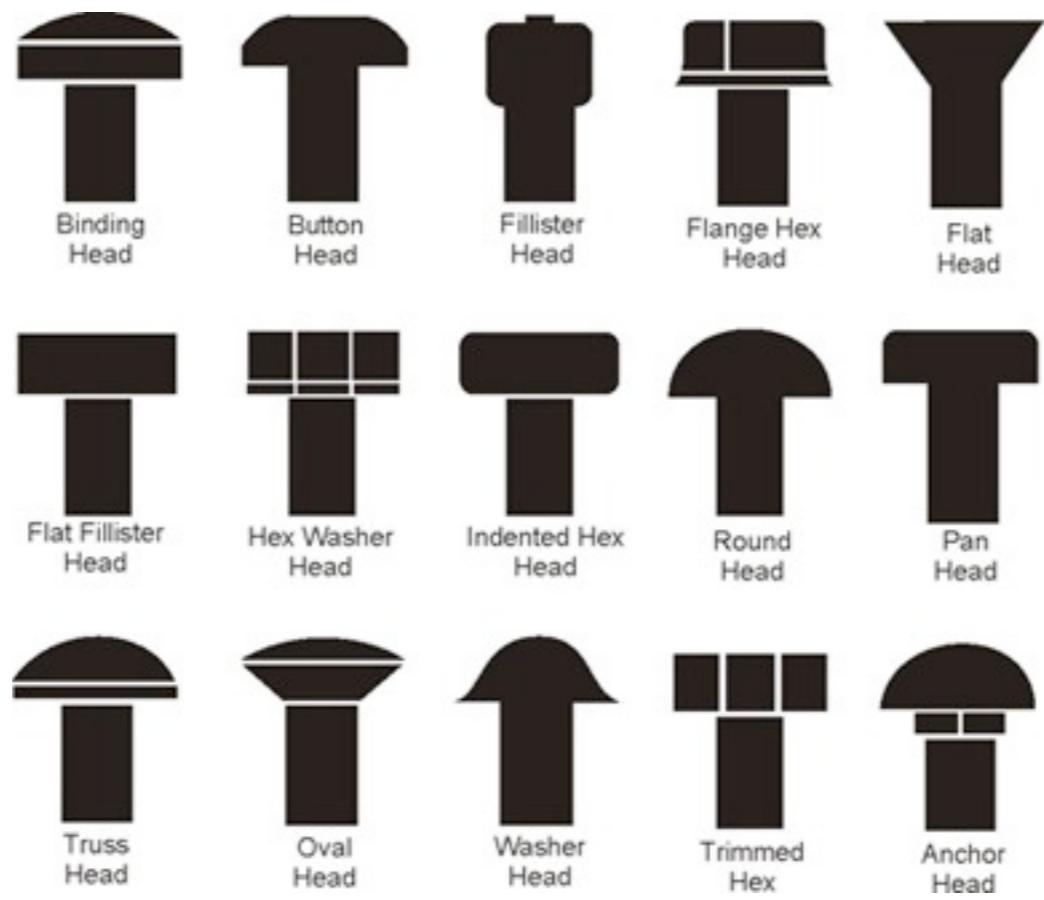
Torx



Security T



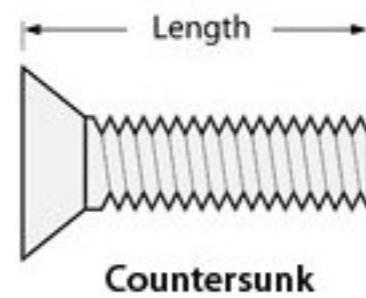
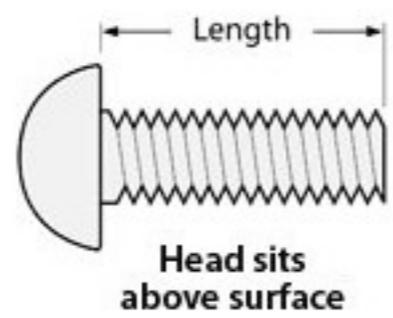
Hexagon



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Add socket head – basically fillister

Rule of thumb



Some bolts are all thread and some have a shoulder. If shoulder is longer than material is thick the threads wont engage



Wednesday, October 23, 13

Some bolts are all thread and some have a shoulder. If shoulder is longer than material is thick the threads wont engage

**Hex**

A six sided nut. Also referred to as a Finished Hex Nut.

**Heavy Hex**

A heavier pattern version of a standard hex nut.

**Nylon Insert Lock**

A nut with a nylon insert to prevent backing off. Also referred to as a Nylock.

**Jam**

A hex nut with a reduced height.

**Nylon Insert Jam Lock**

A nylock nut with a reduced height.

**Wing**

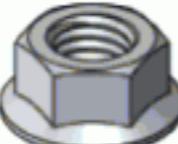
A nut with 'wings' for hand tightening.

**Cap**

A nut with a domed top over the end of the fastener.

**Acorn**

Acorn nuts are a high crown type of cap nut, used for appearance.

**Flange**

A nut with a built in washer like flange.

**Tee**

A nut designed to be driven into wood to create a threaded hole.

**Square**

A four sided nut.

**Prevailing Torque Lock**

A non-reversible lock nut used for high temperature applications.

**K-Lock or Kep**

A nut with an attached free-spinning external tooth lock washer.

**Coupling**

Coupling nuts are long nuts used to connect pieces of threaded rod or other male fasteners.

**Slotted**

Slotted nuts are used in conjunction with a cotter pin on drilled shank fasteners to prevent loosening.

**Castle**

Castle nuts are used in conjunction with a cotter pin on drilled shank fasteners to prevent loosening.



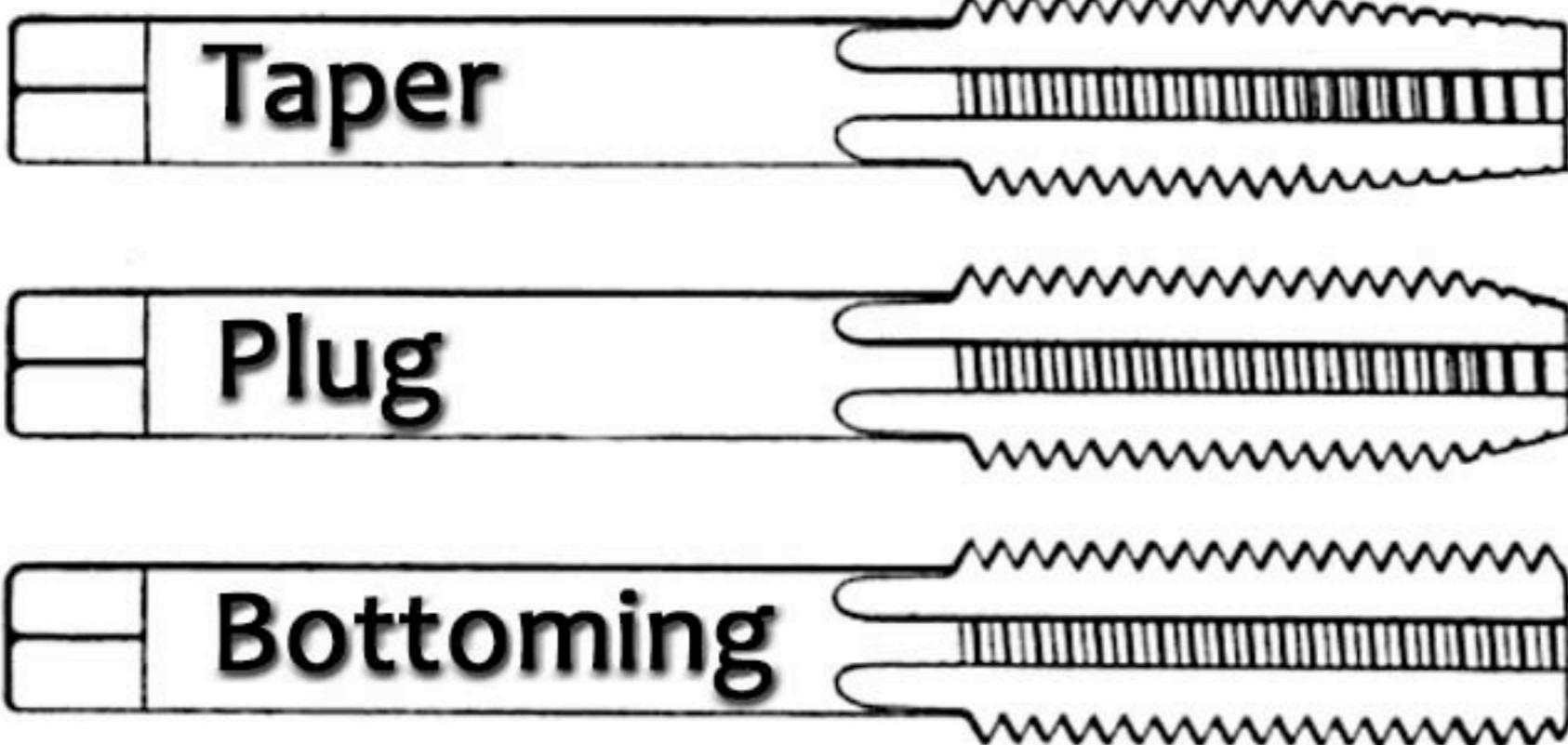
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Instead of nut you can tap. Must have plenty of meat on both sides of hole or it will blow out.
Dont chuck in a drill



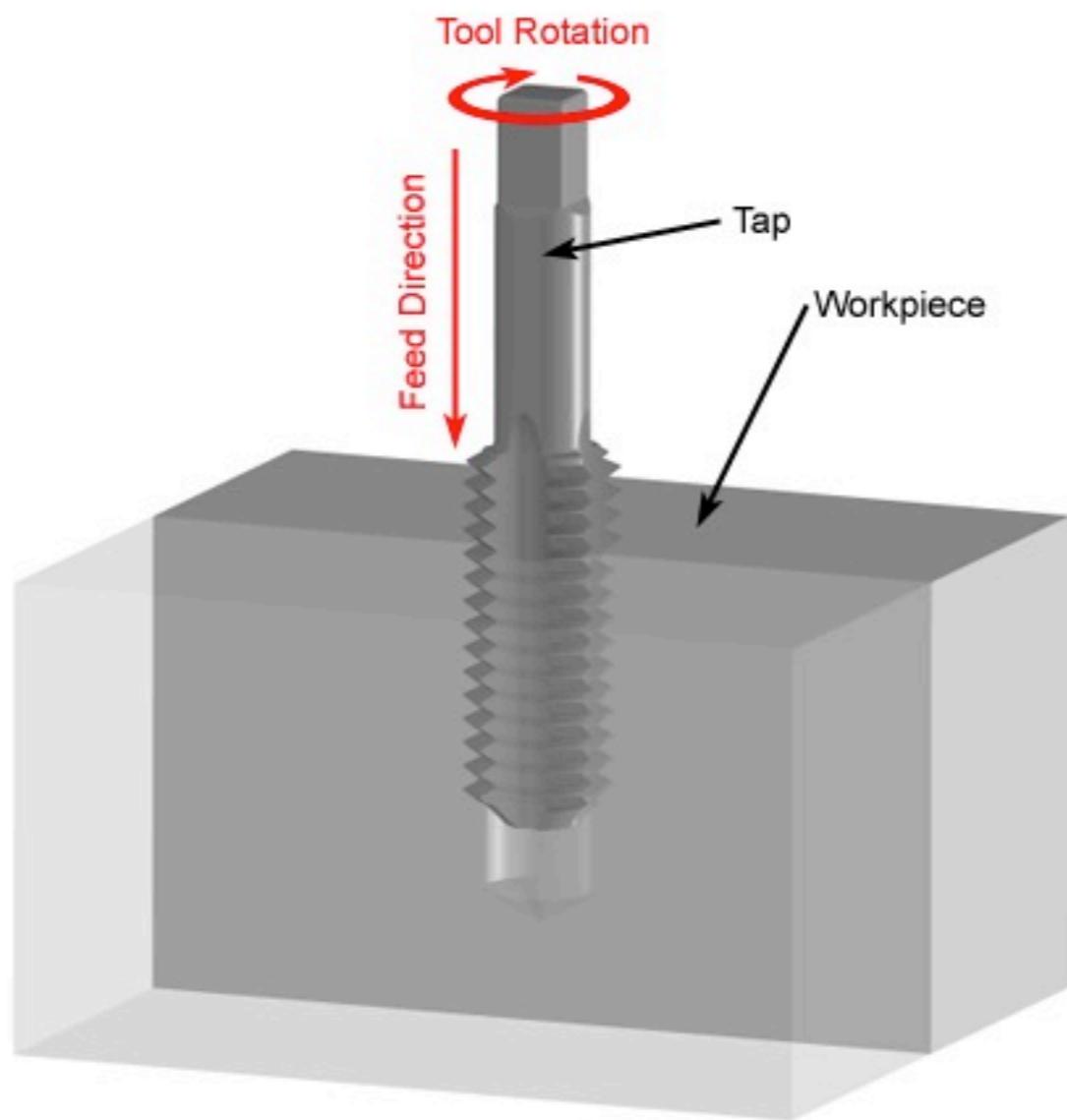
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They make taps that can be used in a drill but are only for thin materials that use through holes



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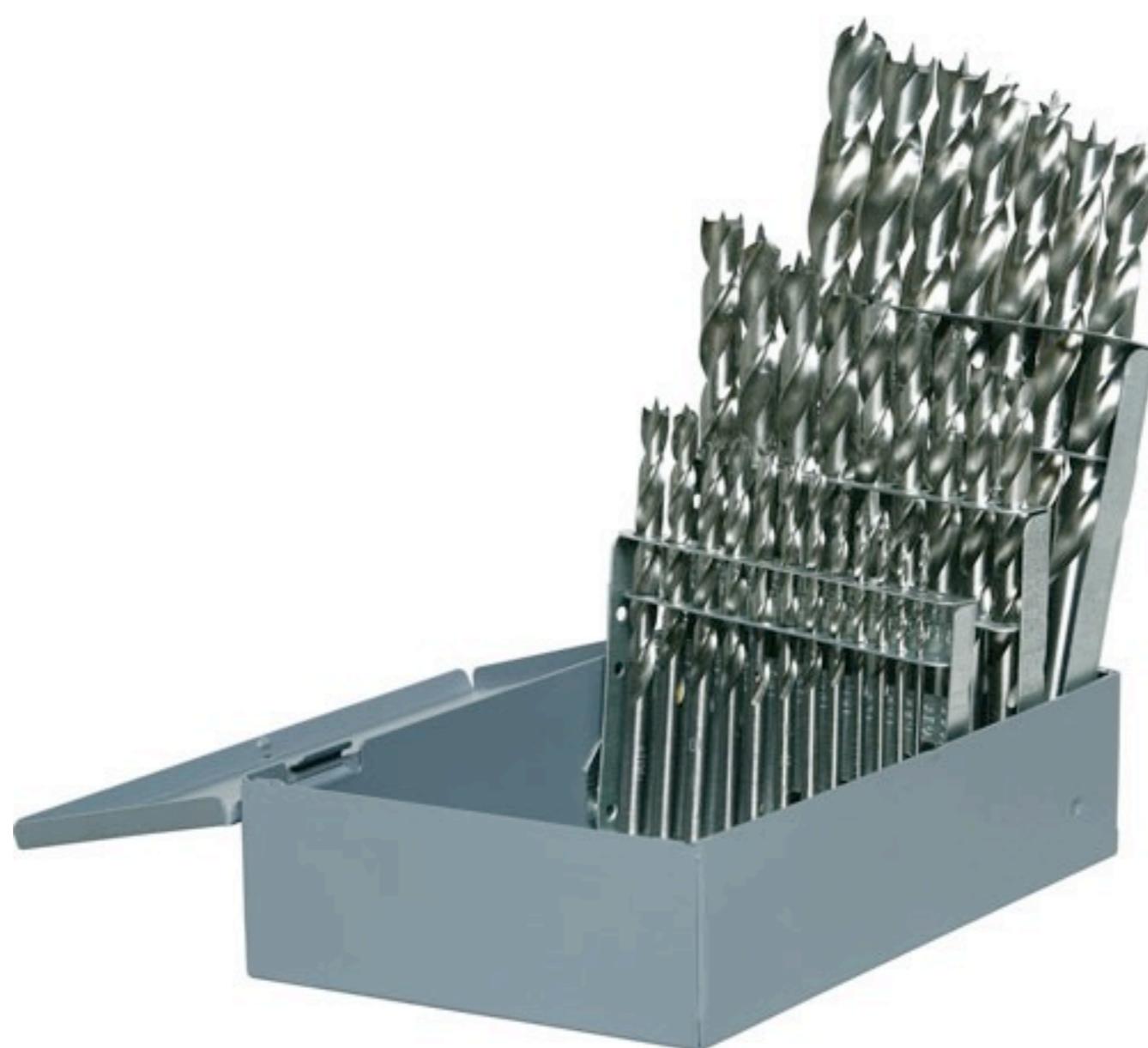
Through
Blind holes



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Taps do break. Never can be pulled out
Through taps
Plug taps
Right size bit for tap (buy together and keep together.)

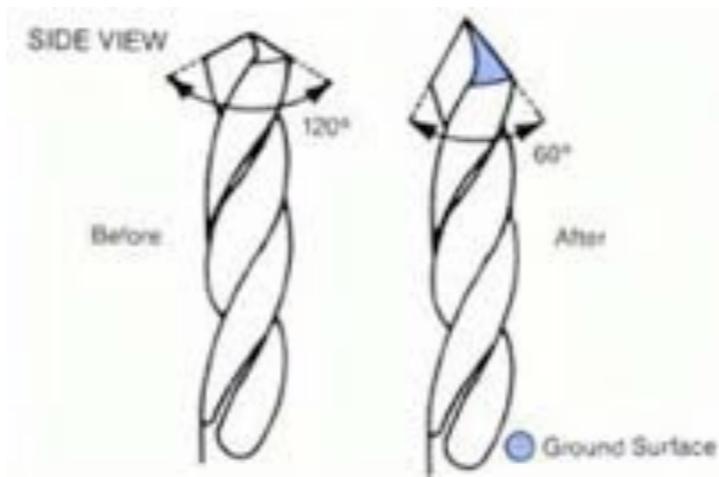


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Stepper bits – work best with a starter bit but can just be used. Step will denote thickness of material.



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Plastic cutting bits are ground to 60 degrees. Need to scrap not cut and plastic tends to ride up on regular bits



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Angle needs to match screw angle- common angles for screws are 60 – 120 degrees.

Metric is usually 90 degree countersink
Standard is usually 82 degree for both UNC
and UNF

The hole size does not match the screw

Try it and you will crack your stuff

Here's the formula:

Screw Dia = (it's size no. multiplied by .013) + .060

That is... Screw Dia = (no. X .013) + .060

So..... for a 4-40 screw it's major dia is (4 X .013)
+ .060 = .112

If you do not have a clearance hole chart, and need to know the clearance, just add 3X the screw size in number (in thousandths).

A clearance hole for a no 4 screw would be .112 + (3X .004) = .124 (use .125 drill)



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No epoxy. It does not join everything



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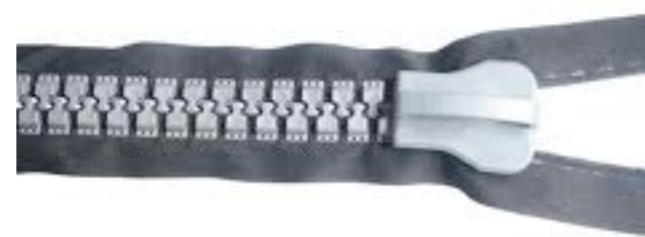
Capillary action



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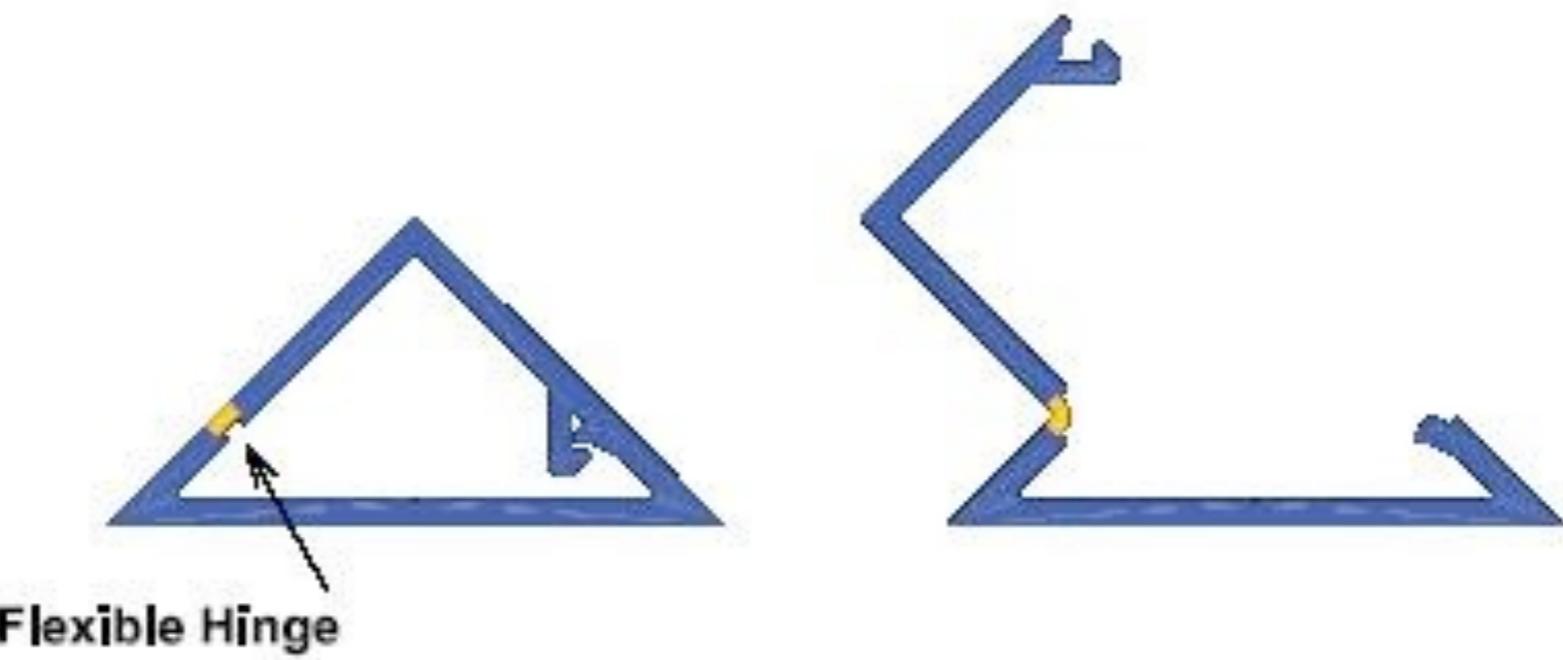
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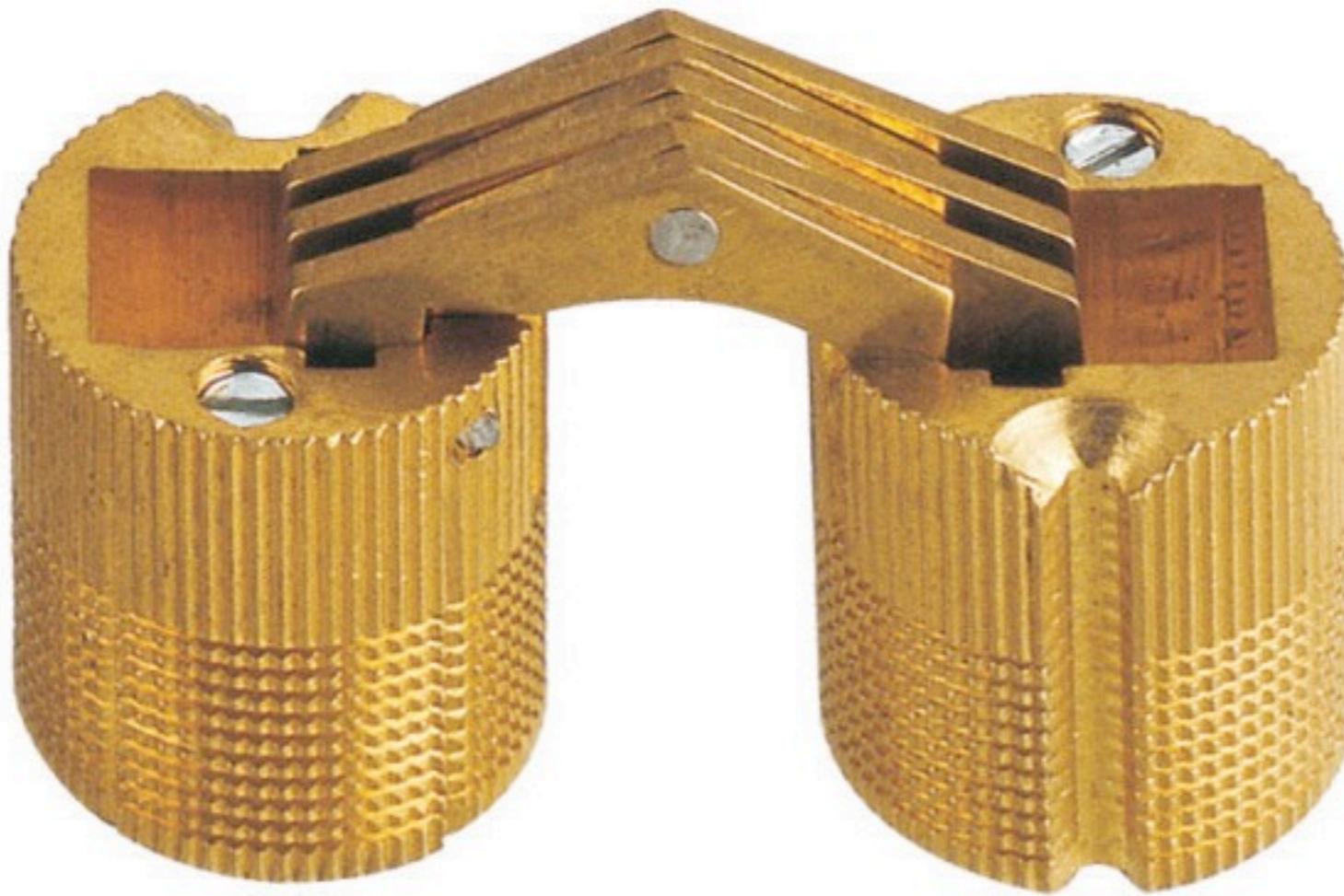


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Joinery

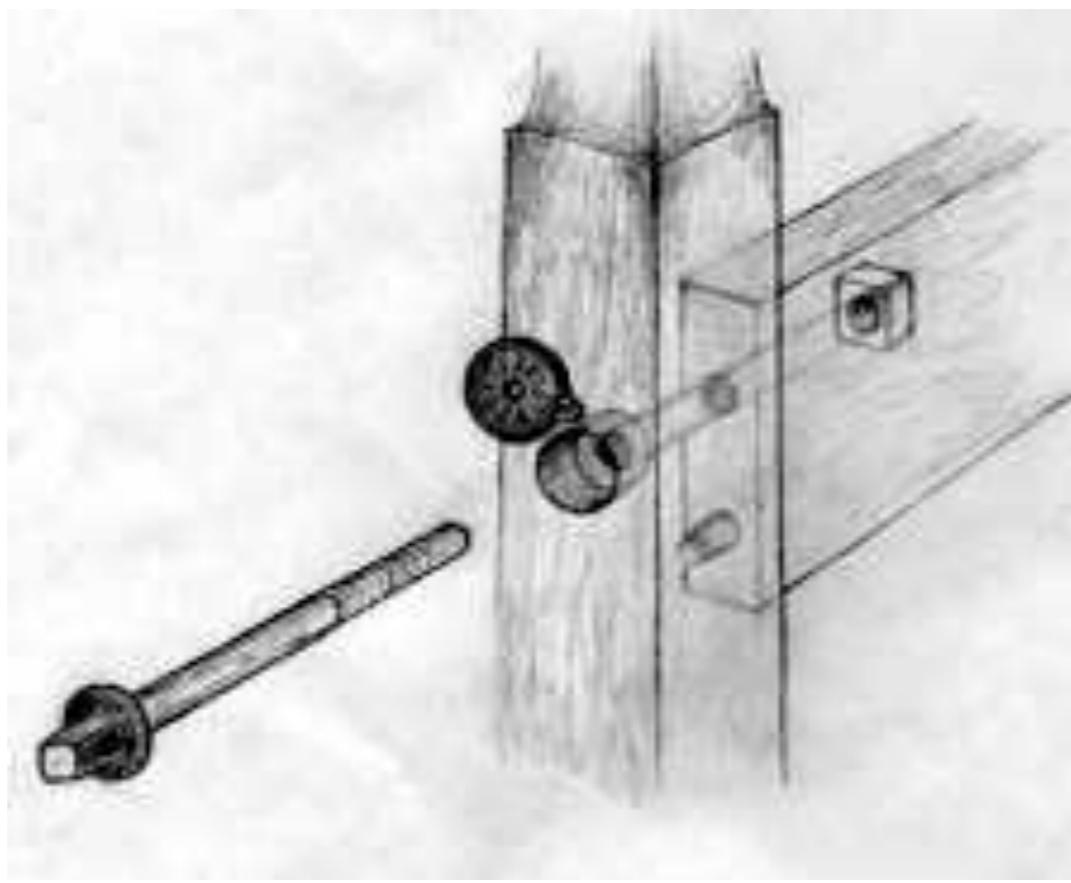


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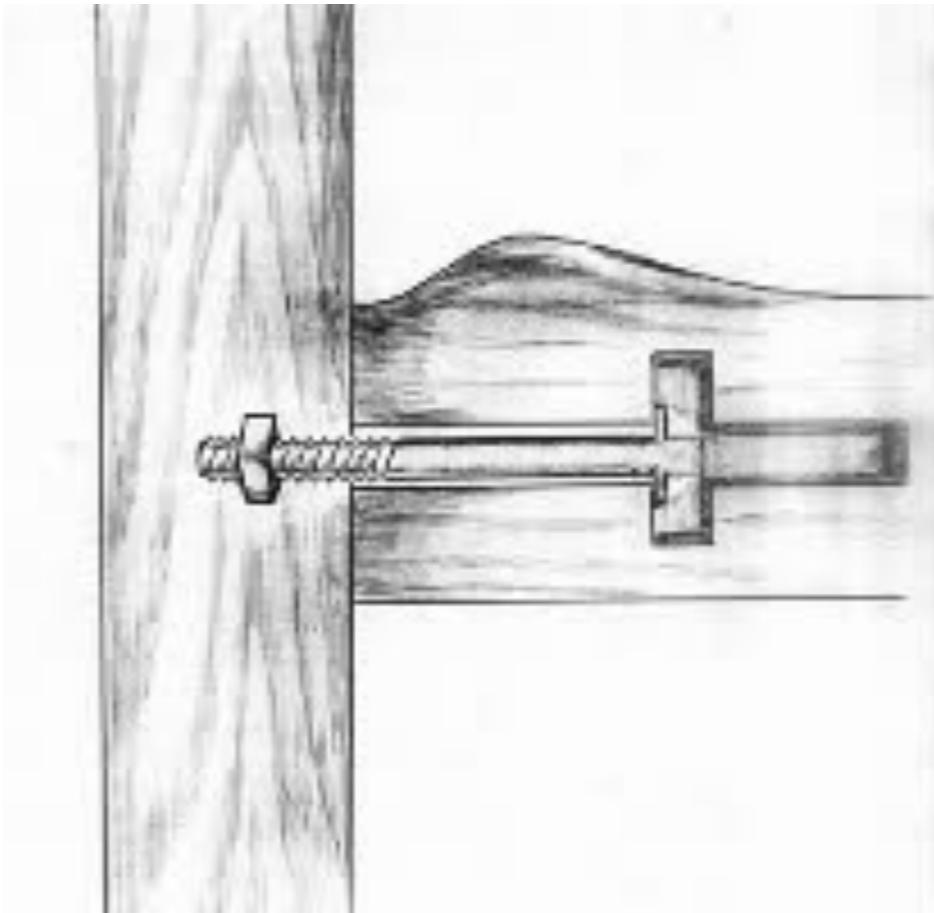
Finish Joinery



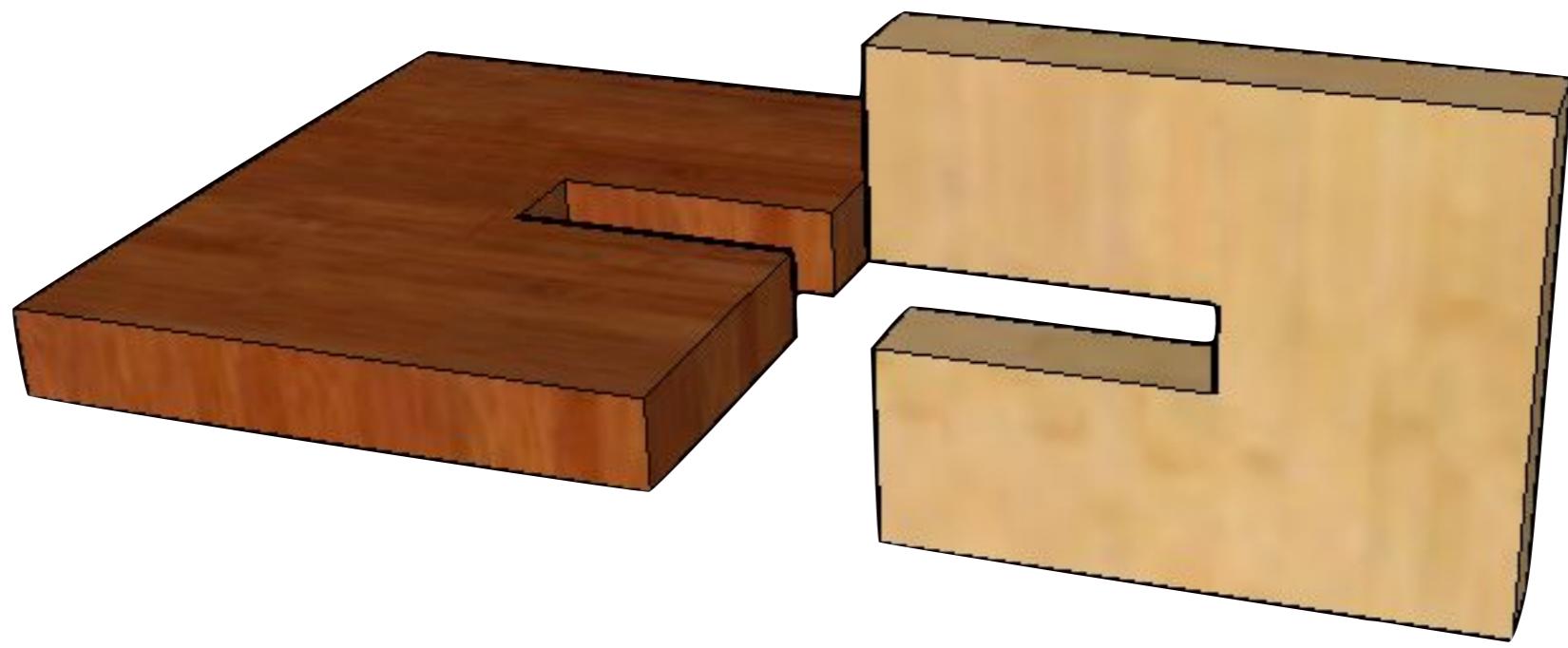
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Wednesday, October 23, 13

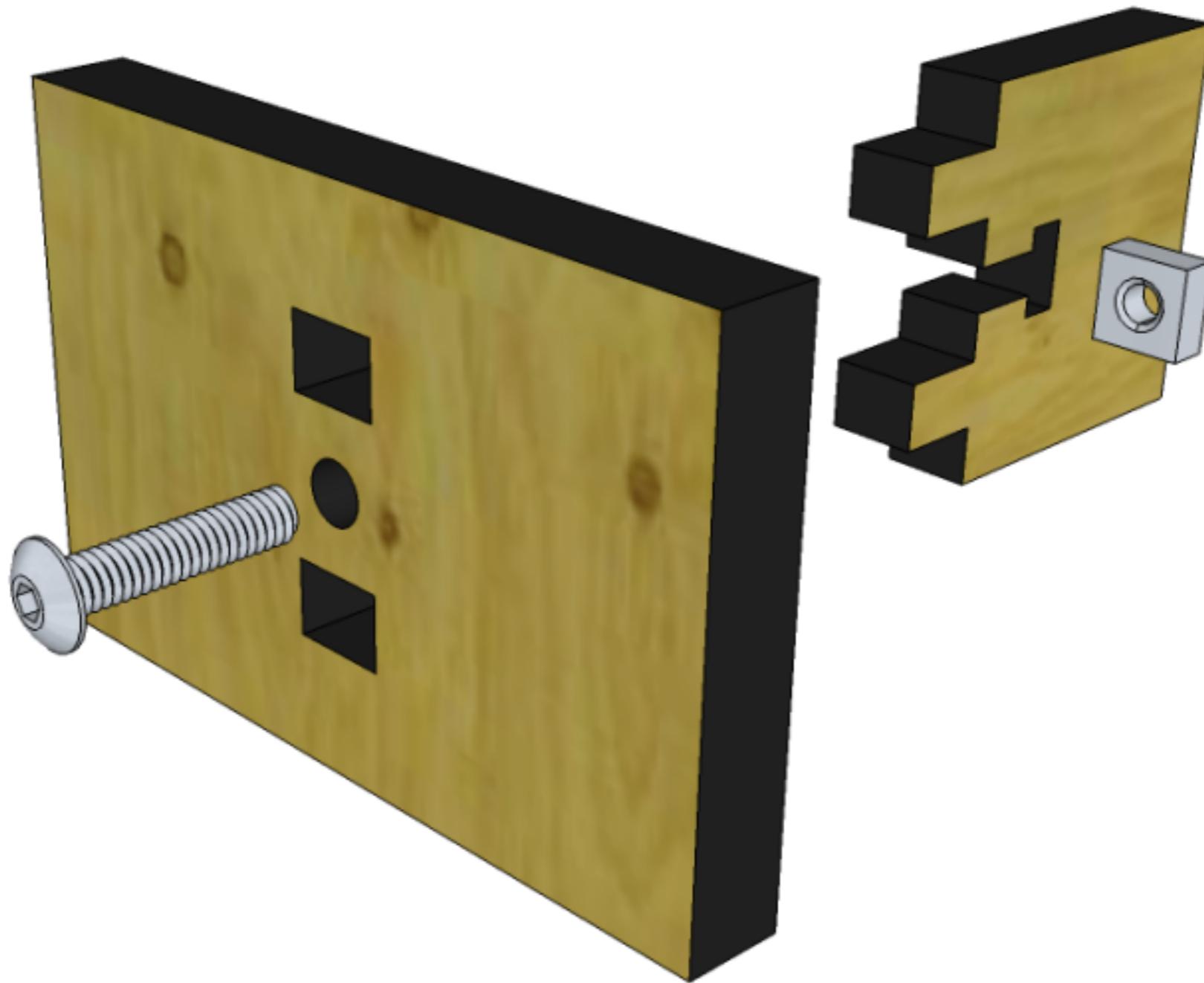


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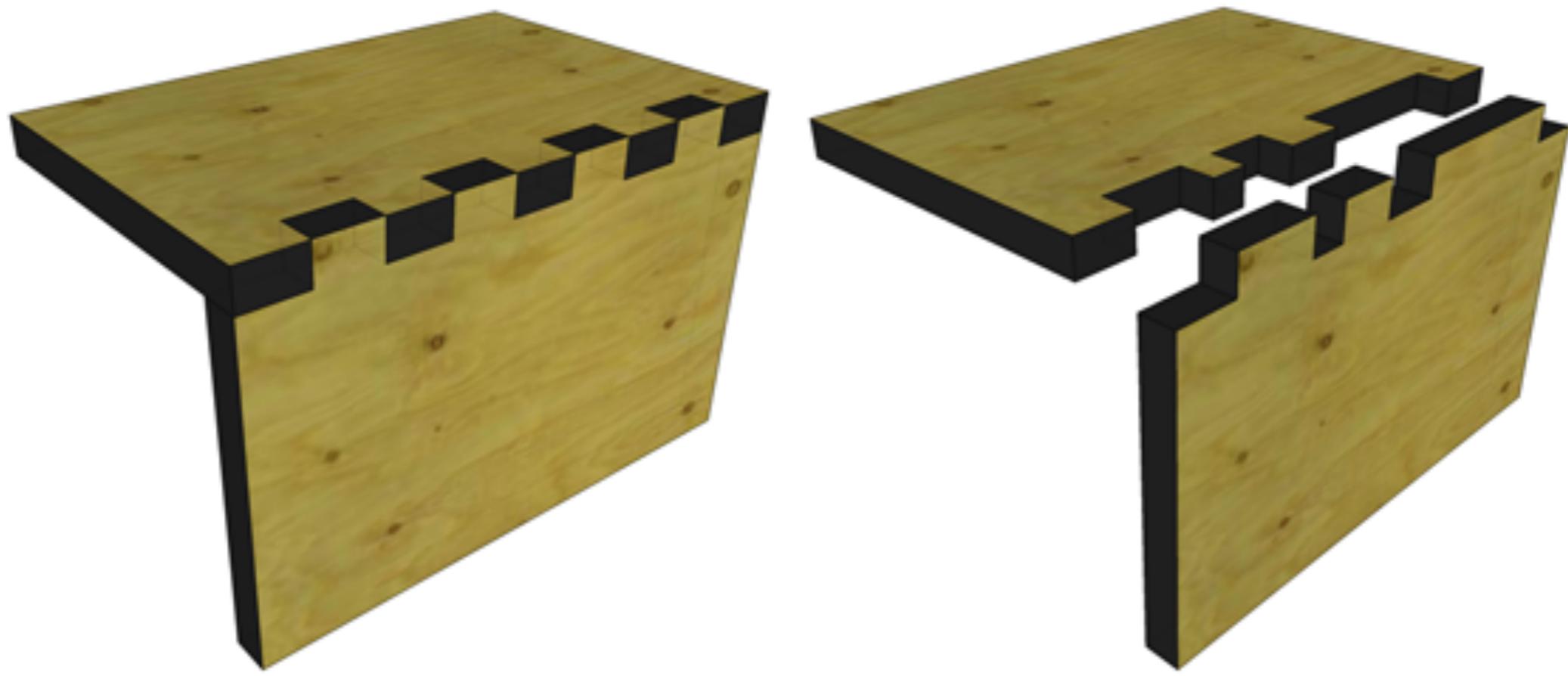


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Crossed half lap like chairs and table

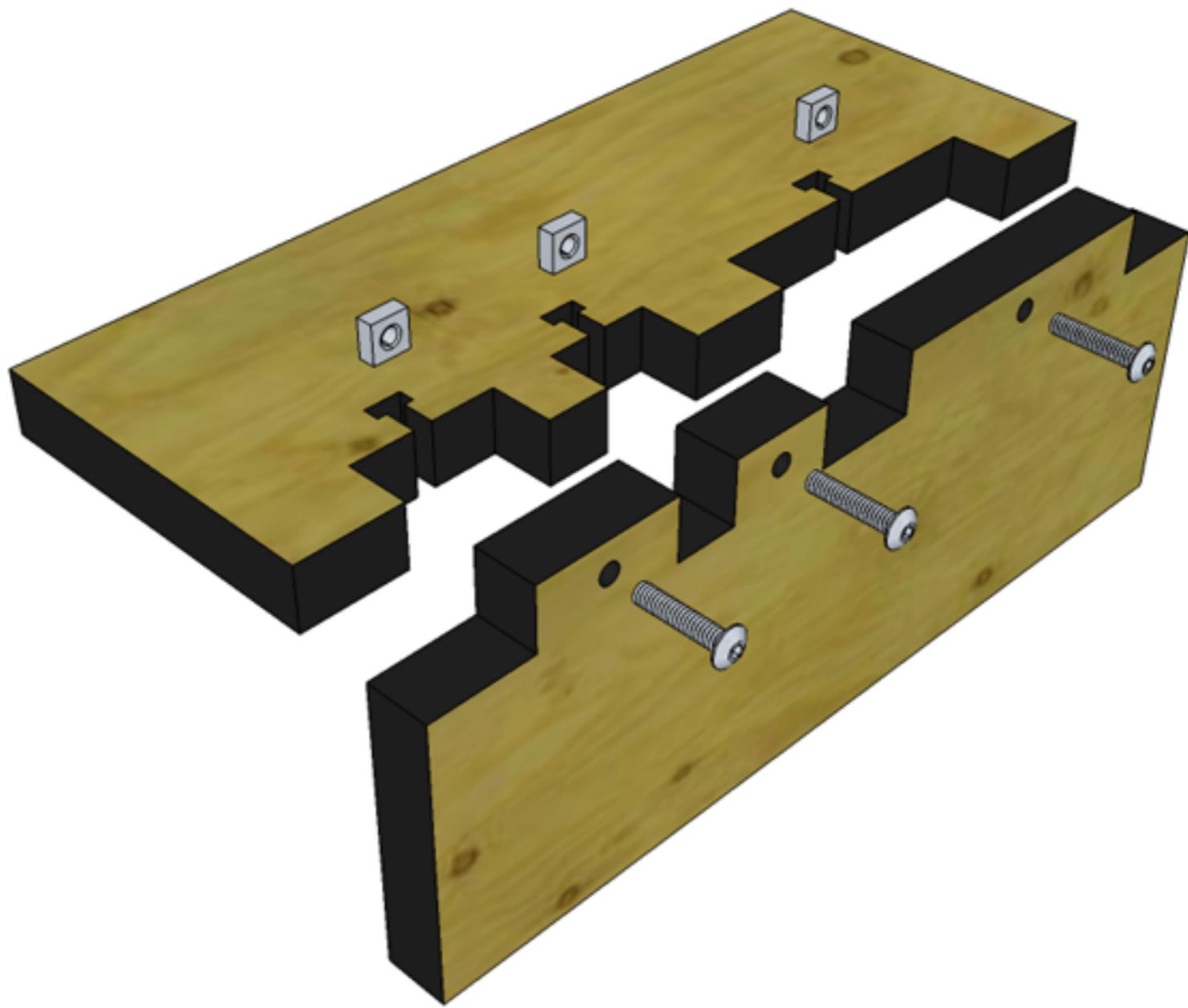


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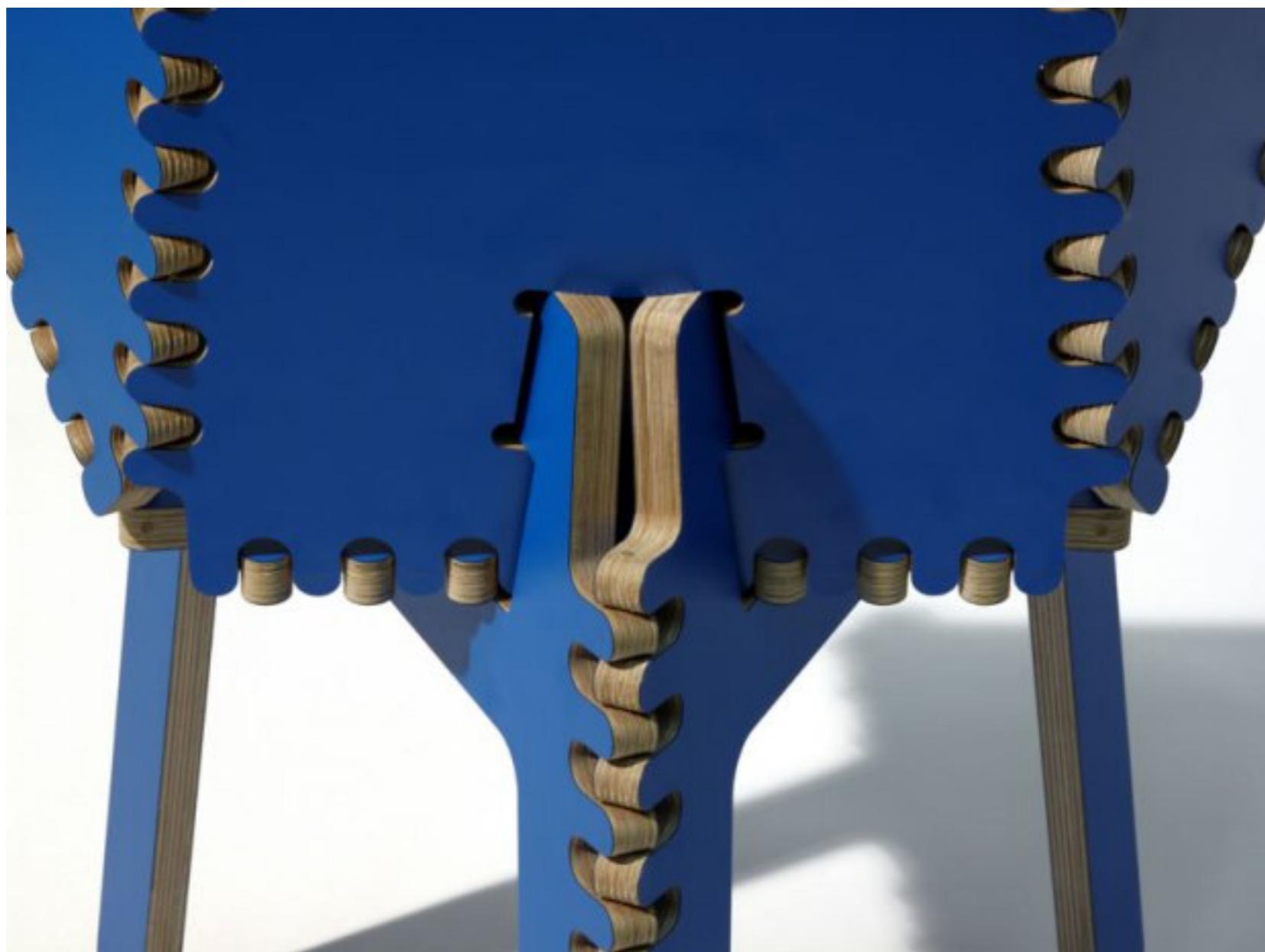
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Finger joint and modified finger joint



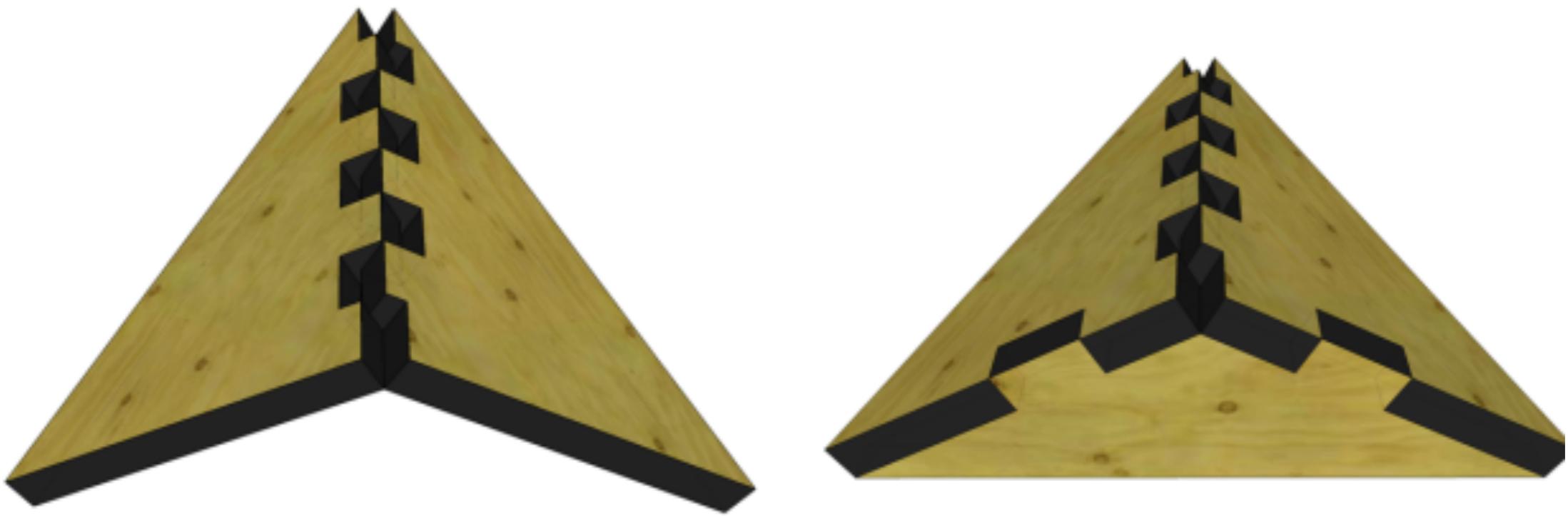
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Combination finger joint and t-slot and captive screw

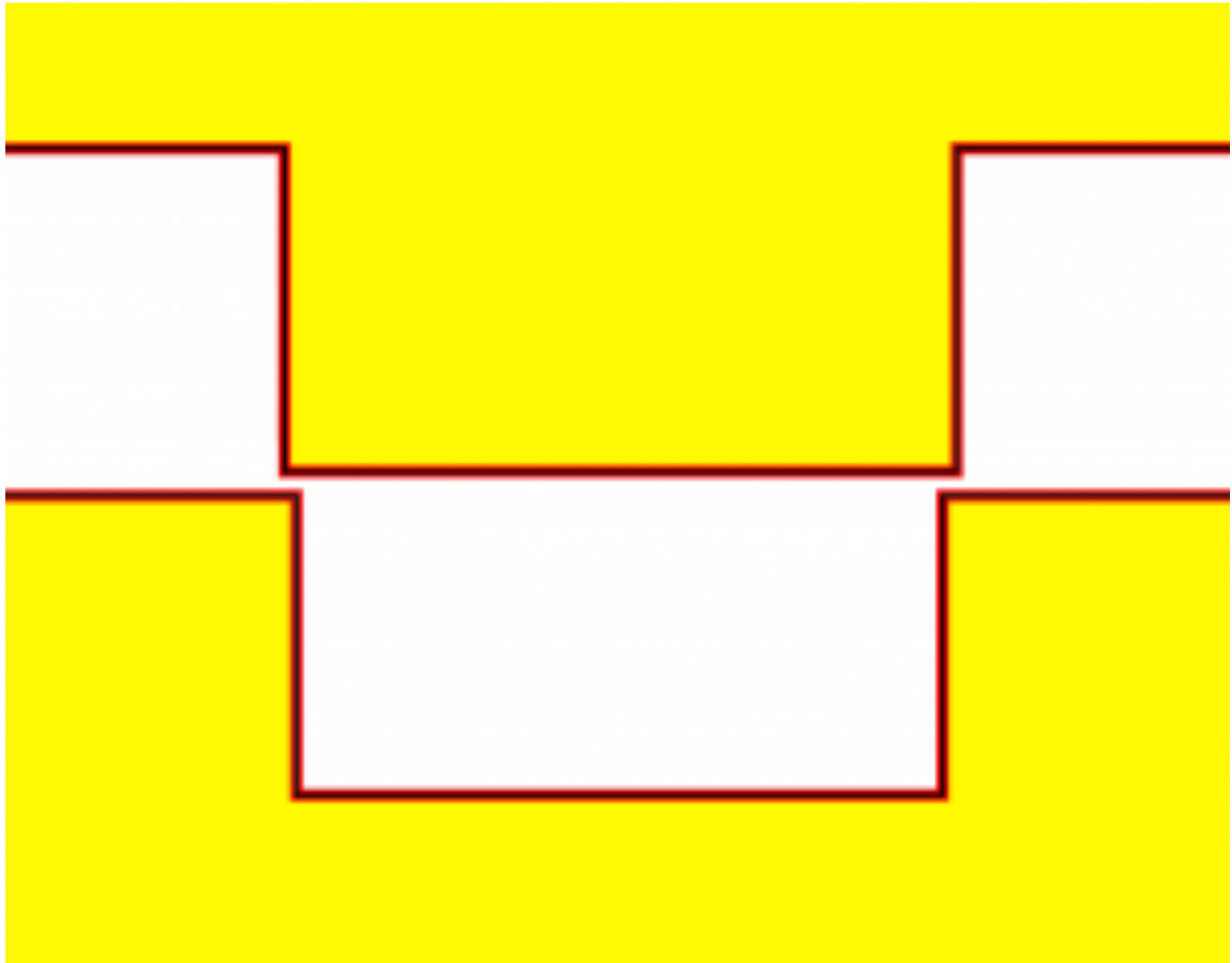


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FINGER OR BOX JOINTS CAN BE MODIFIED TO FIT AT ANGLES



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Problem with laser cut finger joints is consistent kerf thickness
Things like Old laser tubes
Differing material thickness

Works great for wood because it gives a bit plastic can and will crack.

Kerf-

Finger drawn +.005

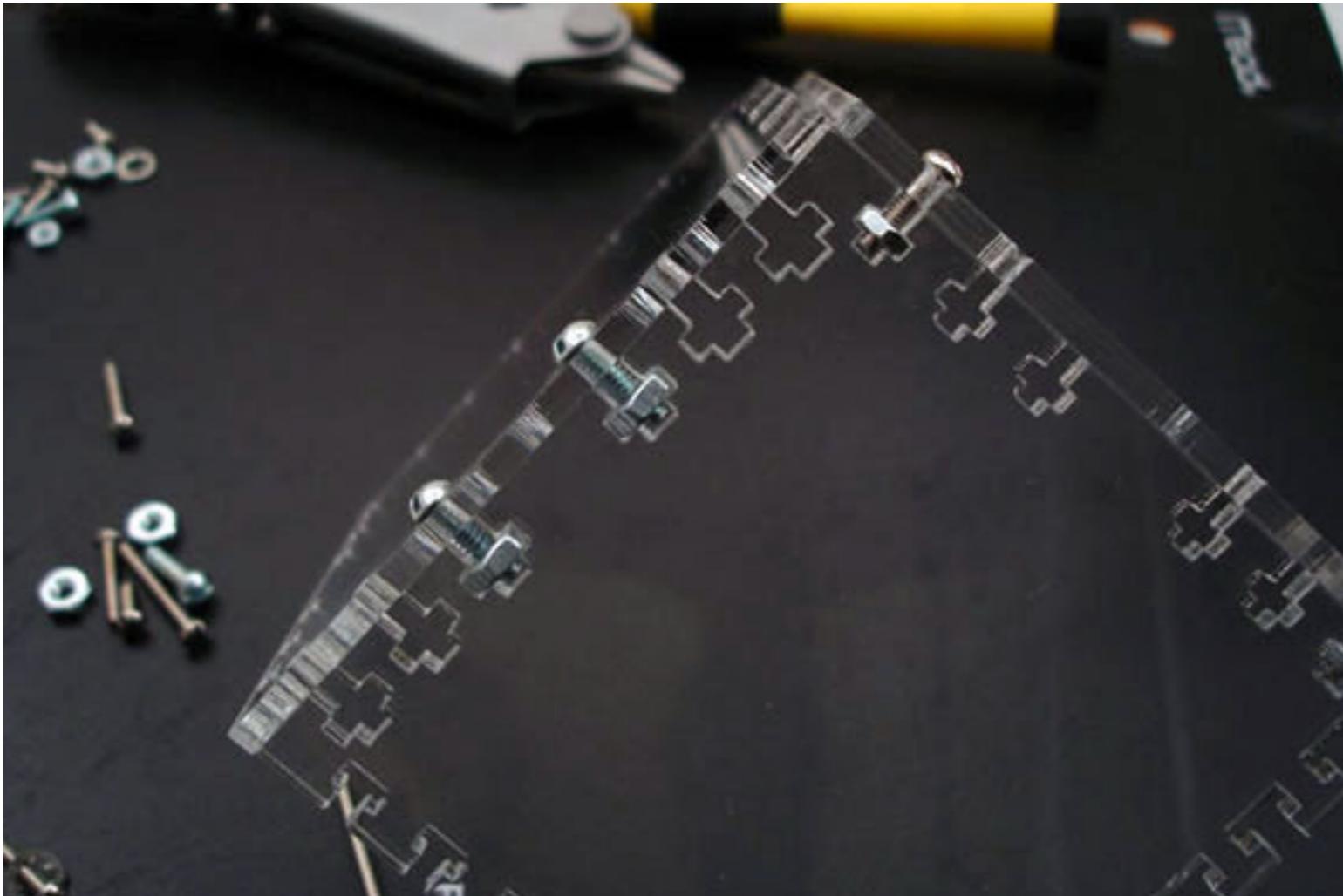
Notch drawn -.005 so that they are equal distance



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BoxMaker

<http://boxmaker.rahulbotics.com/>



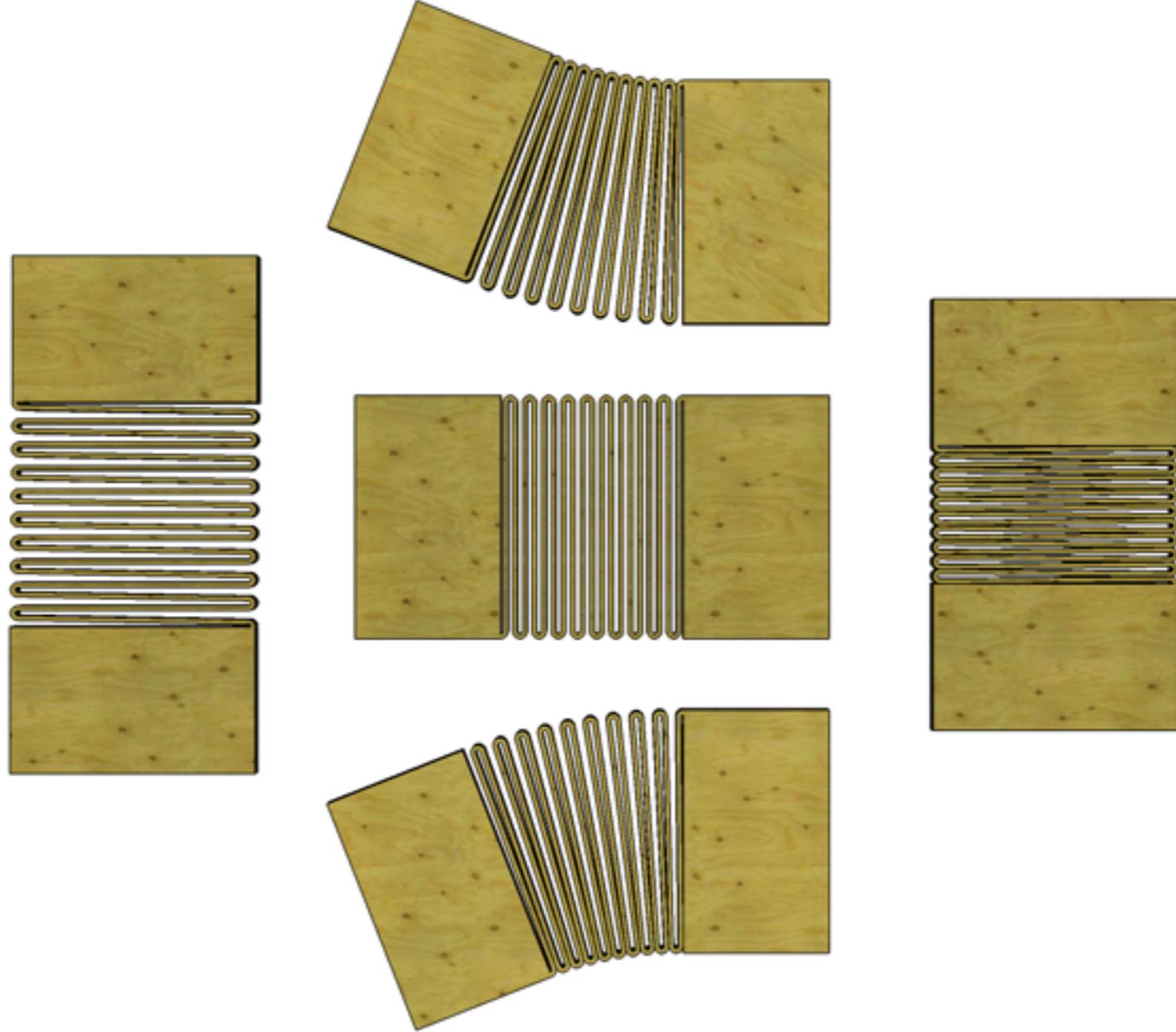
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MAKERCASE

<http://www.makercase.com/>

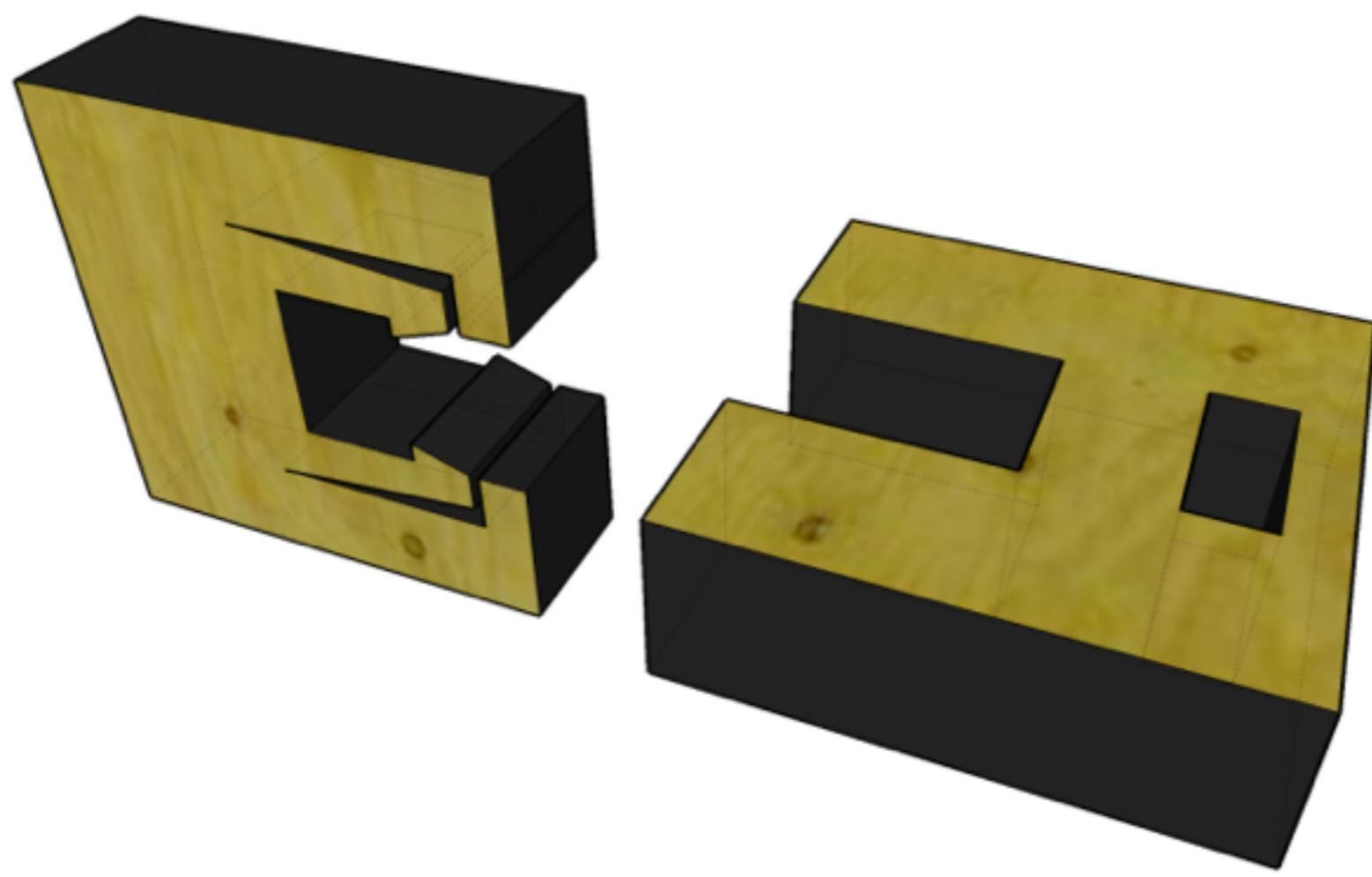
Other kinds of joints brought to you by

Make:

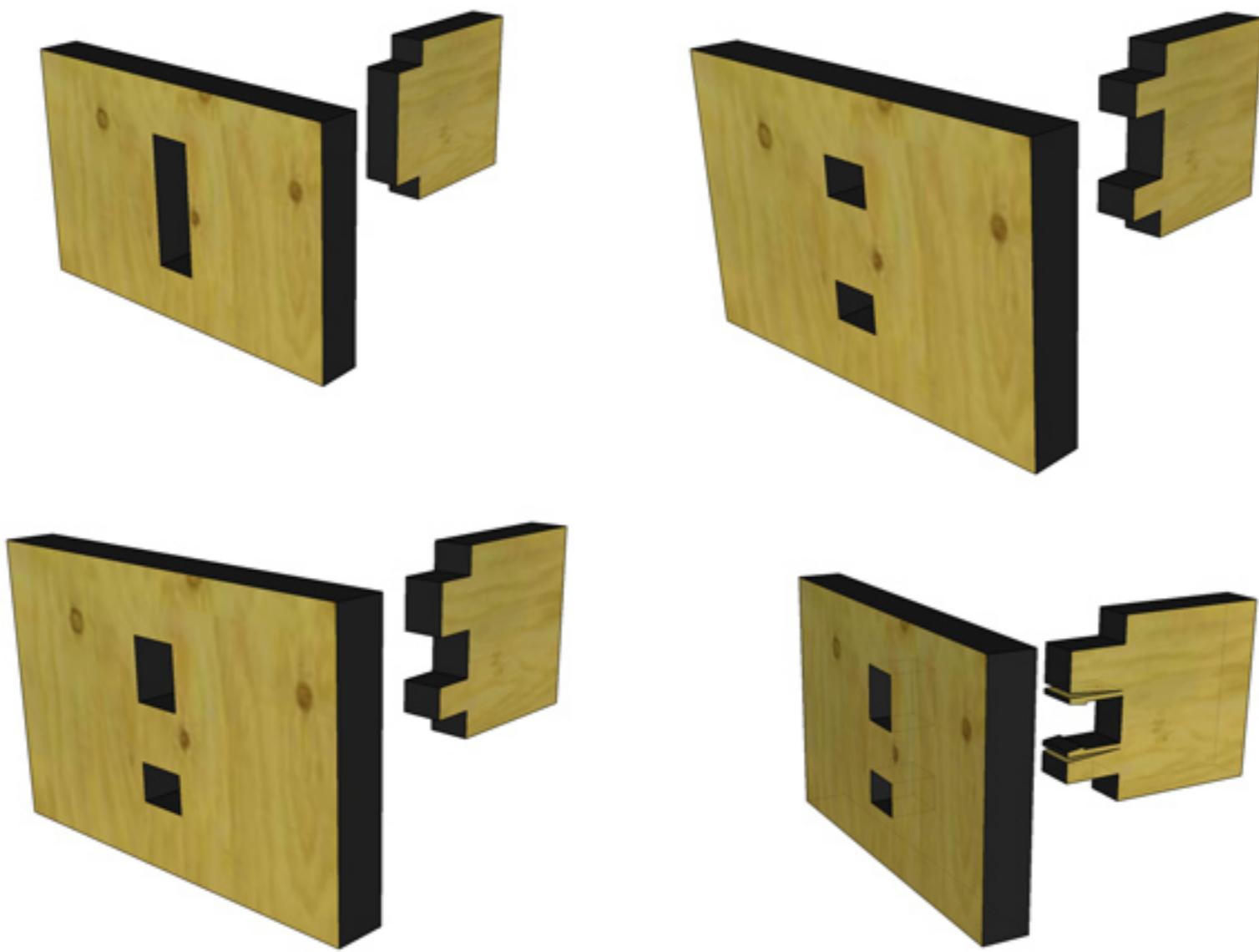


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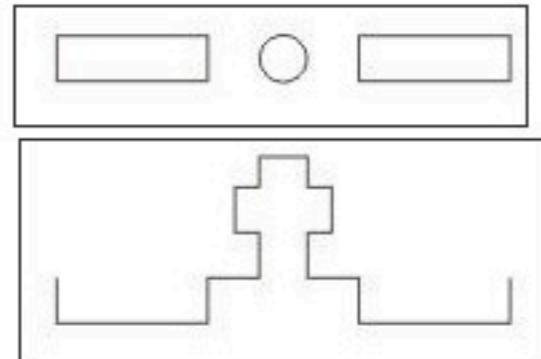
MAKE MAGAZINE – LIVING HINGE



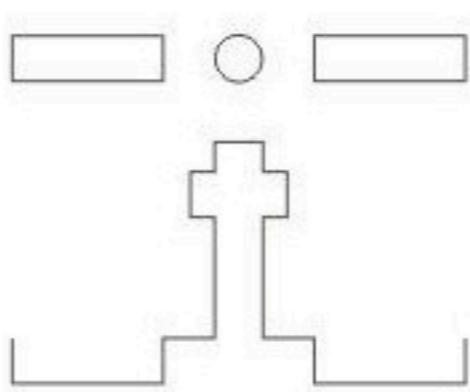
Wednesday, October 23, 13



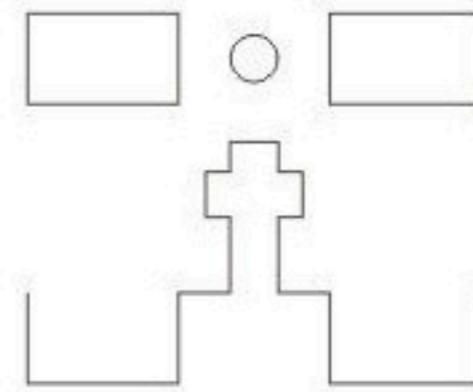
3mm Sheet Stock
3M x 10mm Machine Screw



3mm Sheet Stock
3M x 16mm Machine Screw

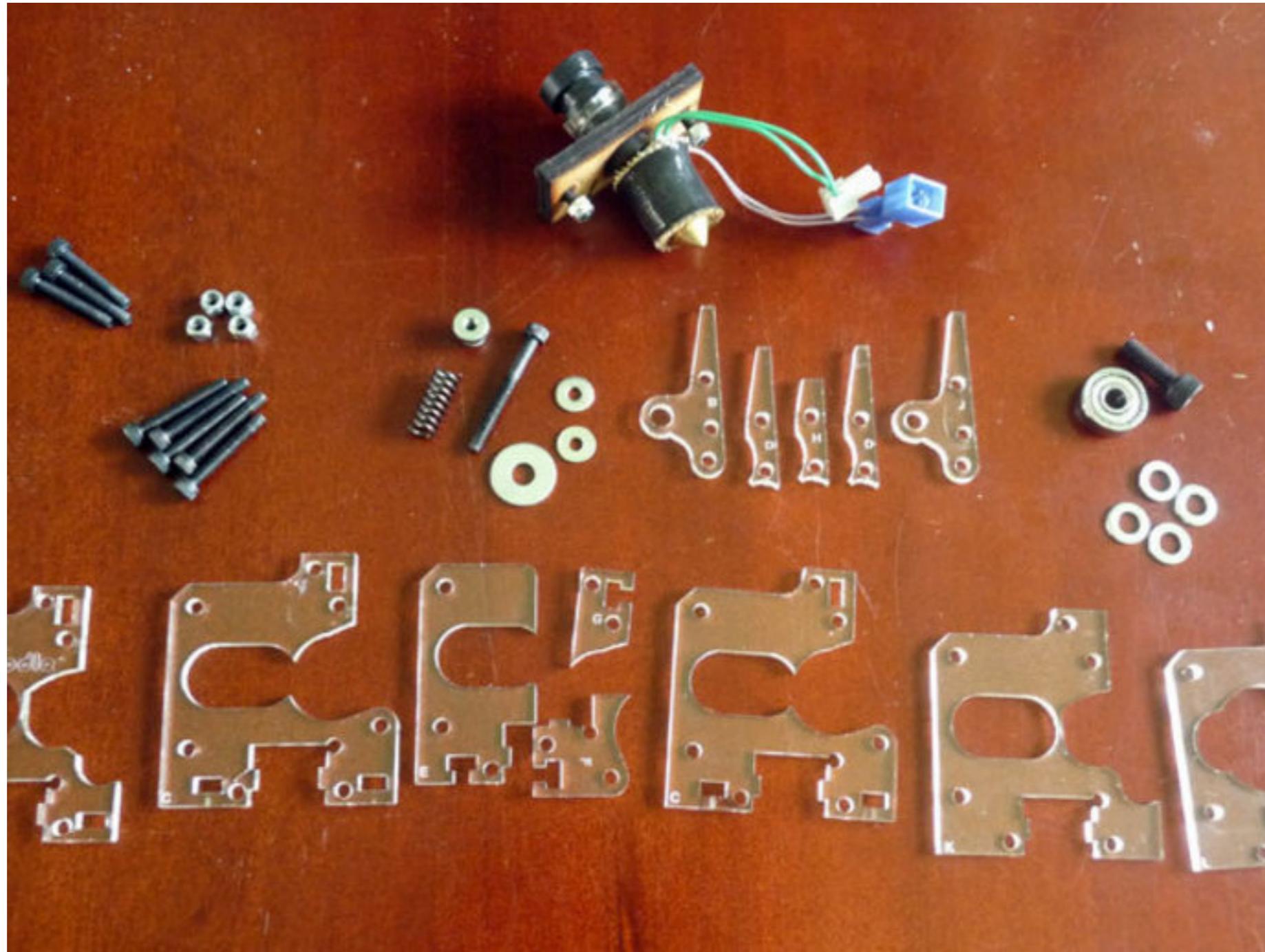


6mm Sheet Stock
3M x 16mm Machine Screw



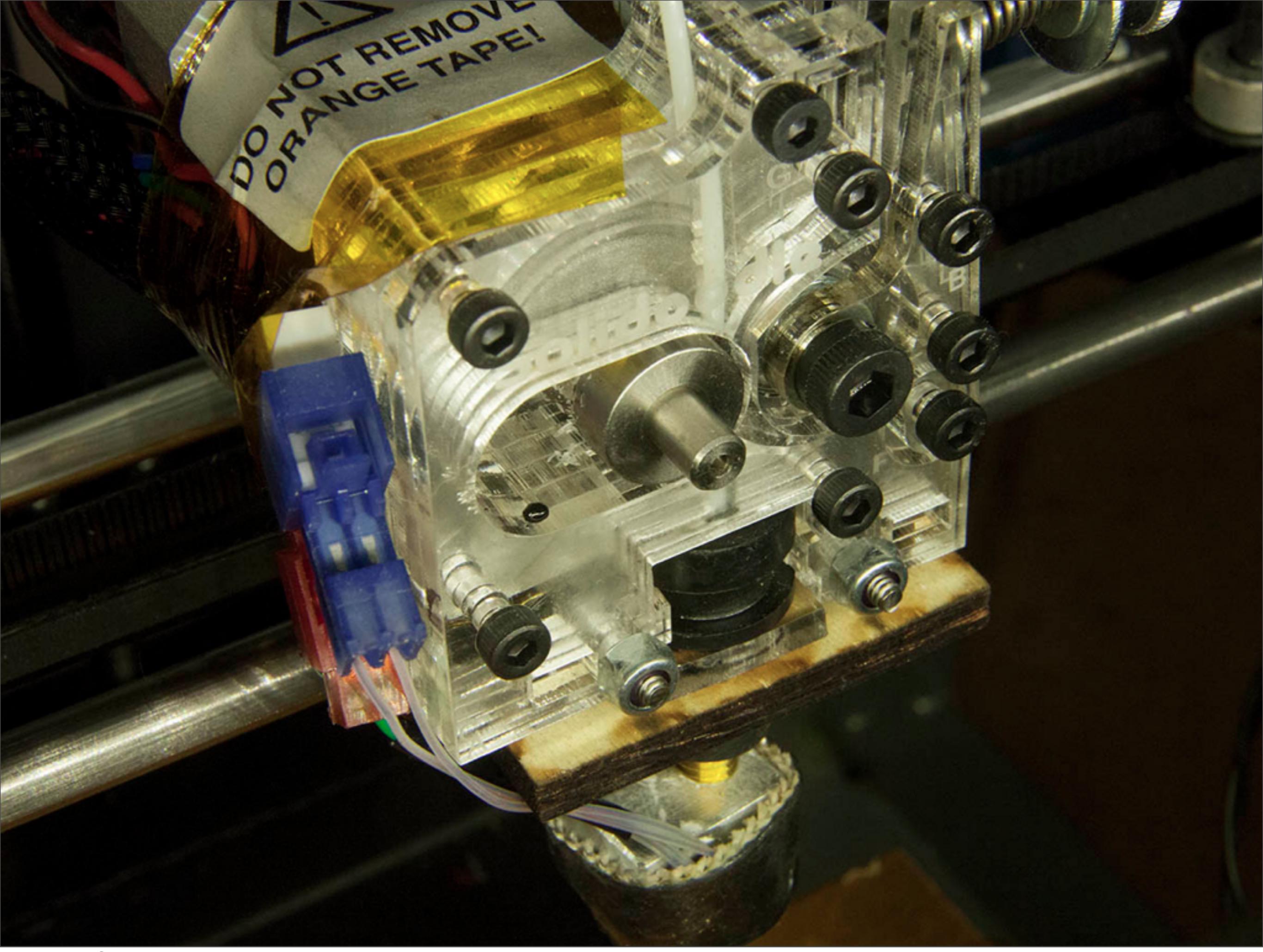
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Extra long part is for length of screw beyond captive nut. Templates for use in inkscape. Free for you if you read the assigned instructable.



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Stacked with through bolts and captive nuts

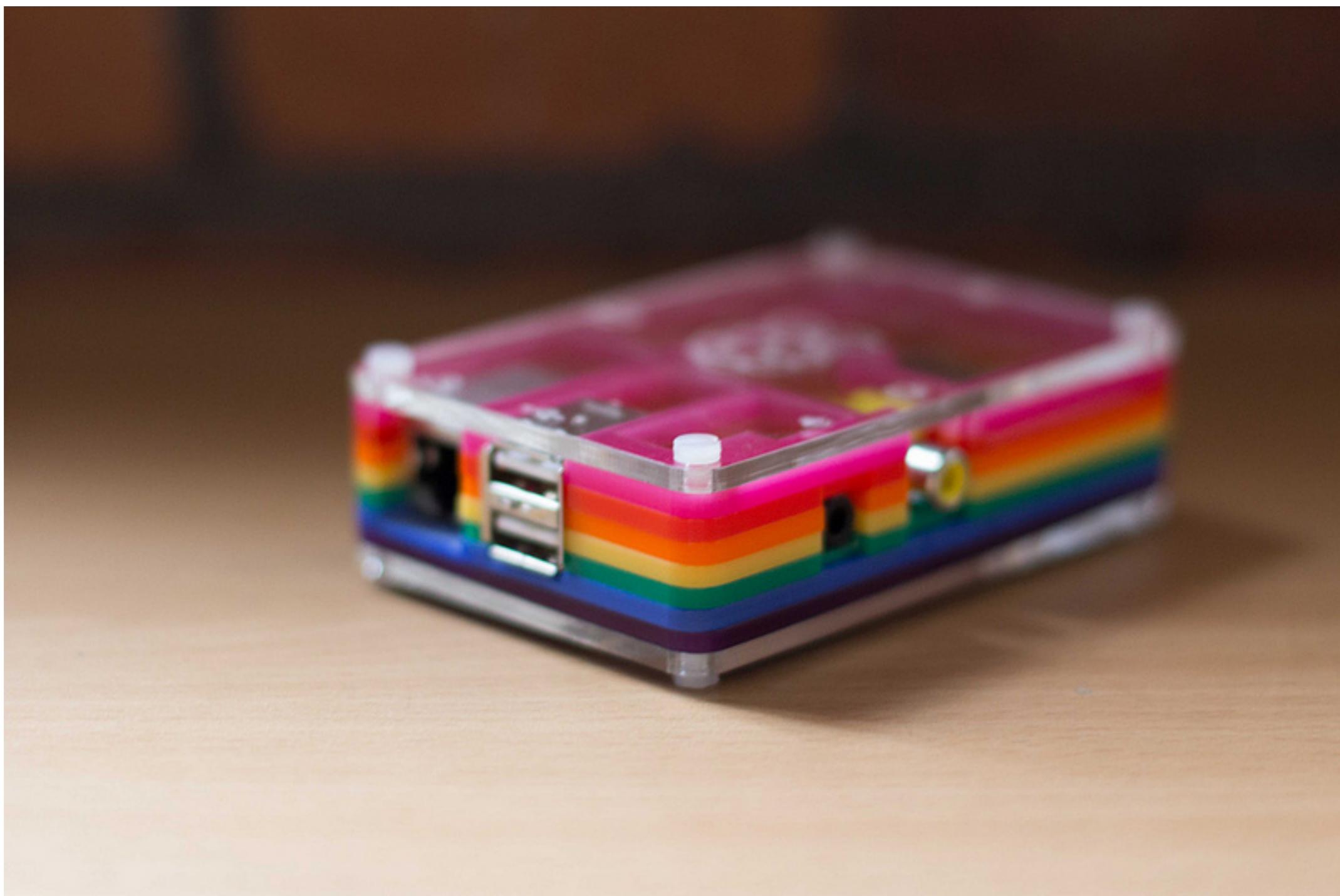


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Nice plastic screws



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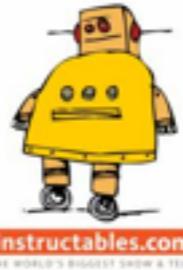
Now, if you own some machines you can invent



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Assignment:

1. Read the **Make:** article on joints.



2. Read the [instructables.com](#) on laser cut fabrication.

3. Read making snug joints in acrylic / wood

4. Design a 6 sided box using a minimum of 2 different joints. Decorate as you will