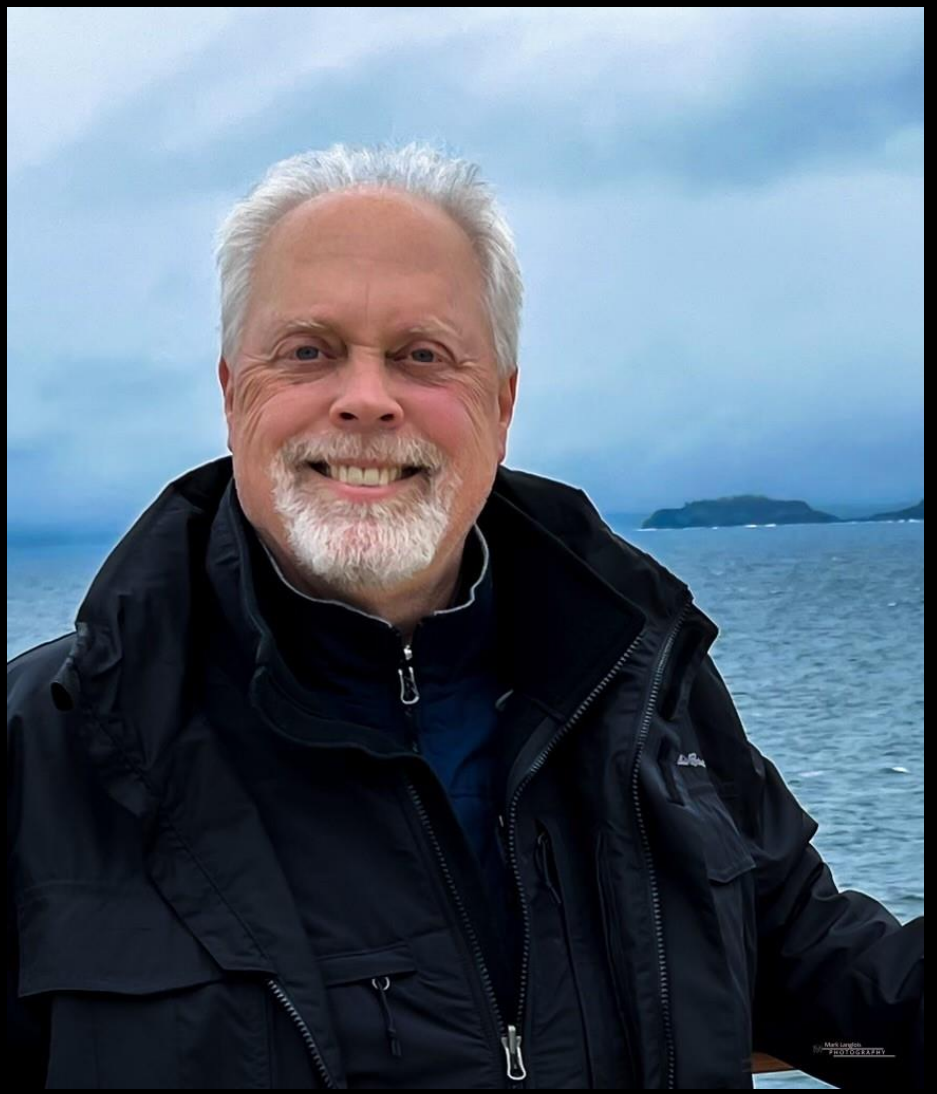
Angular Progression Table, Design and Construction by Mark Langlois

About the man behind the design and creation of the Angular Progression Table.



Name: Mark Bradford Langlois

Status: Married with Children, Grandchildren

Education: B.S. Liberal Arts, Central Michigan University Sociology, Industrial Technology, Computer Science

Career: Design, Engineering, Product Life Cycle Management, IT Consultant, Software Development

Music: J.J. Cale, Jackson Brown, Mark Knopfler, Snowy White, Jazz, Classical

Favorite Book: Catcher in the Rye, by J.D. Salinger

Drink: Oban Single Malt Scotch, Jack Daniels or whatever you have

Cigar: Rocky Patel Vintage 1990, 1992, Undercrown Maduro Robosto

Hobbies: Travel, Photography, Music, Art, Creative Design, Engineering and Metalworking

Book Photography by Mark Langlois
Book Completion Date: October, 2022

Certification of Authentication and Registration Of Ownership

Angular Progression Table (2” x 8 Degrees, continuous progression)
Construction: 1” x 1” steel tube and 3/8 diameter Steel Rod, ¼” plate glass shelves, notched with 1” bevel all around.

Original Design By Mark Langlois, Created By Mark Langlois

Purchased By *Gifted To The “Lower Level” Mark & Marianne Langlois*
Date *August 10, 2022*
Color *Disco Aqua,* PPB-7038, PSS-0106, PPS 2974
Design Iteration Number: 121775-3A
Registration Number: ML-ISC-3A-0 0 0 0 1

Disco Aqua PPB-7038, PSS-0106, PPS 2974

Signature Plate Located Under Bottom Shelf, Right Cross Rail

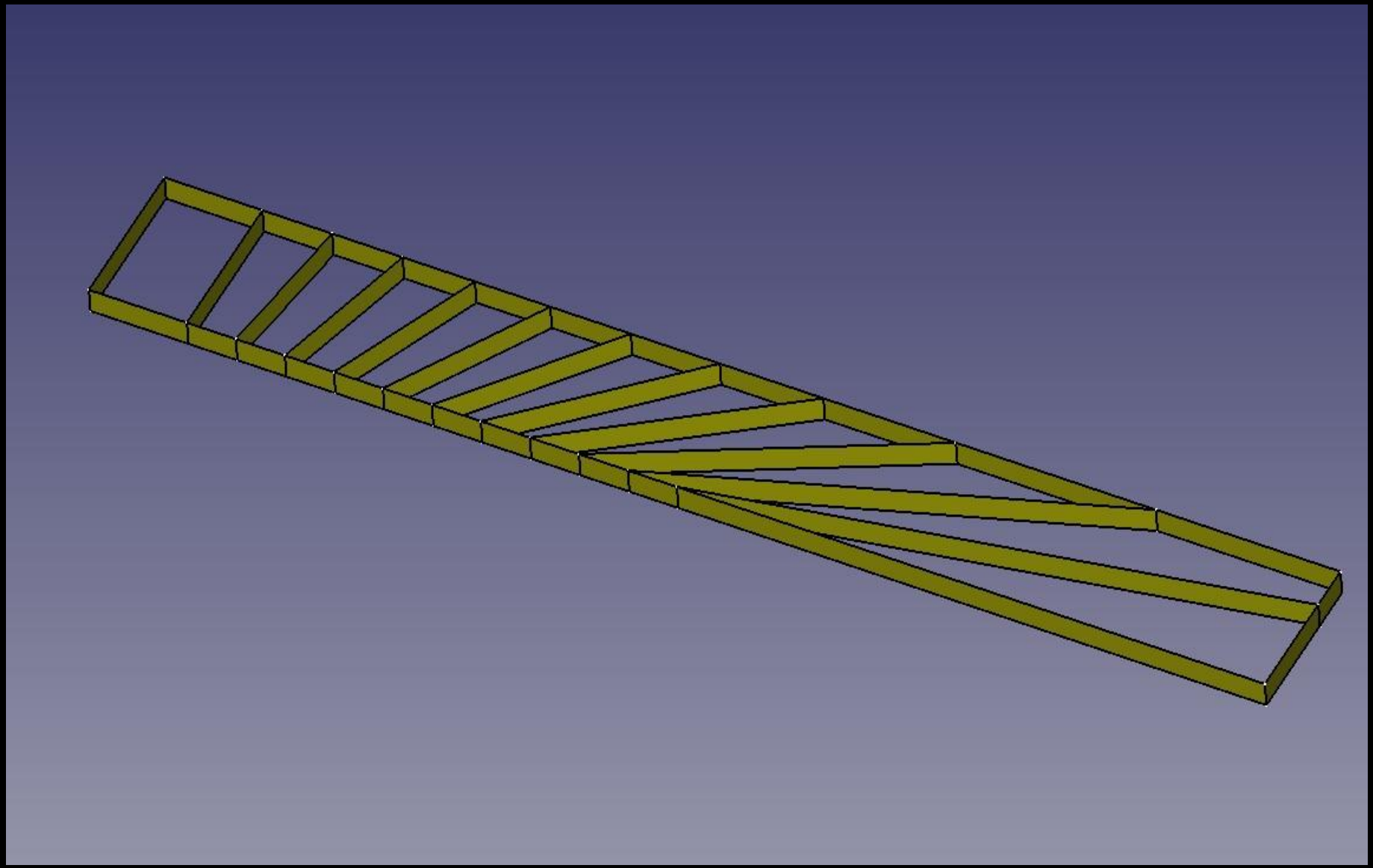
Introduction:

The creation of the Angular Progression Table was driven by my desire to marry elements of the 3/8 steel rod I use to create my 42” circular tables and the 1” square steel tube that I use for my wine rack configurations.

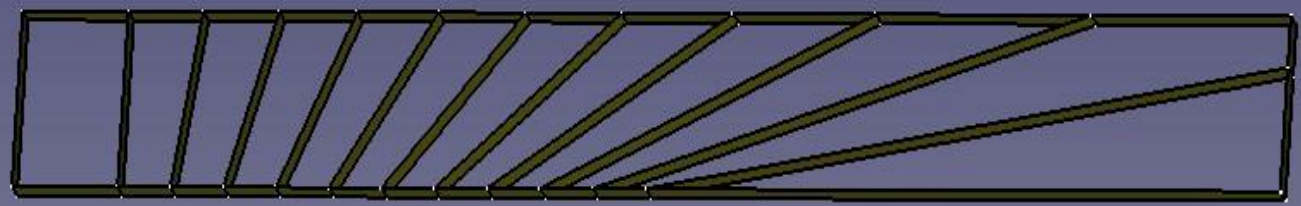
I incorporated an angular geometric progression design in 3/8” steel rod on the interior of each shelf panel. I experimented with a number of angular configurations in my CAD system to get some idea of what I thought would look interesting. I settled on an angular progression with a 2” step and an 8 degree increment. Starting from vertical and ending with a total progression step of 20” and an 80 degree total sweep angle.

Each panel was made using the same fixture and tooling. After creating each of the panels, I experimented with positioning them symmetrically and in a reverse pattern. I settled on reversing the middle panel to create a sequence of angular sweeps from the top to the bottom shelf.

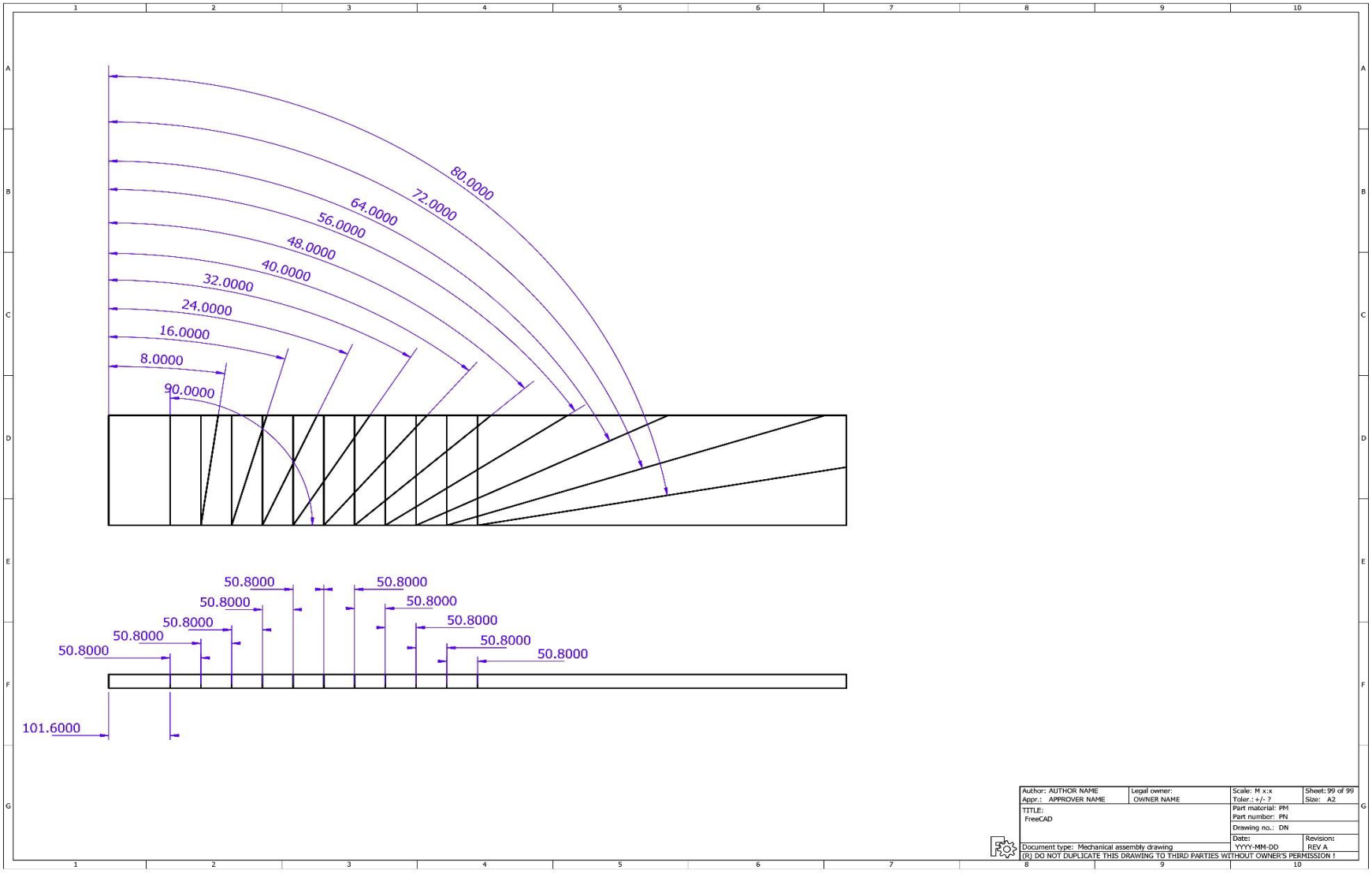
The Angular Progression Table is part of a catalog and family of designs that I have created. The Angular Progression Table is: Design Iteration Number: ML-ISC-121775-3A.



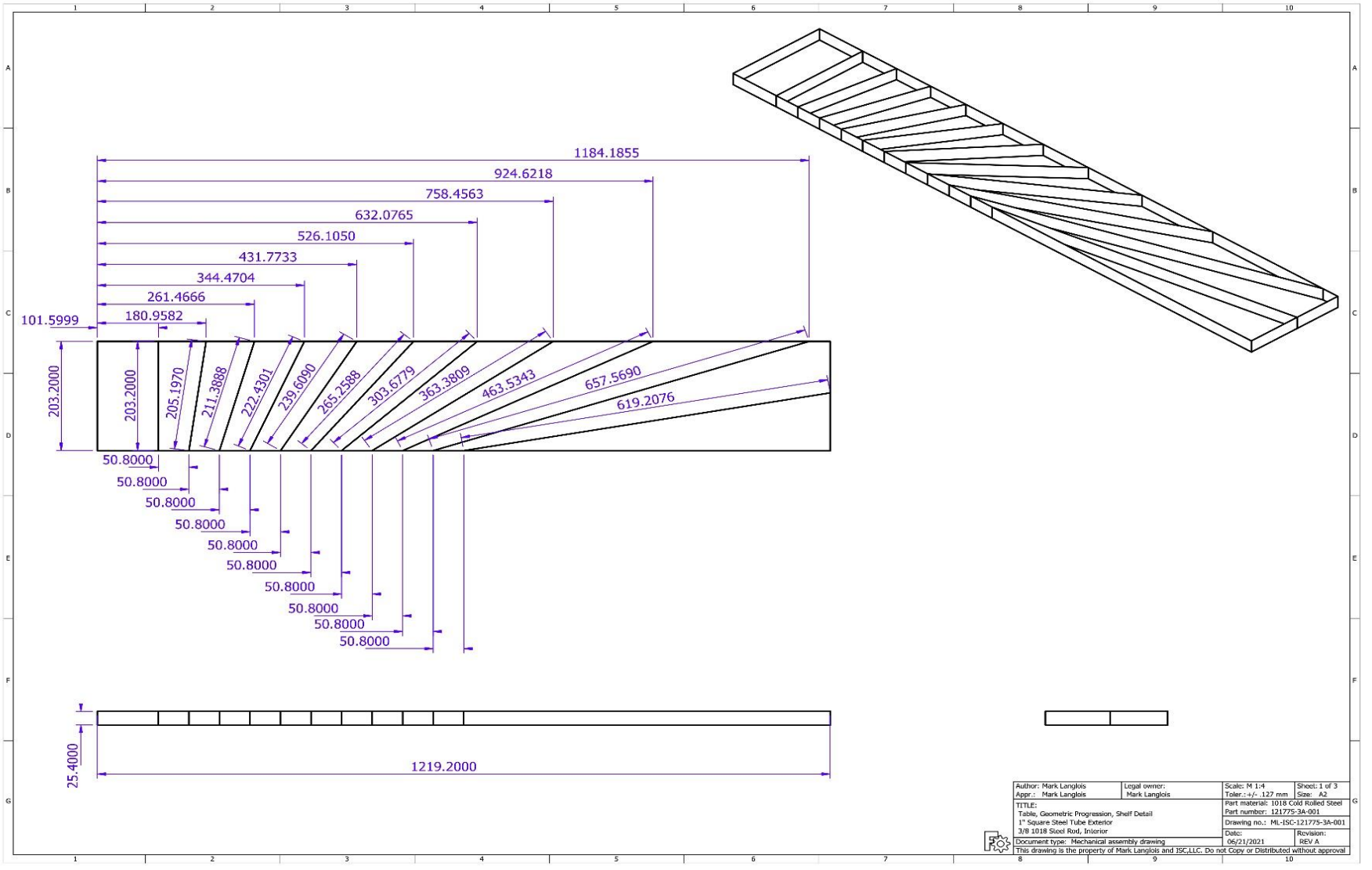
Solid model representation of angular progression panel interior rods.



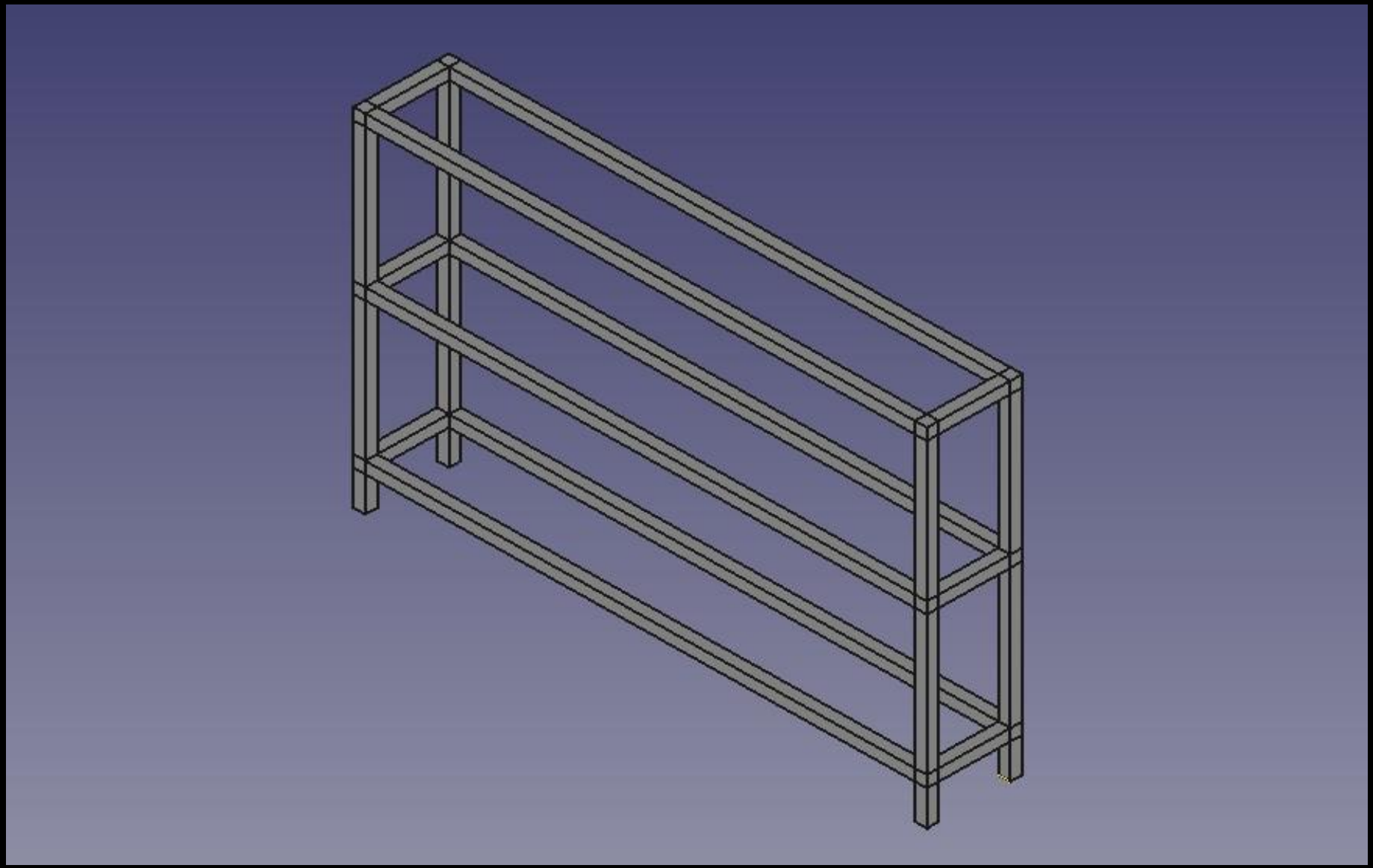
Angular progression panel, 3/8 steel rods used on the interior of the panel.



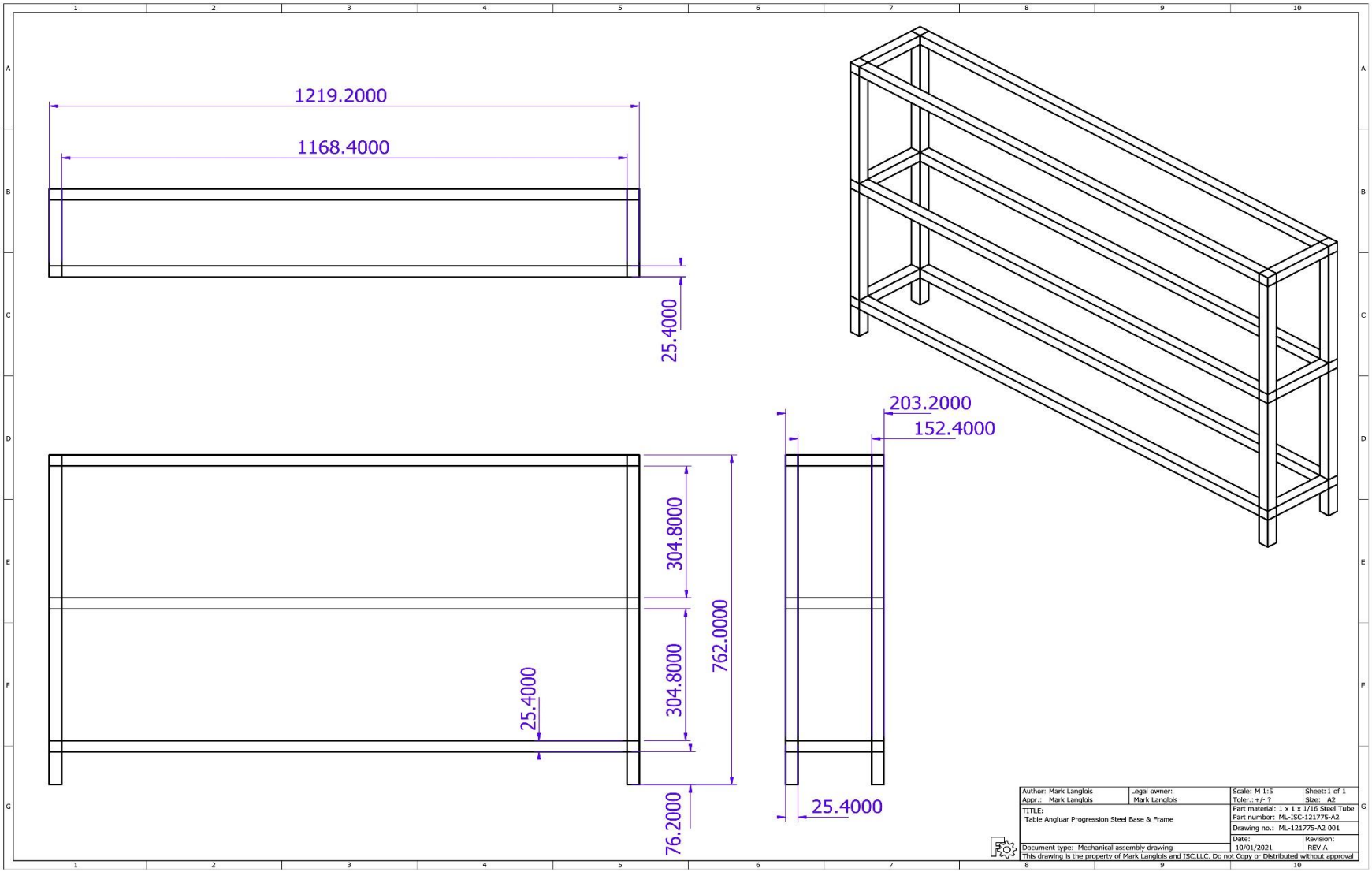
Angular Progression Panel Drawing: Step size 2” X 8 degrees, 10 iterations from vertical.



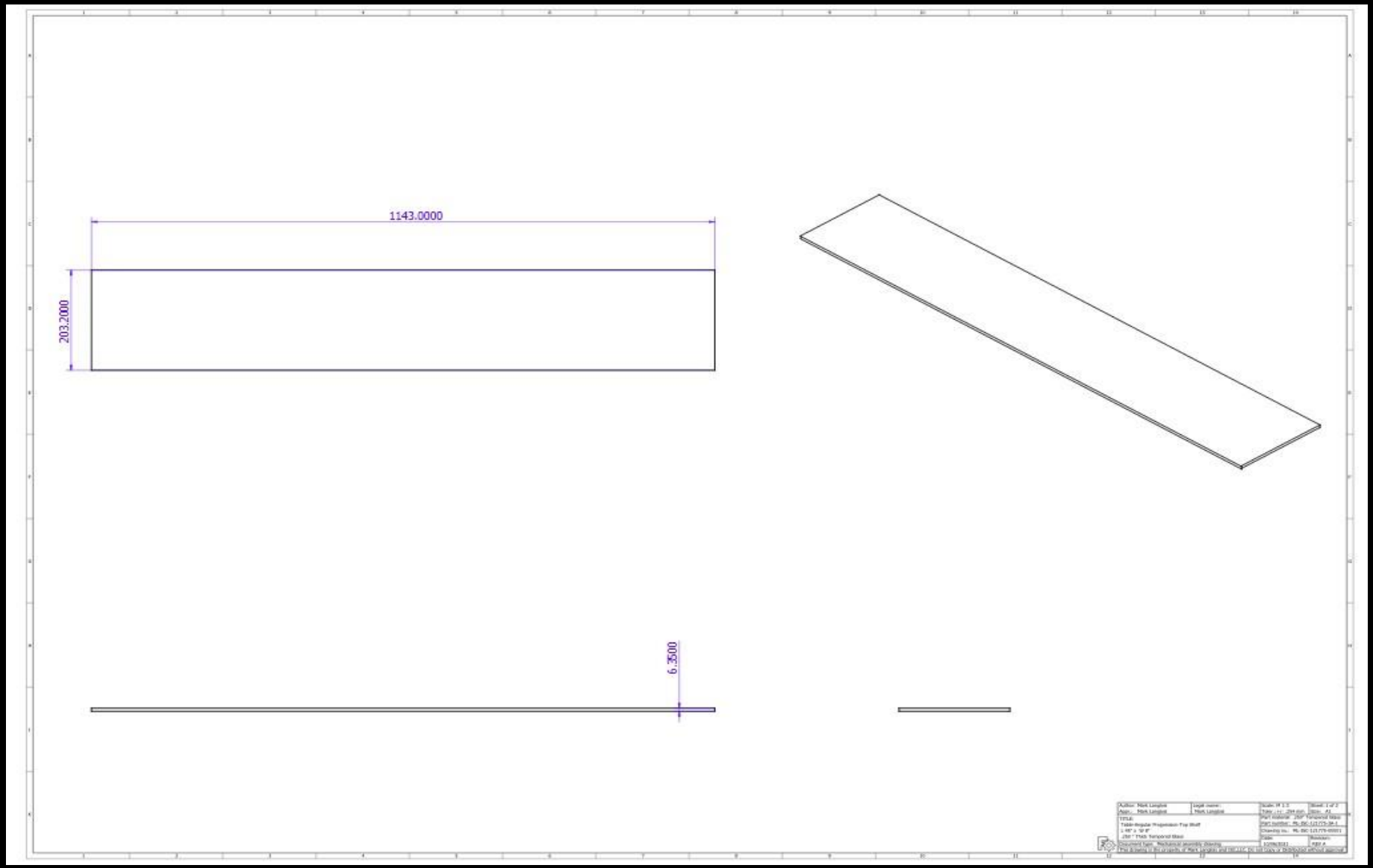
Angular Progression Panel Drawing: 3/8 Steel rod positions (X, Y) and steel rod linear lengths.



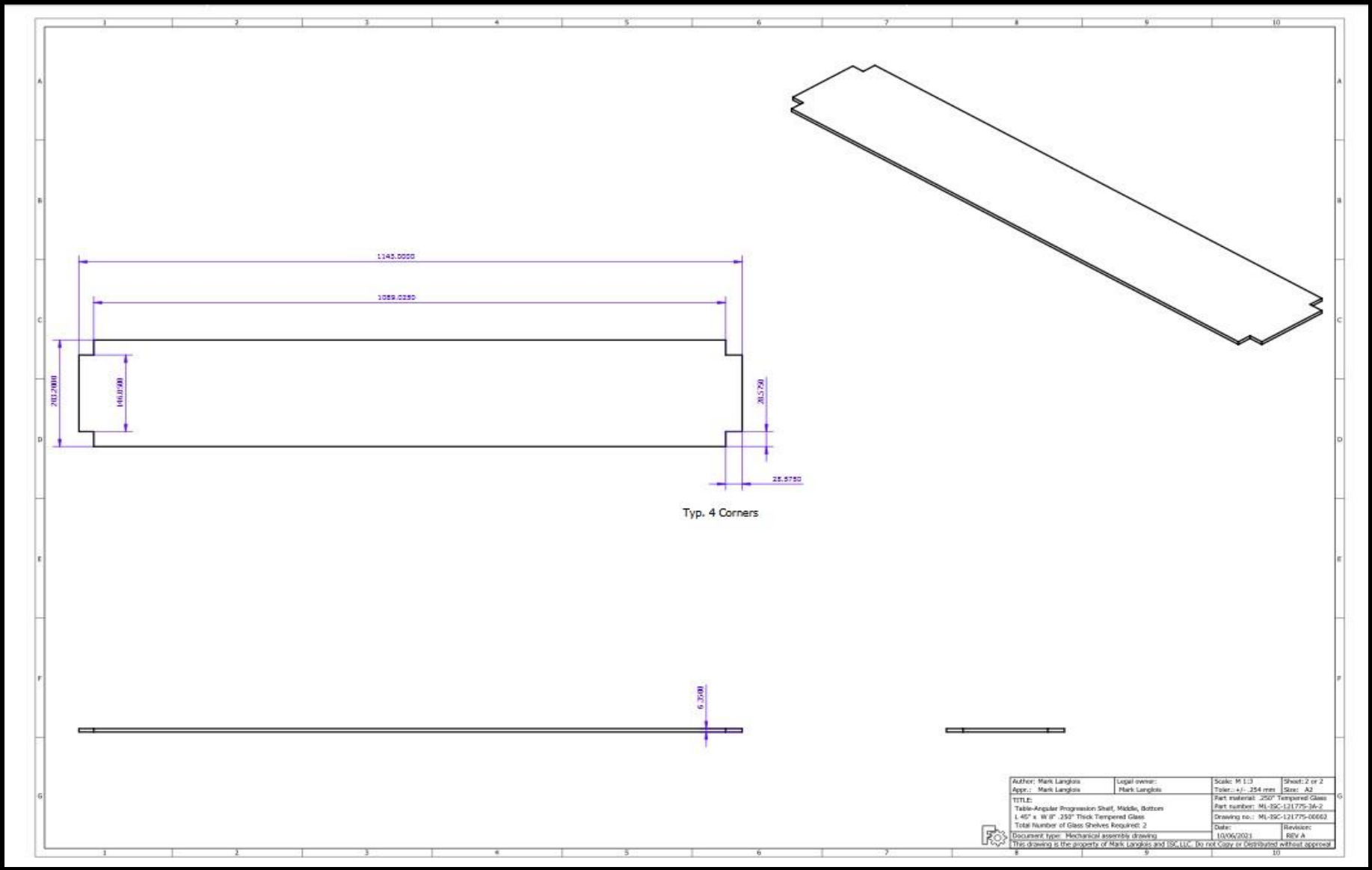
Solid model rendering of the angular progression table; frame and panels.



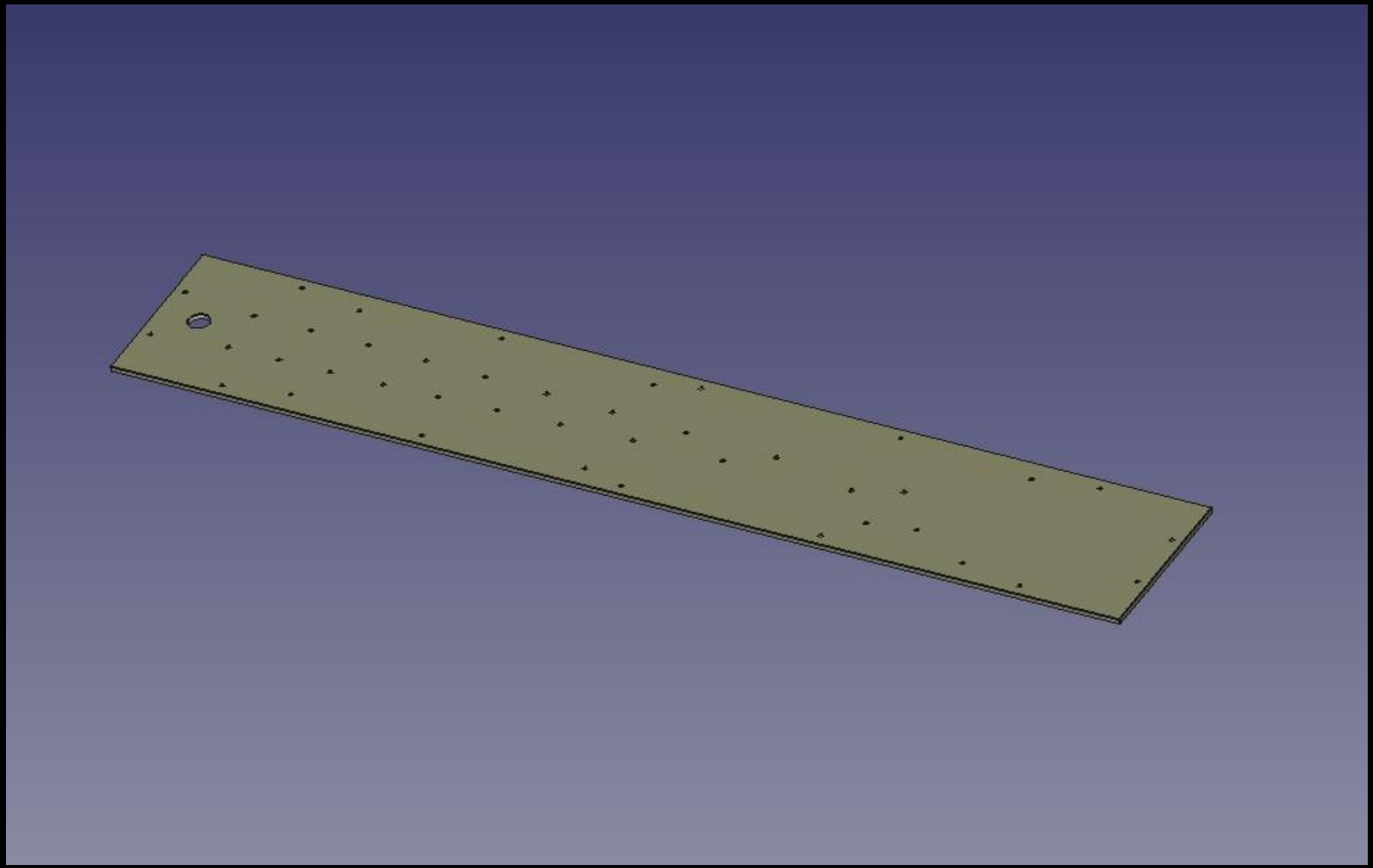
Drawing of angular progression table; frame and panels.



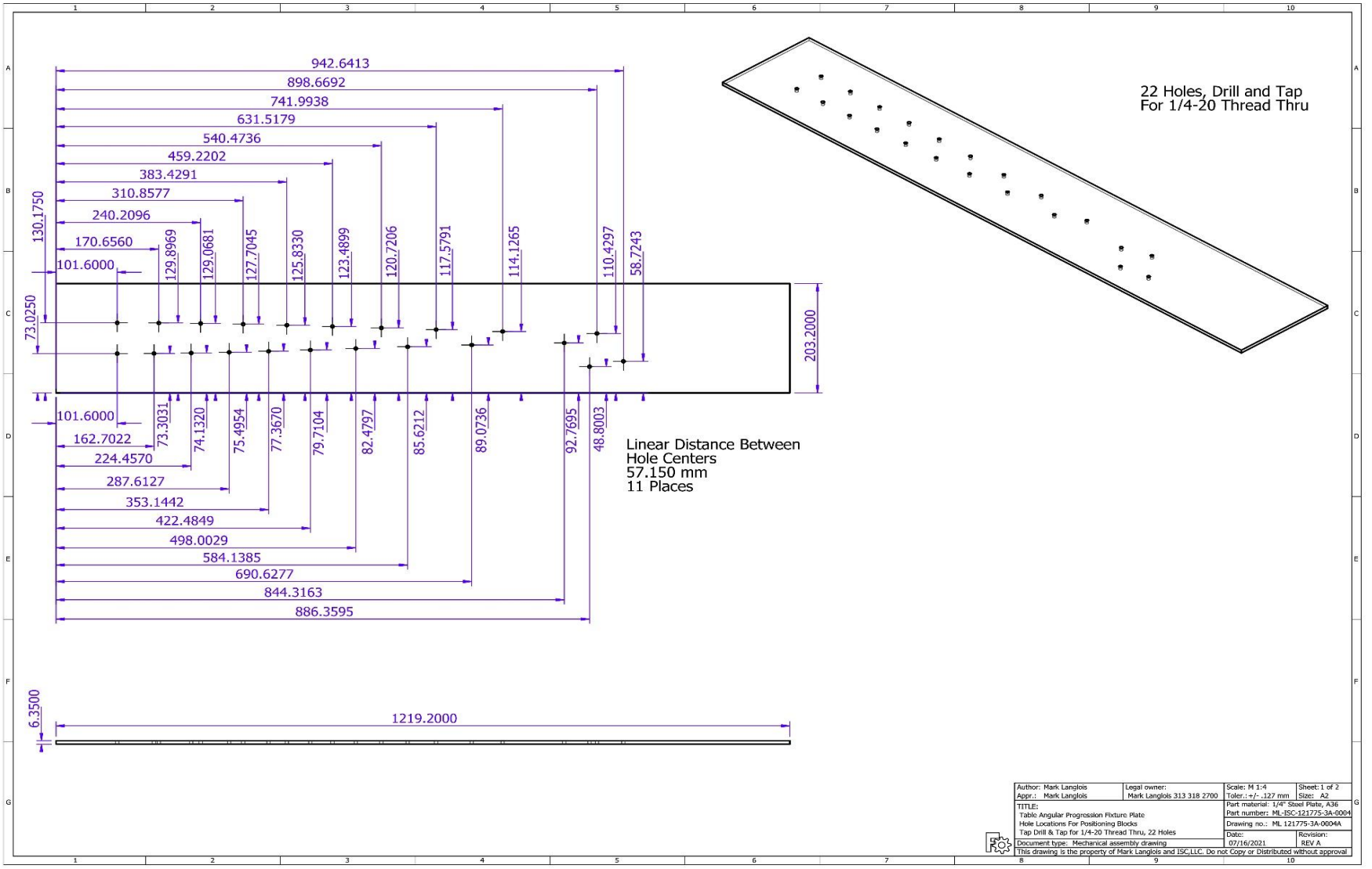
Drawing of angular progression table top shelf, 1/4” plate glass, 1” bevel all sides.



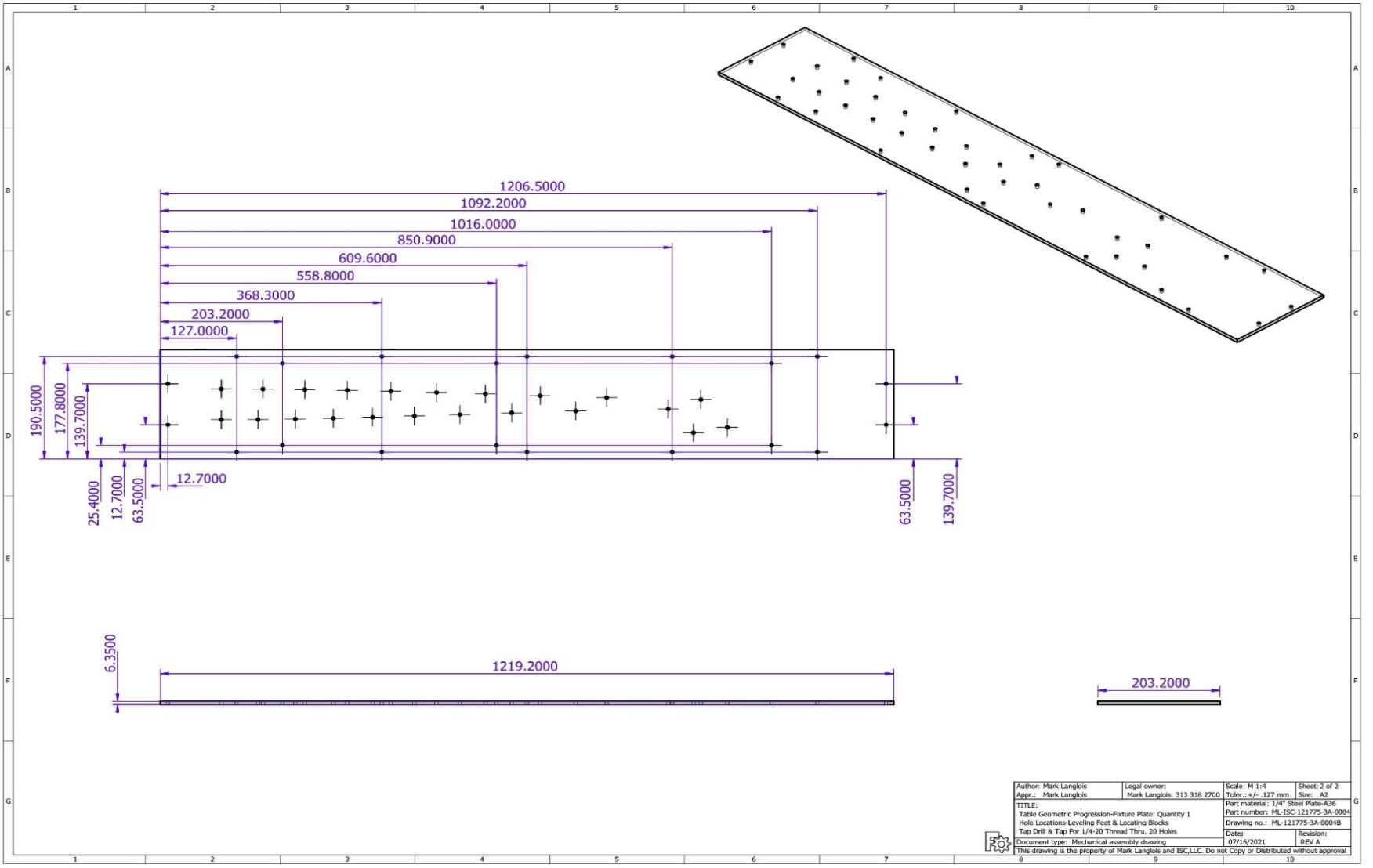
Drawing of angular progression table middle/bottom shelf, 1/4” plate glass, 1 1/8” notches, 4 places, 1” bevel all sides.



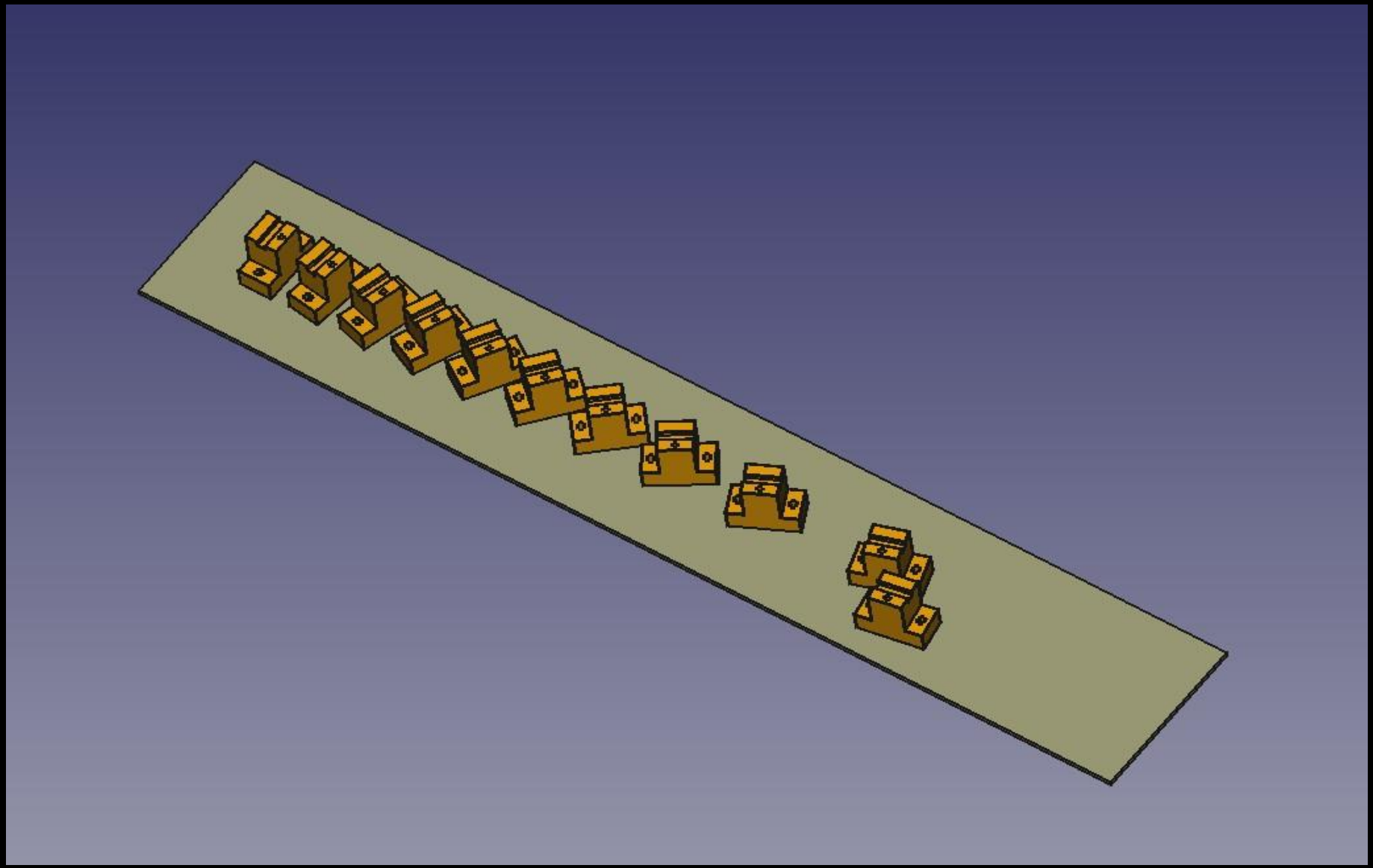
Solid model of angular progression panel fixture plate: The plate locates the positioning blocks, leveling feet and magnetic height spacers.



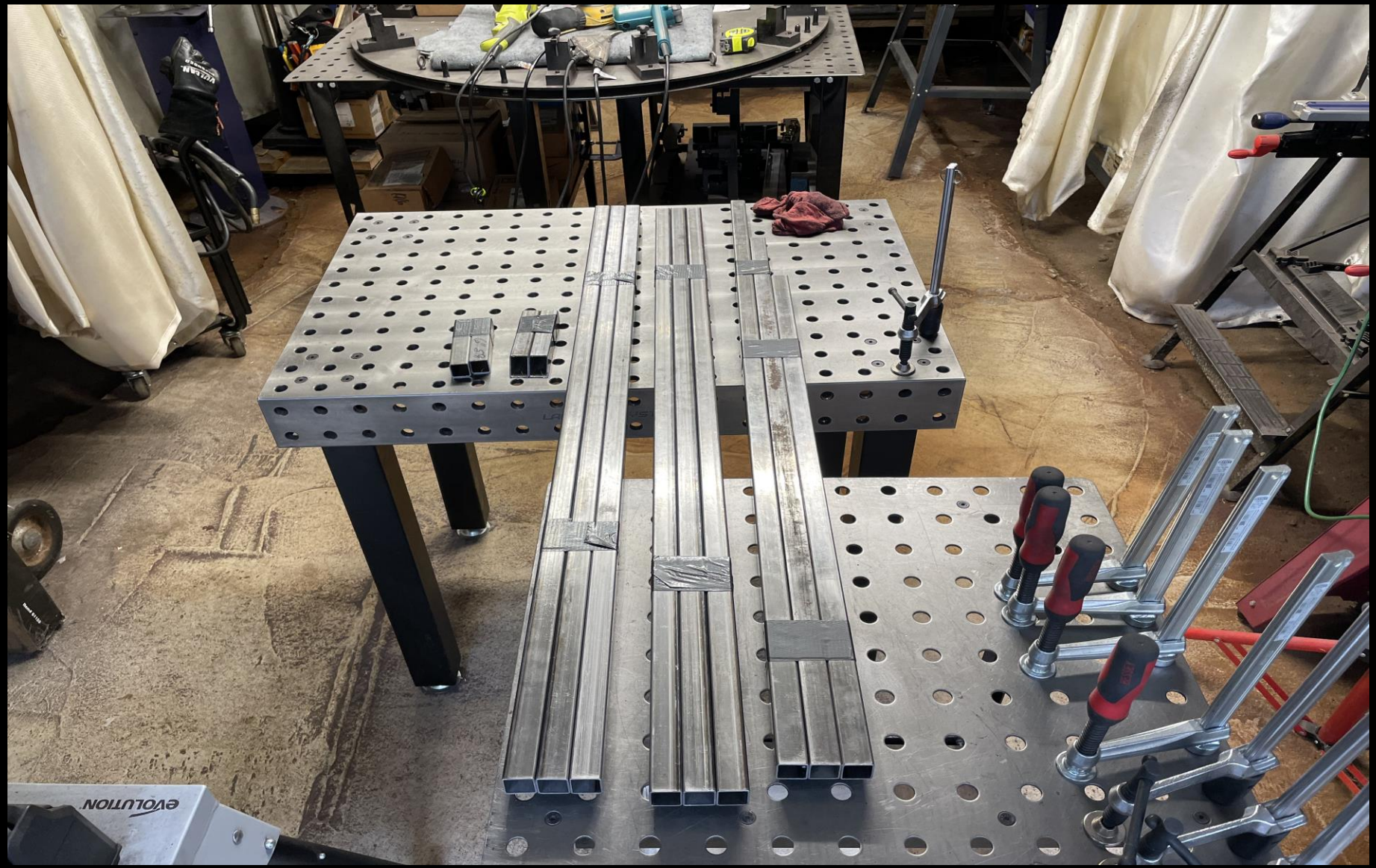
Drawing, fixture plate positioning block hole locations.



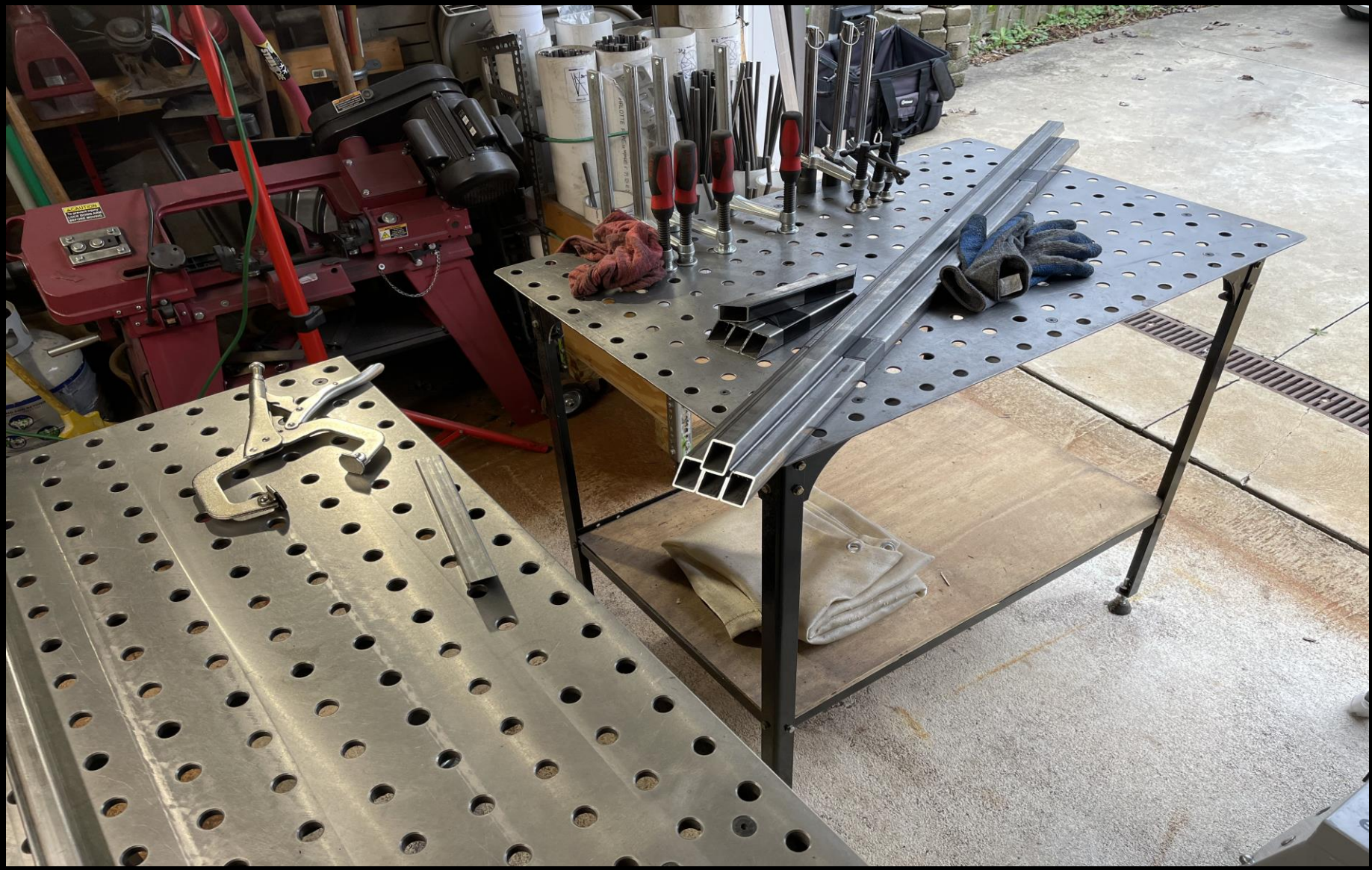
Drawing, fixture leveling feet and rail height hole locations.



Solid model showing positioning blocks located on fixture plate. I leveraged the positioning blocks from my table project in the design of this fixture.



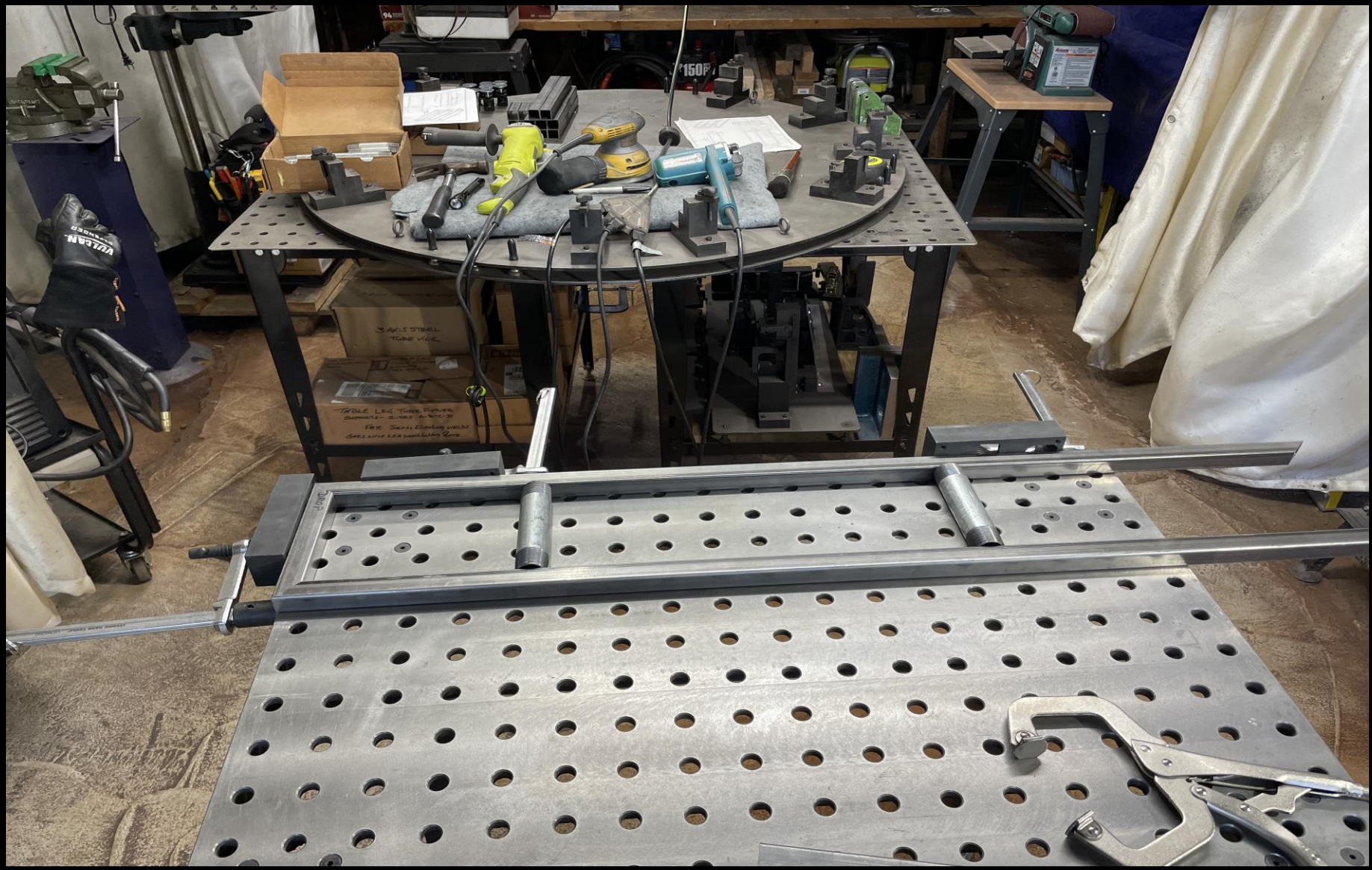
Raw Stock Preparation: The three panels will be created first using 45 degree miter cuts. The stock was stacked and bound so I can cut all three pieces at the same time, insuring the miter cuts are the same for each set.



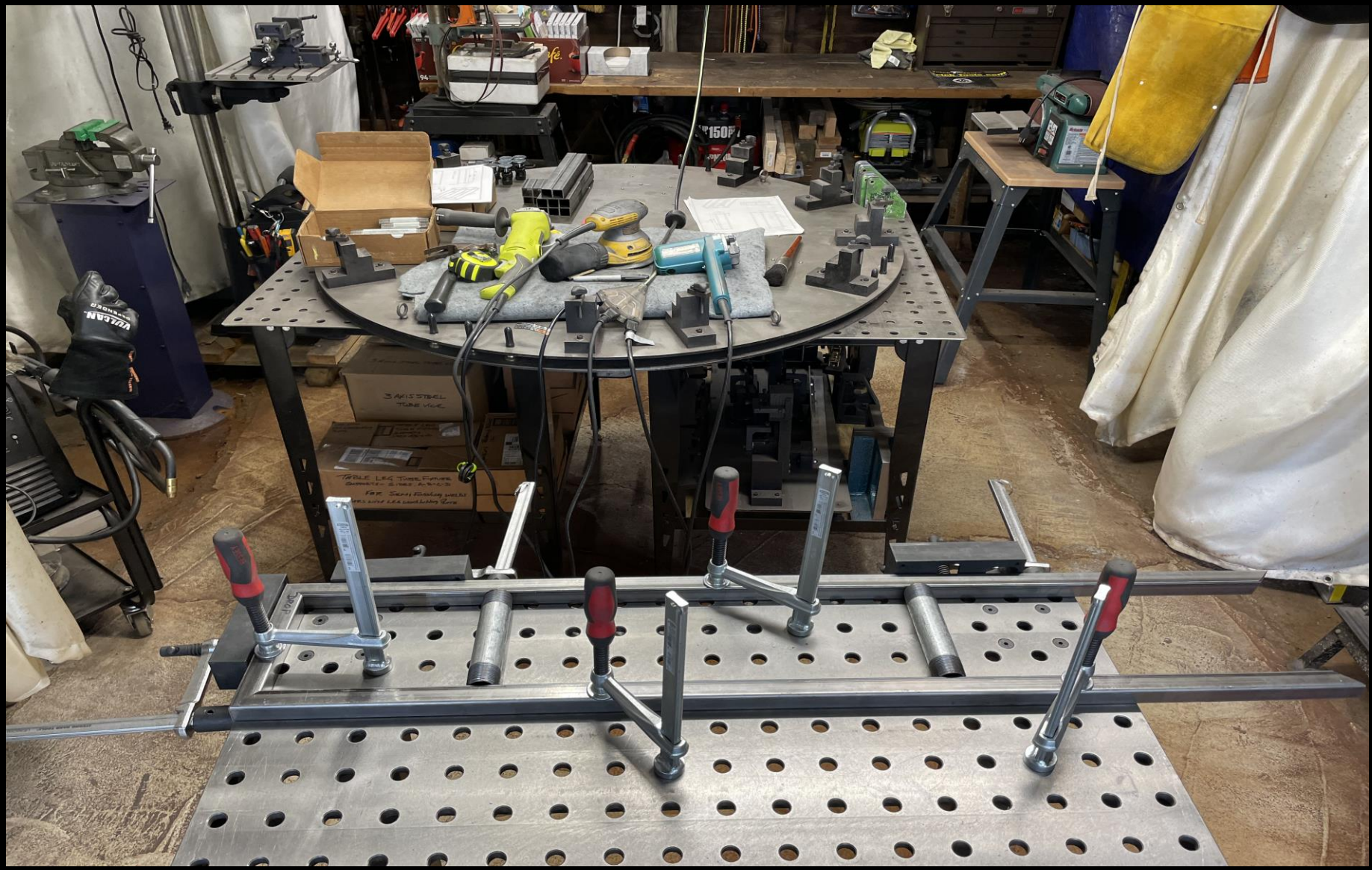
The stock is organized by lengths. The entire stock will be used to construct the table. Drops from one cut are components for other parts of the table. The actual size of the remaining drop depends on what is consumed by the saw blade.

The welding table is set up so that the panels will be square and straight. To Insure the 8” spacing between the rails, I am using 6” pipe nipples as spacers. The pipe nipples lengths are within .010 thousandths of each other, and the ends are square.

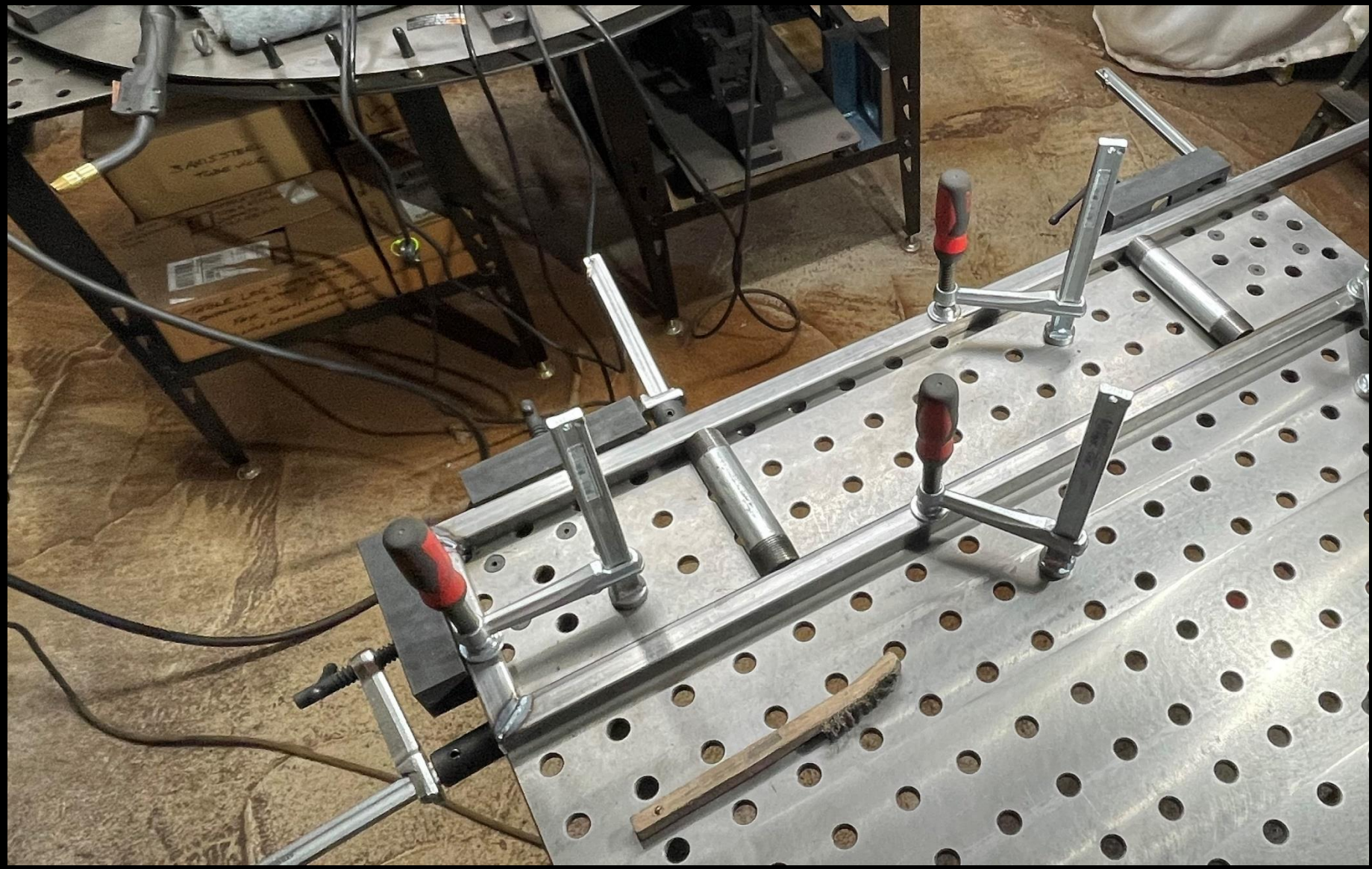
The miter saw cuts very accurate 45 degree angles and the welding table squares keep the angles on the panel at 90 degrees. I want to make sure I can replicate the construction of each panel to be the same as close as I can.



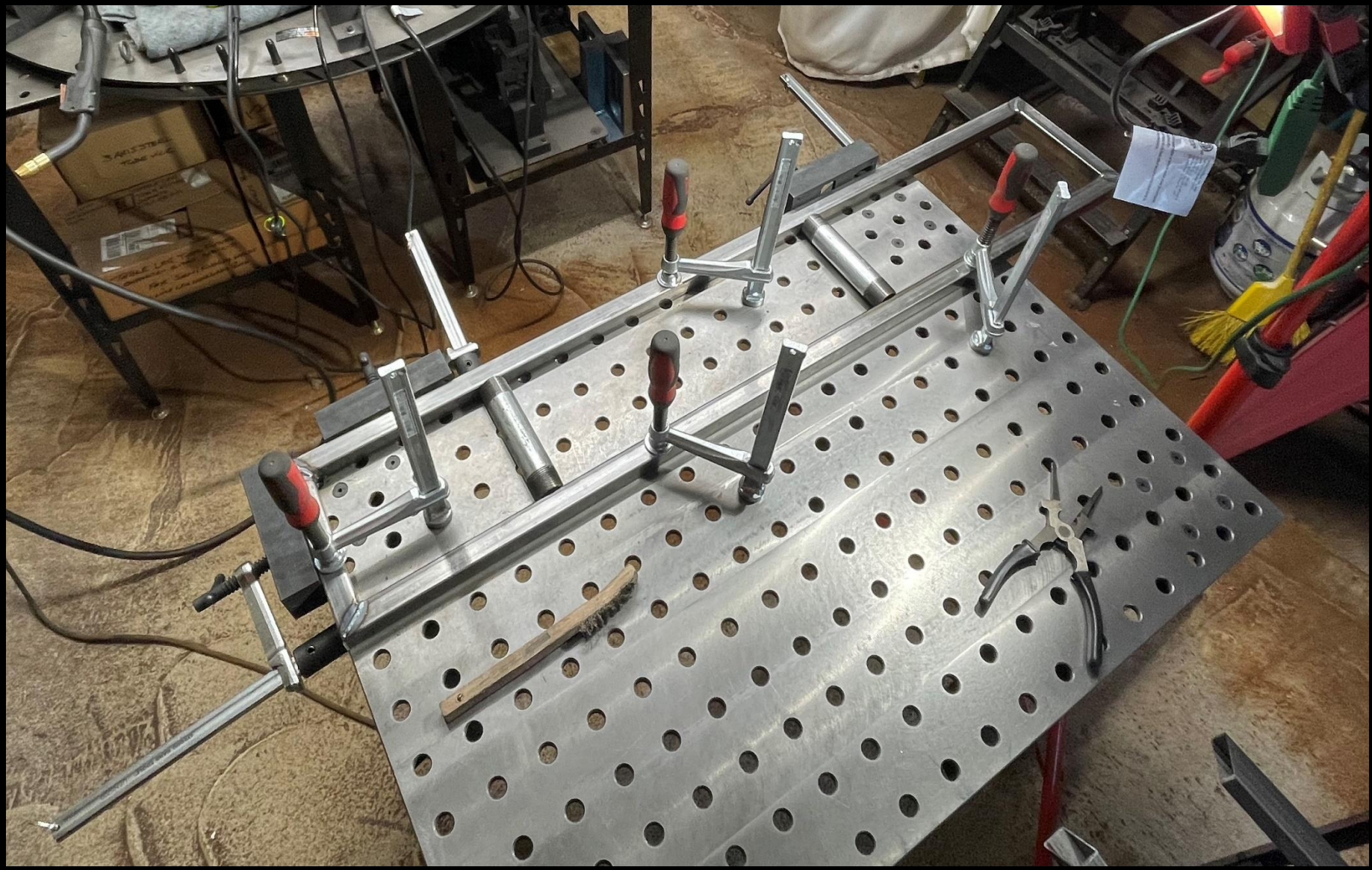
The table length is 48” long. My welding table is clearly not that long, so I will have to weld one end and then rotate the panel 180 to weld the other end. Then, I will Flip the panel over and weld the B side miters.



With the rails aligned and square, table clamps are used to hold the rails and panel ends in the correct position for welding.

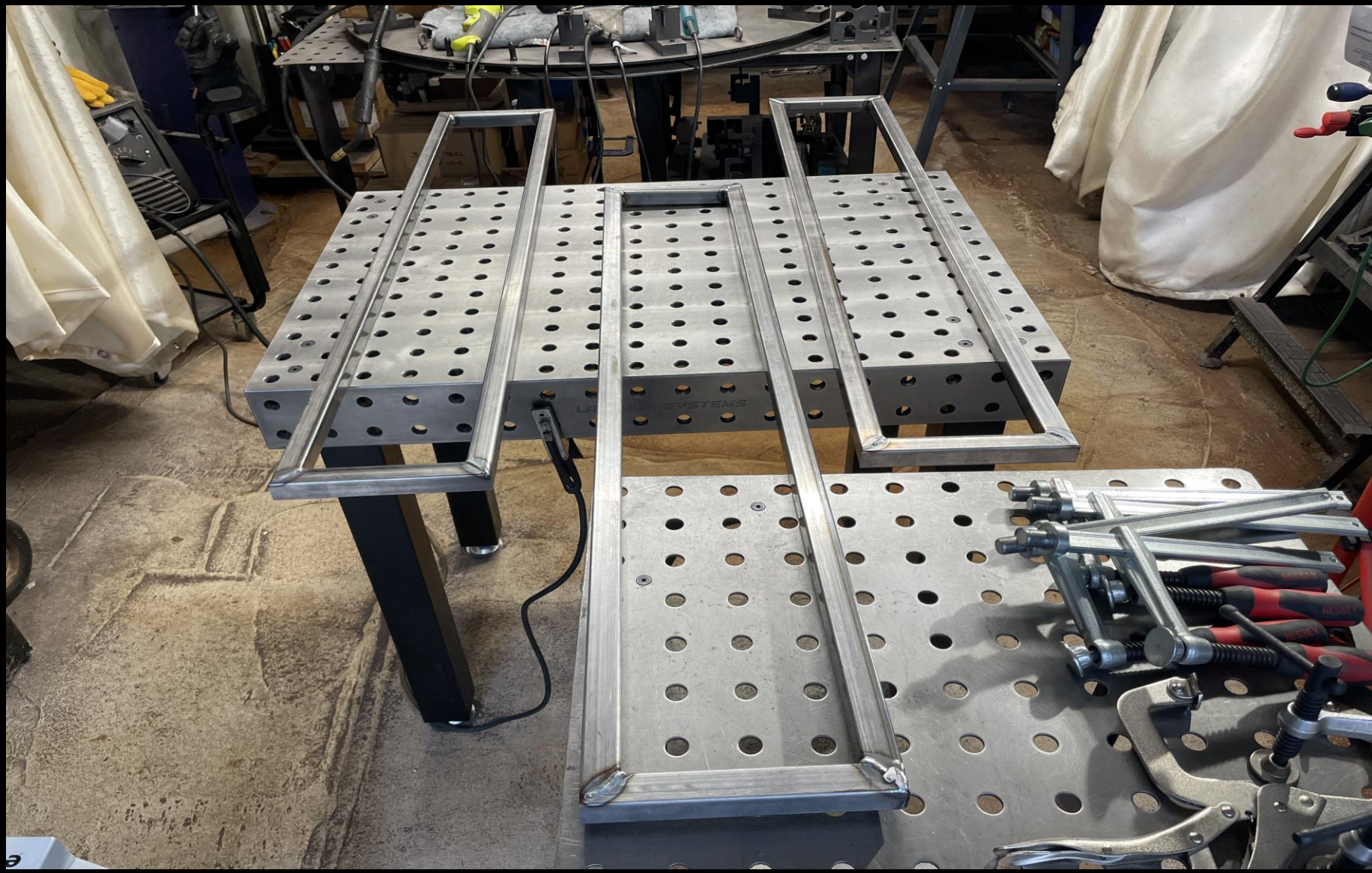


The miter cuts and inside angles are welded first. The settings on the welder for the panels (steel tube with a wall thickness of .060”) are not going to be the same when I weld the 3/8 steel rods on the inside of these panels.

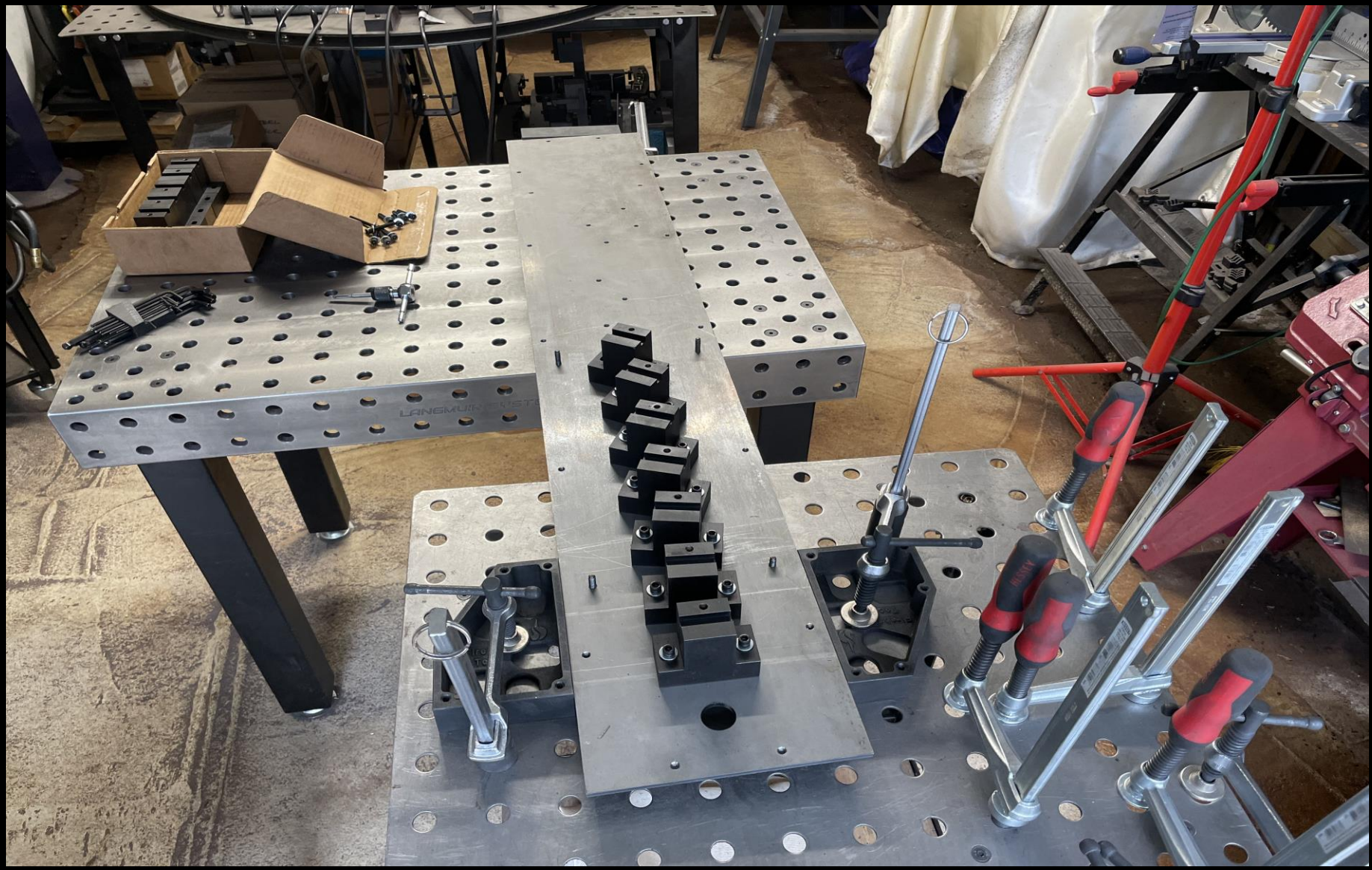


Rotating the panel 180 degrees and nesting it into the welding squares, I can clamp and weld the other end of the panel miters and inside angles.

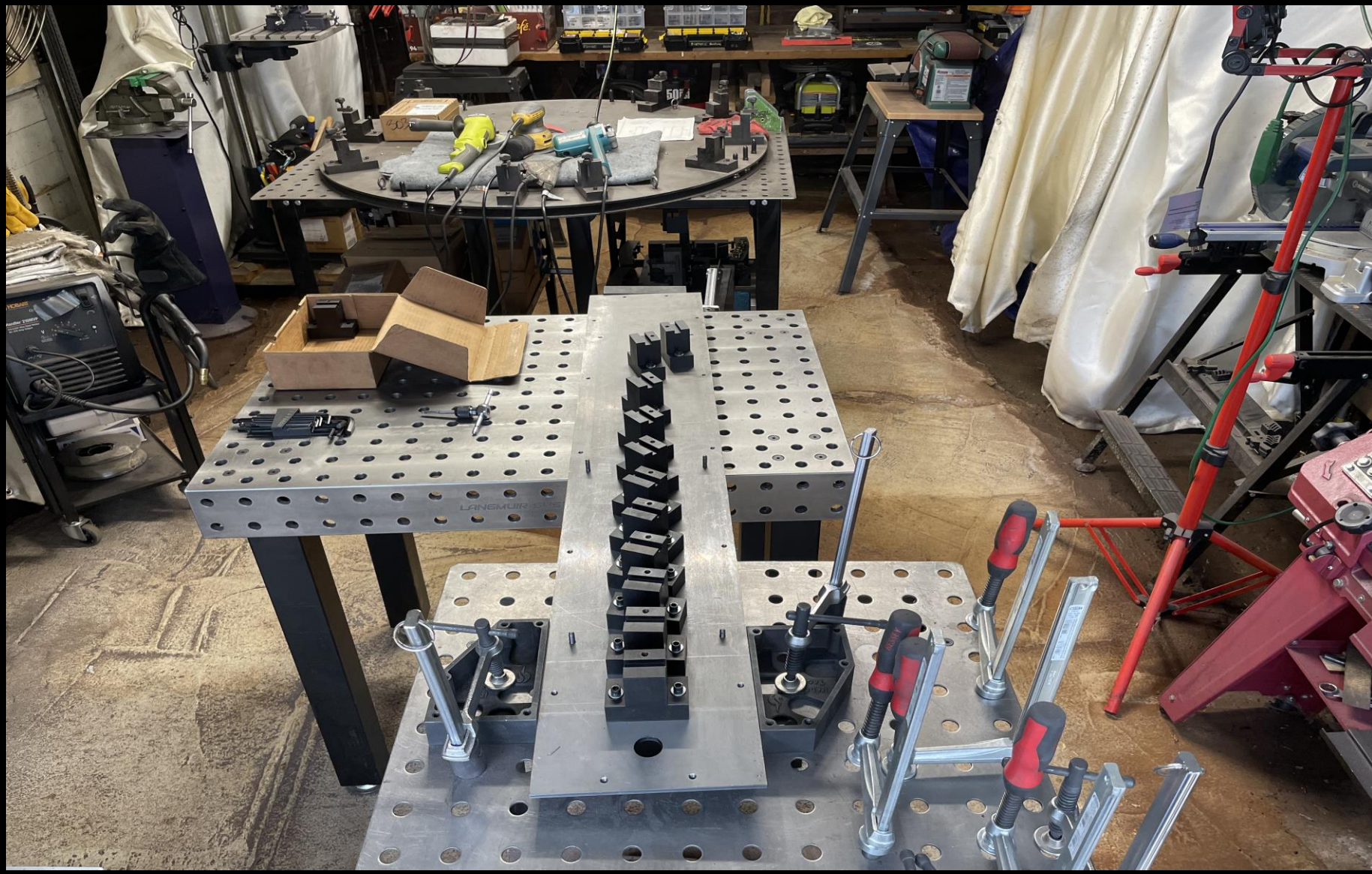
Because the A-Side welds are complete, I just need to flip the panel over and I can clamp and weld both ends of the panel miters and inside angles on the B-Side.



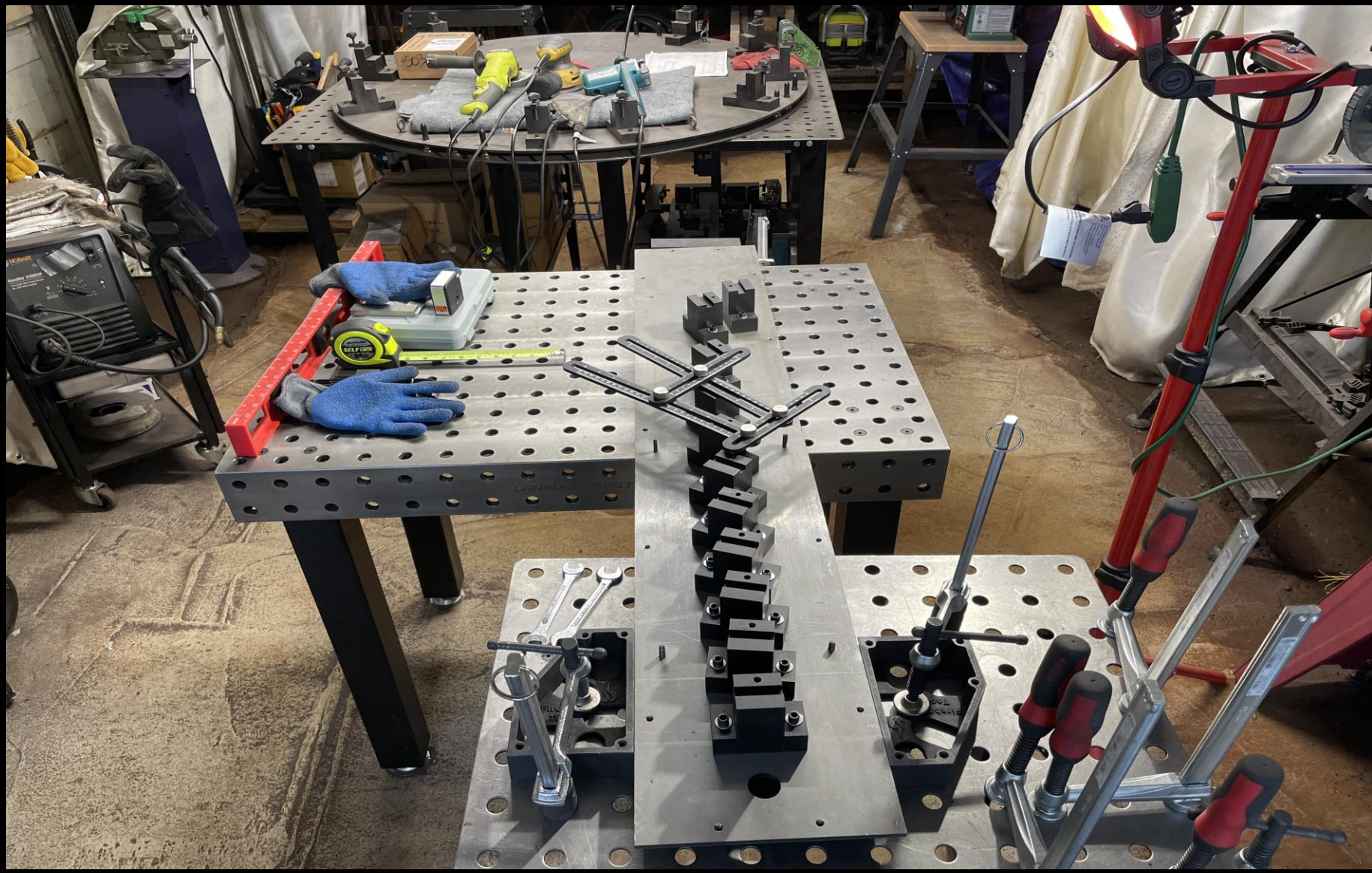
All three panels are welded and complete. I don’t have to clean up the existing miter welds yet. I will clean up all of the miter welds and interior panel welds at the same time.



My next task is installing the positioning blocks on the fixture base plate to generate the interior angular progression pattern.

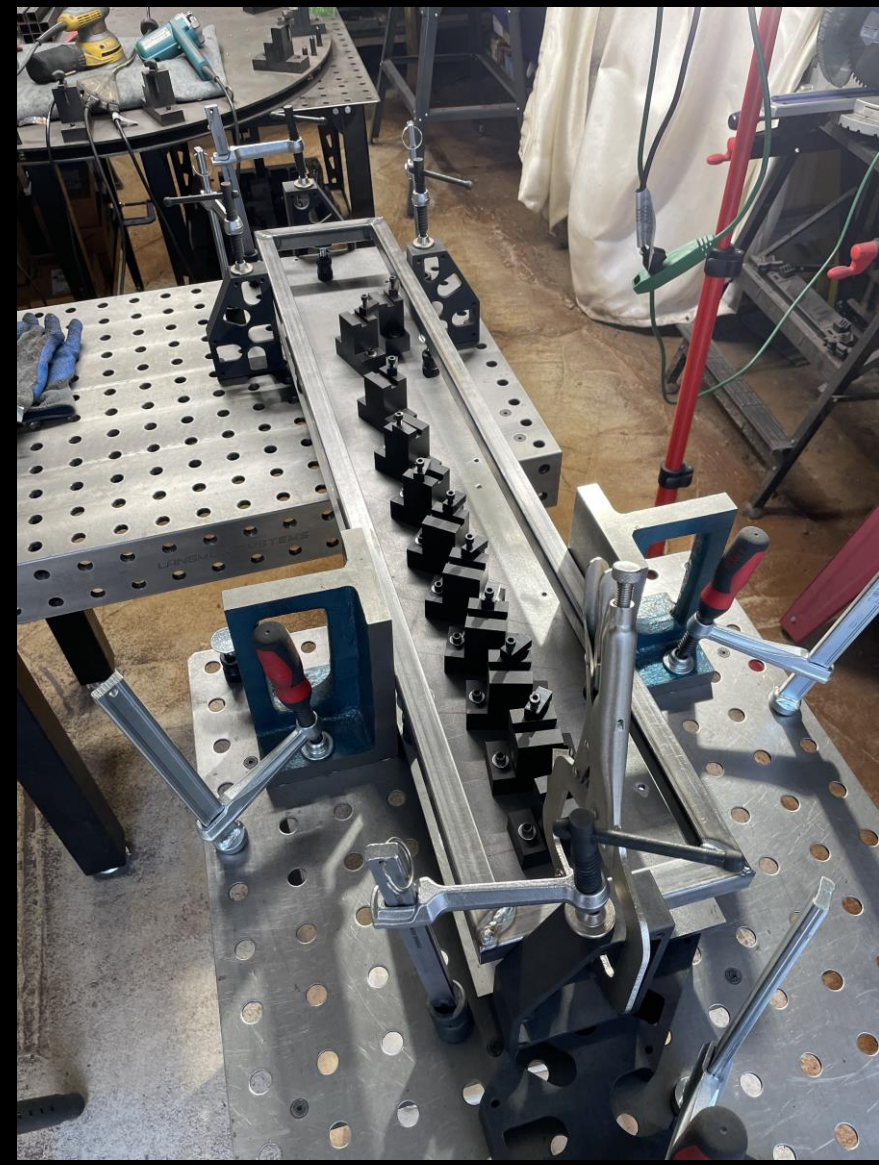


The holes in the fixture base plate provide a reasonable starting point to qualify the location of the positioning blocks. The positioning blocks have narrow slots to allow for minor adjustments in the screw holes to qualify the step and angle on the plate.



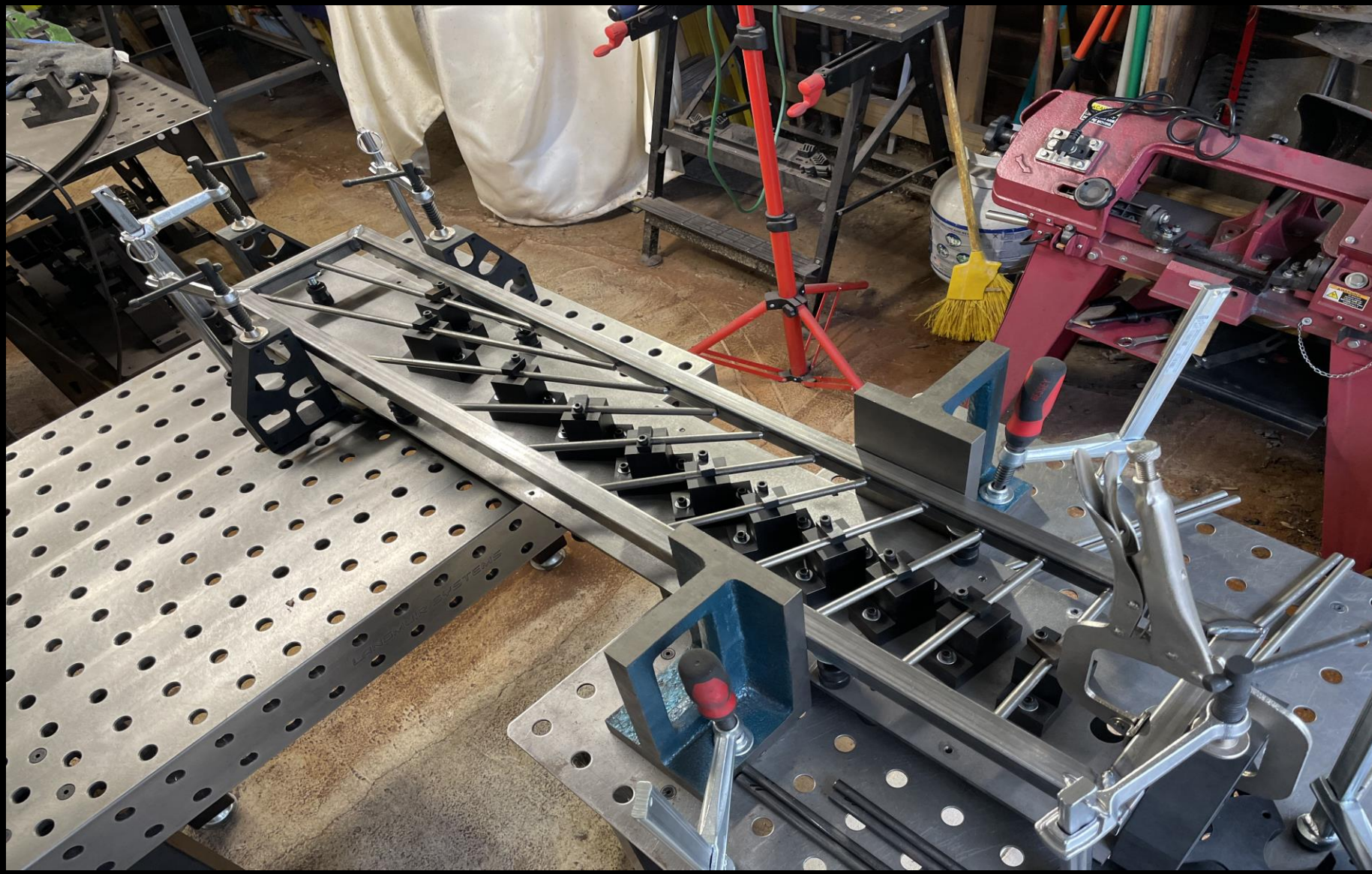
I used a digital angle finder set at 98.0 degrees to position each of the individual blocks. The 8 degree angle increment is relative to the previous block with a 2” step. I setup an angle template as a gauge to align each block in the progression.

I replaced the 3/8 magnetic spacers bolts with 3/8 elevator bolts so the panels sit on a flat surface. The spacers were all gauged to the center line of the 1” steel tube using a caliper at 2.1953”. They are located on the fixture plate in 8 places.



I need to load a panel into the fixture on the magnetic spacers and get the panel square to the fixture, I used angle plates and welding squares to locate the panel in the proper location on the fixture plate.

After getting the panel positioned correctly in the fixture, I need to cut each 3/8’ steel rod segment to the linear length to fit inside the panel. The linear lengths on the drawing are close, but still need to be custom fit.

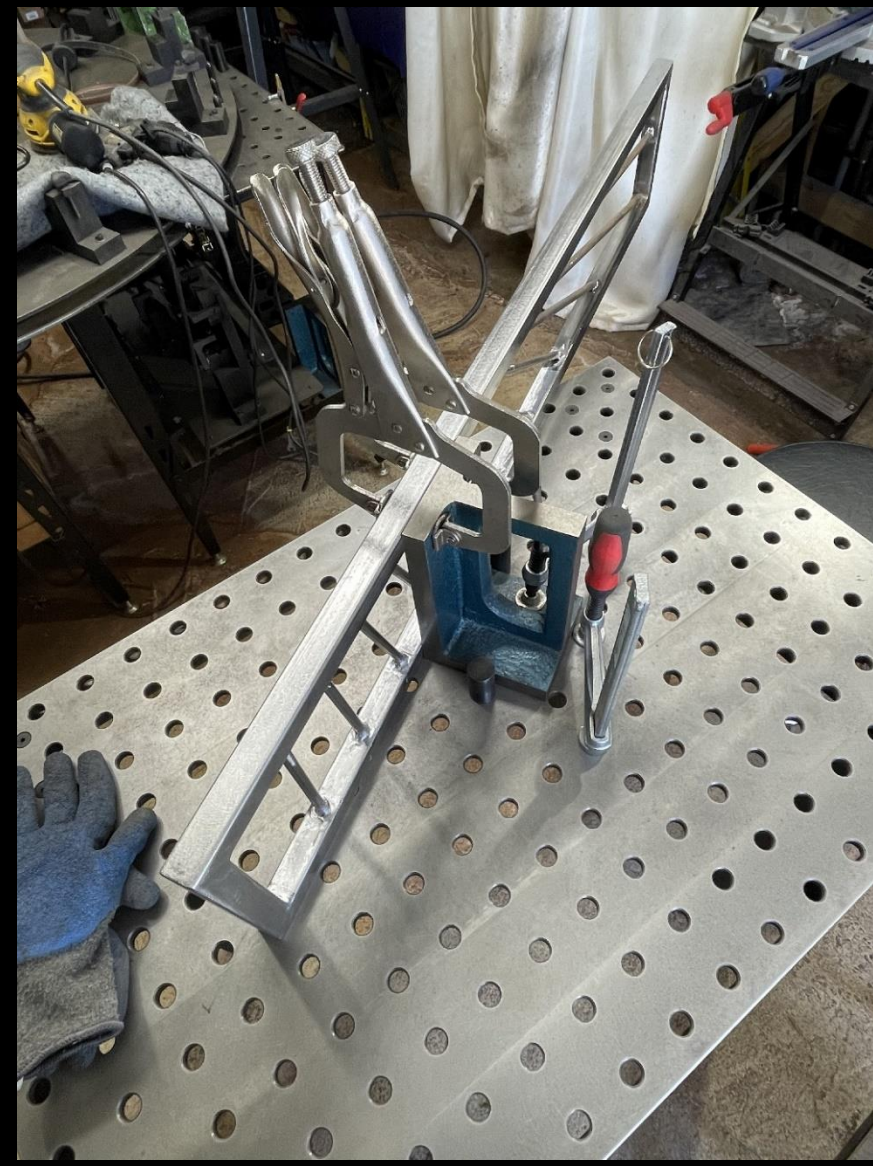


I will need 33 of these 3/8” rod segments, 11 for each panel. I custom fit and numbered the first 11 and then used those as a gauge to cut the rest.

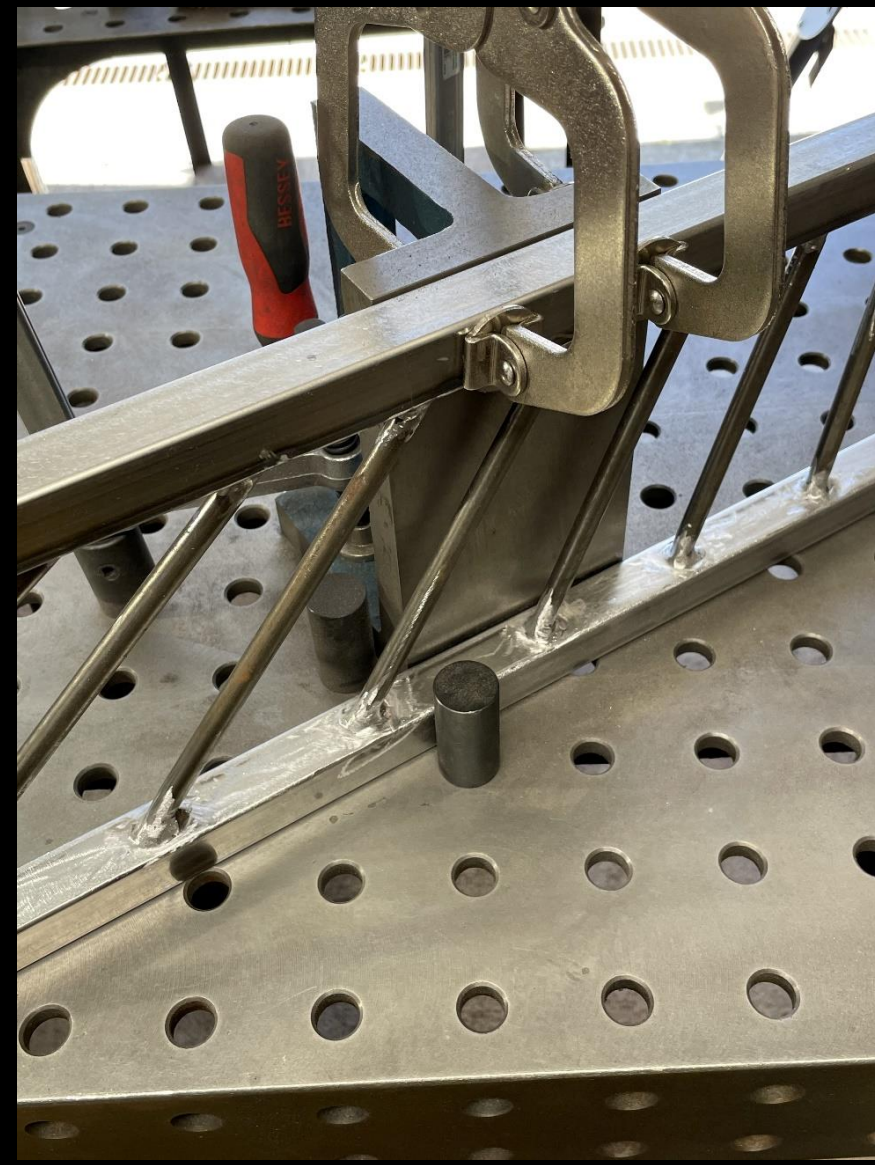
Each of the 3/8” steel rod segments have to be pencil ground on both ends to provide weld relief. This allows the weld to flow into the gap between the panel wall and around steel rod, allowing solid weld contact between the two different materials.

I need to test the welder settings to get a good balance to weld these two different materials (the 3/8’’ steel rod is solid and square steel tube has a wall thickness of .060”). I need to get a reasonable result and not burn through the steel tube.

Using the fixture, I have tack welded the 3/8” steel rods in the center of all three panels. I will finish welding the interior rods using a different work holding configuration.

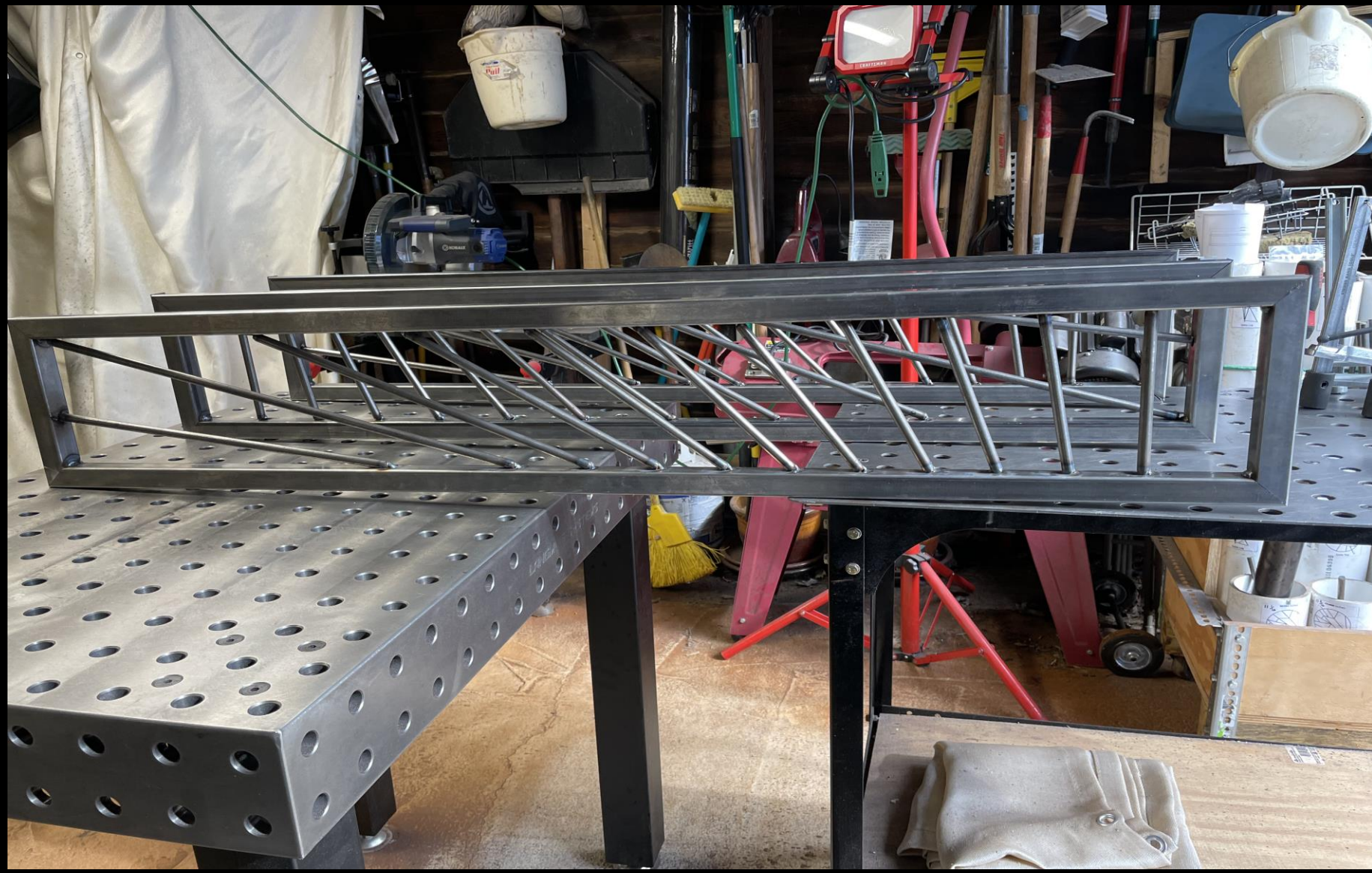


I set up an angle plate and table stops and secured the panel with weld clamps to finish welding each of the steel rods on both sides.



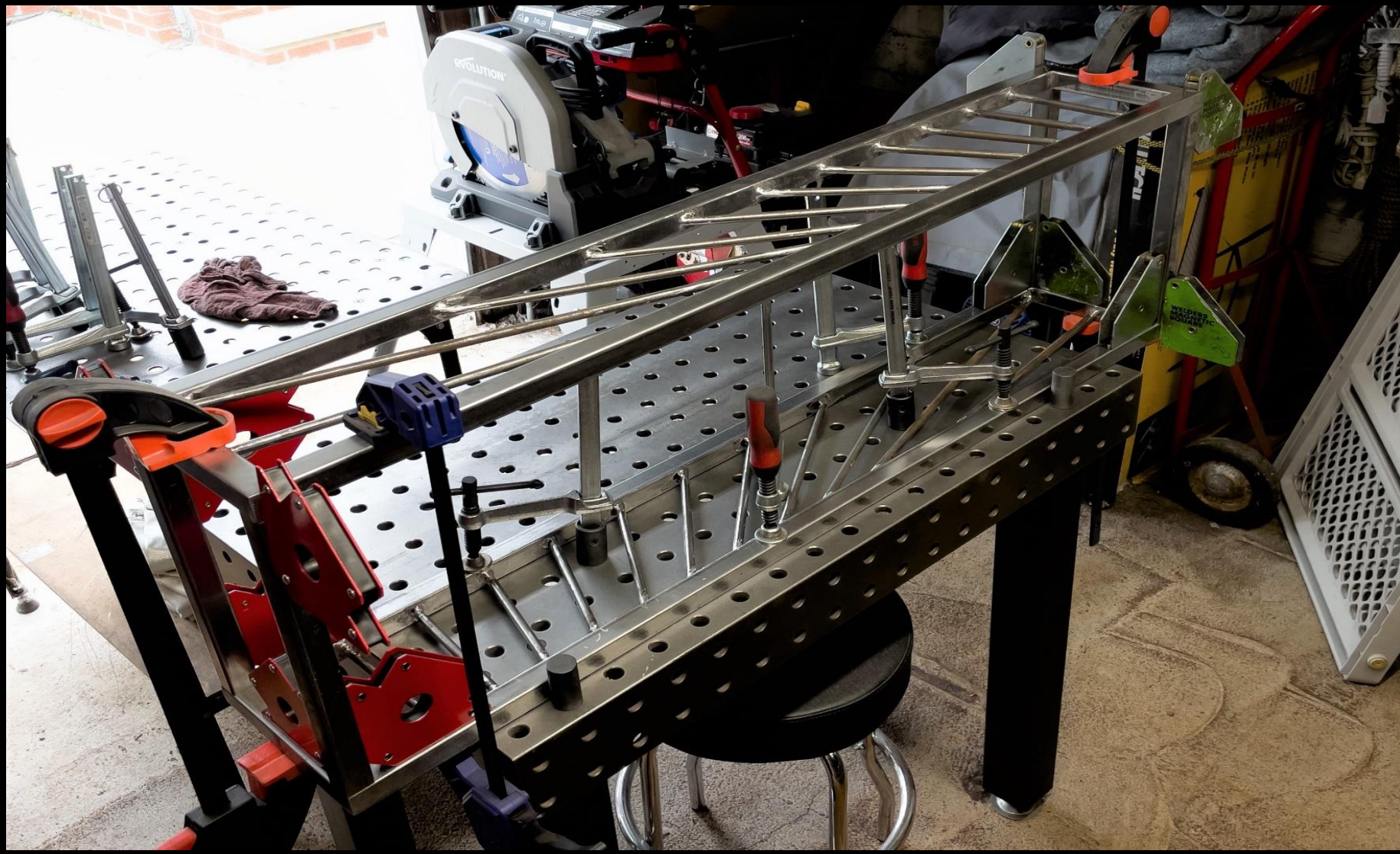
This same setup allowed me to clean up the welds on the interior steel rods using a 1/4” belt grinder and a hand file.

Before stacking and welding the panels, I spent some time looking at the angular progression pattern in different configurations. Orienting the panels using the same directional sweep, reversing the middle panel and flipping one or more of them.



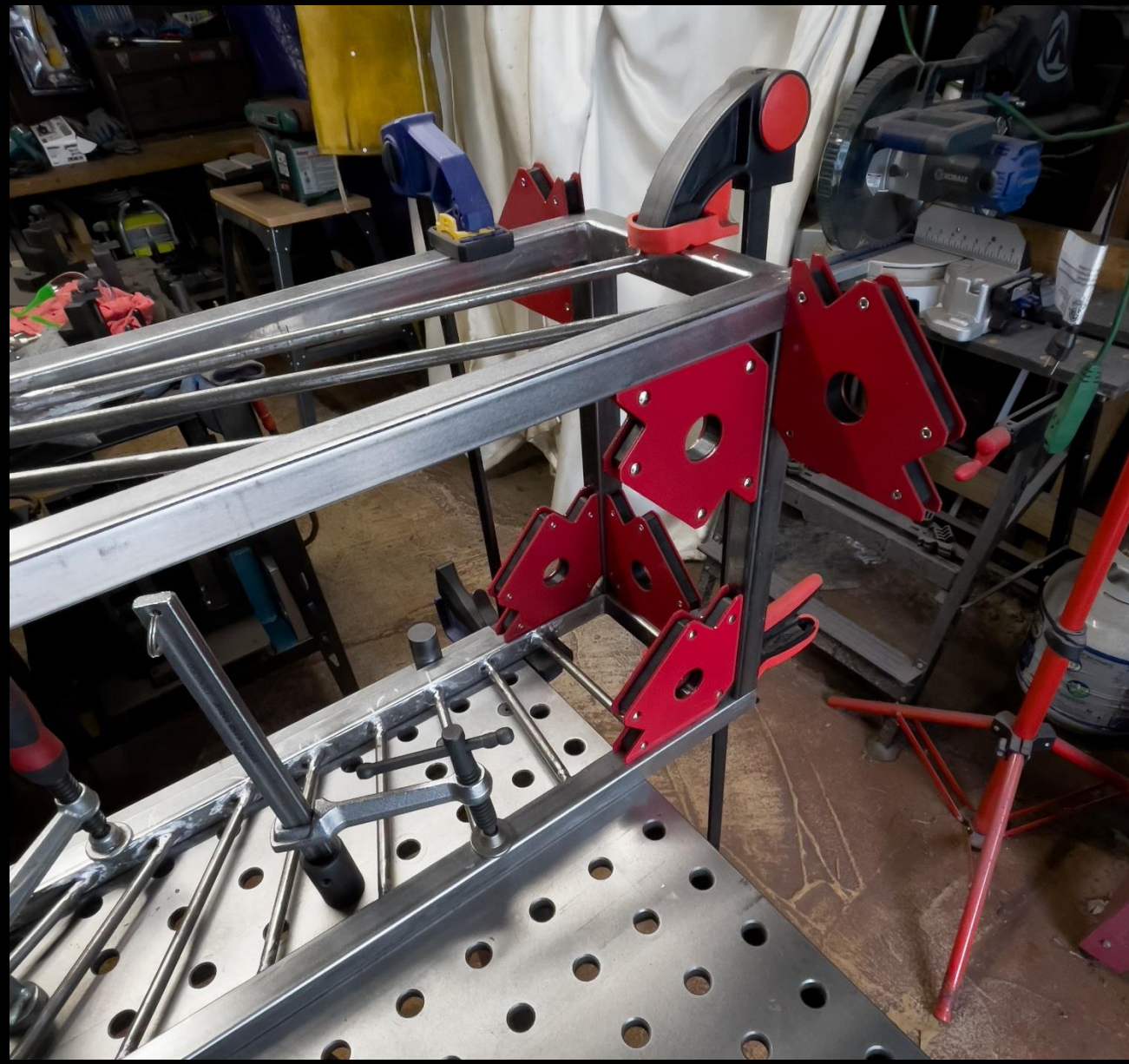
After a number of iterations, I decided to reverse the sweep direction of the middle panel to create a wave pattern in the table’s interior.

Interior wave pattern generated by reversing the middle panel, reversing the geometric progression in the opposite direction. Now that the decision has been made, I will stack panels and weld them upside down, from top to bottom.

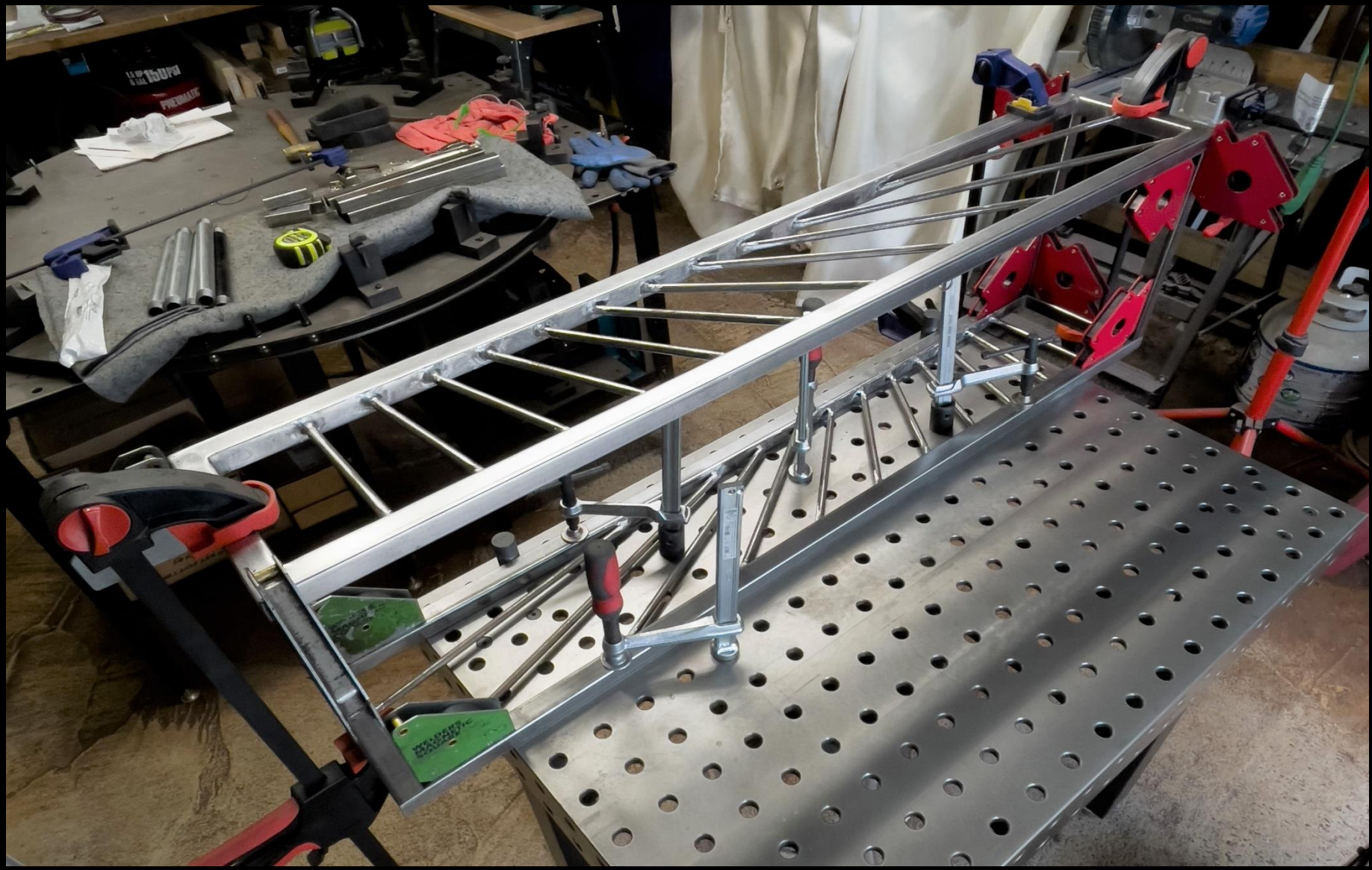


The top shelf lies flat on the welding table and the middle panel, with the desired geometric orientation, is positioned on top of the 12” steel tube legs/spacers.

Aligning the legs to the panel; working hard to achieve 90 degree angles for each leg and at the same time minimize the gap between the top and bottom of the leg and the panels. I had to rely on magnetic squares for this job, three axis clamps don't work here.



Adding to the complexity, heat distortion from welding the rods in the interior, causes the panels to twist across its length. Getting the end of the panel to lay flat on the ends of the legs requires clamping them down.



I spent a good deal of time checking and adjusting things, but at some point you have to call it good and go for it. I have the same exercise to go through two more times. If I had a longer welding table, I would have chosen a different approach.

Repeating the alignment and clamping process for the legs in order to weld the bottom shelf. Then its time to clean up and finish all of the welds I have made so far.

The last step in the welding process is to align and weld the 3” feet that go on the bottom of the table. The feet will get steel threaded inserts after powder coating for a 1/4-20 leveling foot.

Before powder coating, I installed the glass shelves that I ordered for the table to see how they would fit. They were perfect! Glass: 3 shelves, 1/4” thick, 48” x 8”, with a 1” bevel all around. The middle & bottom shelves are notched for the legs.

My last task was weld my stainless steel signature plate onto the bottom of the table. The registration number match's the certification page in this book and is a companion that goes with the table.

The welds have been all finished and the table sanded, ready to go to powder coating.

Table is delivered to the powder coater, The color I chose for this table is a prismatic color, Disco Aqua. It is a three layer coating. Black is the base color, the overcoat is the aqua/flakes, and the top coat is a clear coat that enhances the color and flakes.

Close up of the finish on the geometric progression table without the glass installed. The color was selected to minimize weld blemishes and to complement a photo that I took and had printed on aluminum plate that is the companion to this piece.

Geometric progression table with bumpers and glass installed. The shadows of the interior steel rods create wave patterns that cross and intersect. I am very pleased with my decision to reverse the direction of the middle panel creating this effect.

Geometric Progression table installed in its current location with its companion print.

Angular Progression Table Construction Data	
Design Iteration Number	ML-ISC-121775-3A
Size	L 48” x H 30” x D 8”
Material	1”x 1” Steel Tube, .060 Wall Thickness
Material	3/8" 1018 Steel Rod
Material	1/4" Plate Glass, 48" X 8", 1" Bevel All Sides
Threaded Steel Inserts:	4 Inserts, 1" square, 1/4-20 Thread
Steel Leveling Feet:	4, 1-1/4, 1/4-20 Thread
Construction	Welded Construction
Steel Base: Linear Feet	36 Linear Feet, Steel Tube
Steel Rod: Linear Feet	37 Linear Feet, Steel Rod
Glass Shelves: Square Feet	8 Square Feet of Glass
Steel Base: Weight	29.772 lbs.
Steel Rod: Weight	13.56 lbs.
Glass Shelves: Weight	26.16 lbs
Angular Progression Table: Total Weight	69.092 lbs.
Total Number of Welds	194
Approximate Man Hours To Construct	720
Finish: Powder Coat, Prismatic Powders, Disco Aqua	Color #: PPB 7038, PSS 0106, PPS 2974
Steel Cost: Steel Tube	$110.00
Steel Cost: Steel Rod	$39.66
Fixture Plate Cost: Plate, Laser Cut & Tap	$210.00
Glass Cost: Custom Cut Glass, 3 Pieces	$440.00
Powder Coat Cost:	$250.00
Angular Progression Table: Total Cost	$1,049.66

Geometric progression table construction data. Some values are approximate.