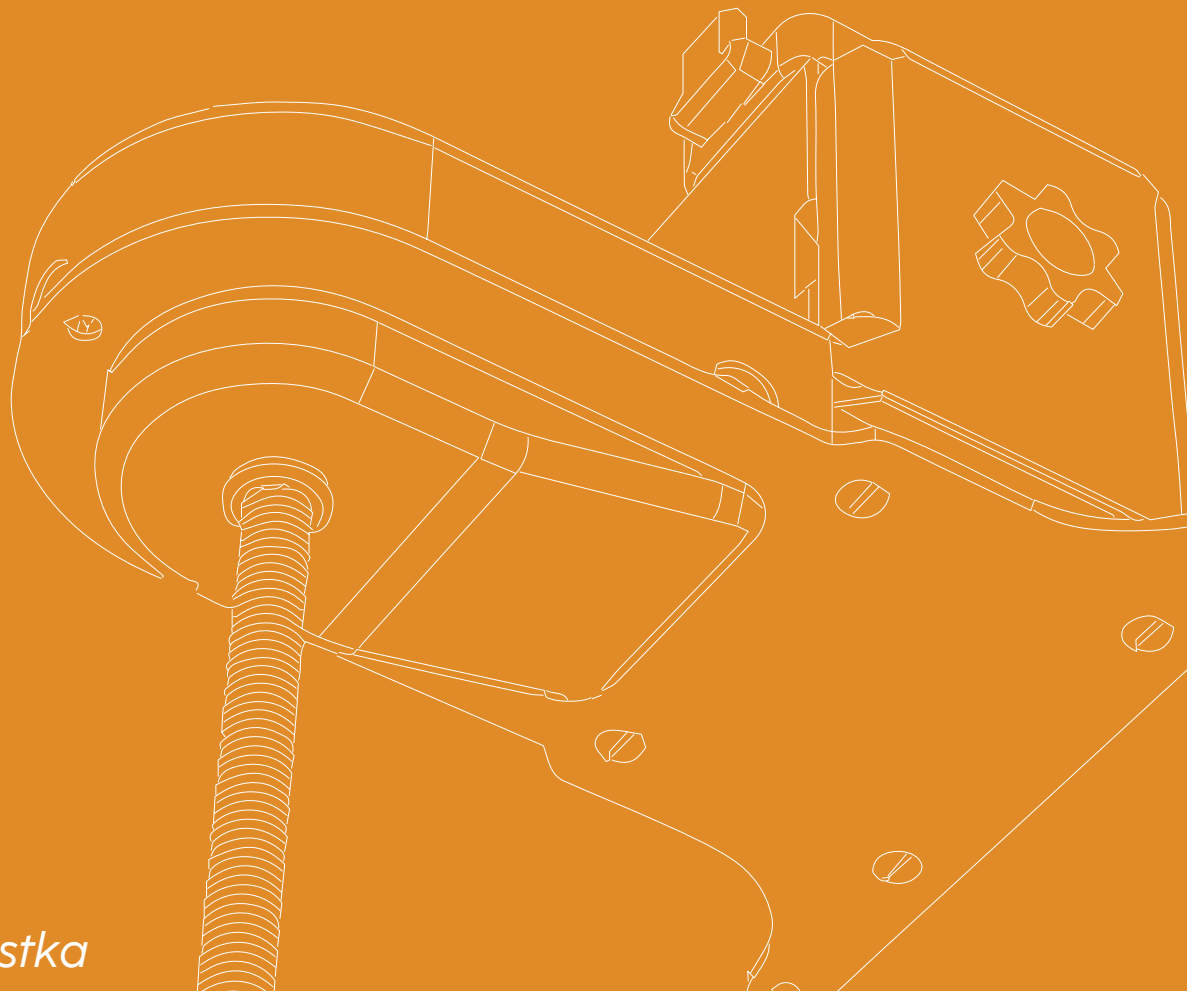
PORT:ABLE

Degree Project for Bachelor of Fine Arts in Design



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PORT:ABLE
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First of all I want to thank my younger brother Jan for spending an enormous amount of hours keeping me company, sharing ideas, solving problems, brainstorming, spending nights at school together and keeping me sane during this process. *Naprawde bez Ciebie nie dal bym rady, dziekuje Jasiek!*

Thank you Markus for all the help, uplifting words, critique and food we shared during the project. Thank you Jenny for always keeping us company and fed during the darkest and most stressful nights.

I really want to thank Jasjit Singh for all the supervision time, for the feedback I got and for all the uplifting words you said when I was about to give up.

I want to thank Charlotte, Claus and Anna for sharp critique and all the things you said to help me grow as a designer during this project.

But most of all I want to thank my dad and my mom for always believing that I can do it. Thank you dad for solving all the issues with the concepts as if it was a life and death situation and thank you mom for always helping me look from the bright side on everything.

And lastly, thank you all KID3 and Formula people for all the help I was blessed to receive.

Summary

This is a documentation of a bachelor examination project called “PORT:ABLE” done by Dominik Garstka. The project goal is a development of a product which makes any swing arm type lamp portable, by changing how the lamp receives power and how it is mounted. During the project a concept was developed and a display prototype was made.

Sammanfattning

Detta är en dokumentation av ett kandidatexamensprojekt kallat “PORT:ABLE” gjort av Dominik Garstka. Projektets mål är en utveckling av en produkt som gör en svängarmslampa bärbar, genom att ändra hur lampan får ström och hur den monteras. Under projektets gång utvecklades ett koncept och en displayprototyp gjordes

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Prologue

Port:able is a project which works as a learning opportunity on bringing an spontaneous idea to a product concept. The main focus area is how would a solo designer solve problems along the way and how much is one able to do before the help of professionals from other fields are required.

When starting the project I had no prior knowledge or experience working with high voltage electronics. While working on the project I reached a point where an electrical engineering degree was required.

Motivation

Background

After starting the bachelor project, I was strongly advised against all of my project ideas by my supervisors. Originally I was looking for an automotive oriented project, but after being advised against four car oriented project ideas I decided to pivot towards a different approach.

The idea behind port:able was just a thought at first, but after reasoning and thinking about the delay I already had to work against, I turned it into a project idea. When the concept of port:able was finally accepted, I was already 5 weeks behind the scheduled work plan.

The original idea was very spontaneous, it was just a random thought while browsing IKEA for a kitchen lamp. While seeing the TERTIAL lamp on display, I thought it would work very well for the cutting board area in the kitchen, where I desperately needed more light. TERTIAL is a swing arm type lamp, commonly used for workspaces and desktops. Since I already owned 2 of them at the time: one on my drawing desk and one on a workbench in my workshop, I knew it was a quality product. Then for some unknown reason, I just pulled it out from the display mount, but was unable to fully eject it back due to the cable dragging it down. So my first impulsive thought was why did they not make the mounting pin a connector instead, the same type as a mini-jack connector; users would be able to plug it in in any position and still rotate it freely.

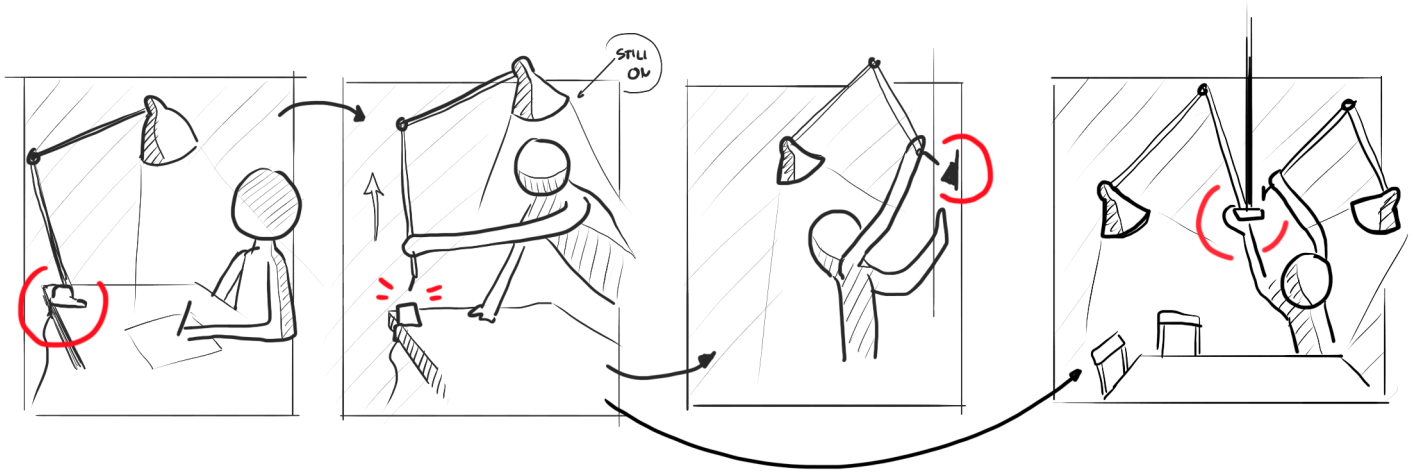
The motivation to further explore the idea and the possible outcome if I would base my project around it gave me my roommate at the time Markus Åkerman. He also owns a TERTIAL lamp from IKEA, but the mounting solution on his lamp is an iron weight at the bottom. It makes it easier to relocate the lamp when needed, which we did a lot while working on design projects together. Markus thought my comment was a bullseye idea not only for a commercial product, but also a solution for our problem at home.

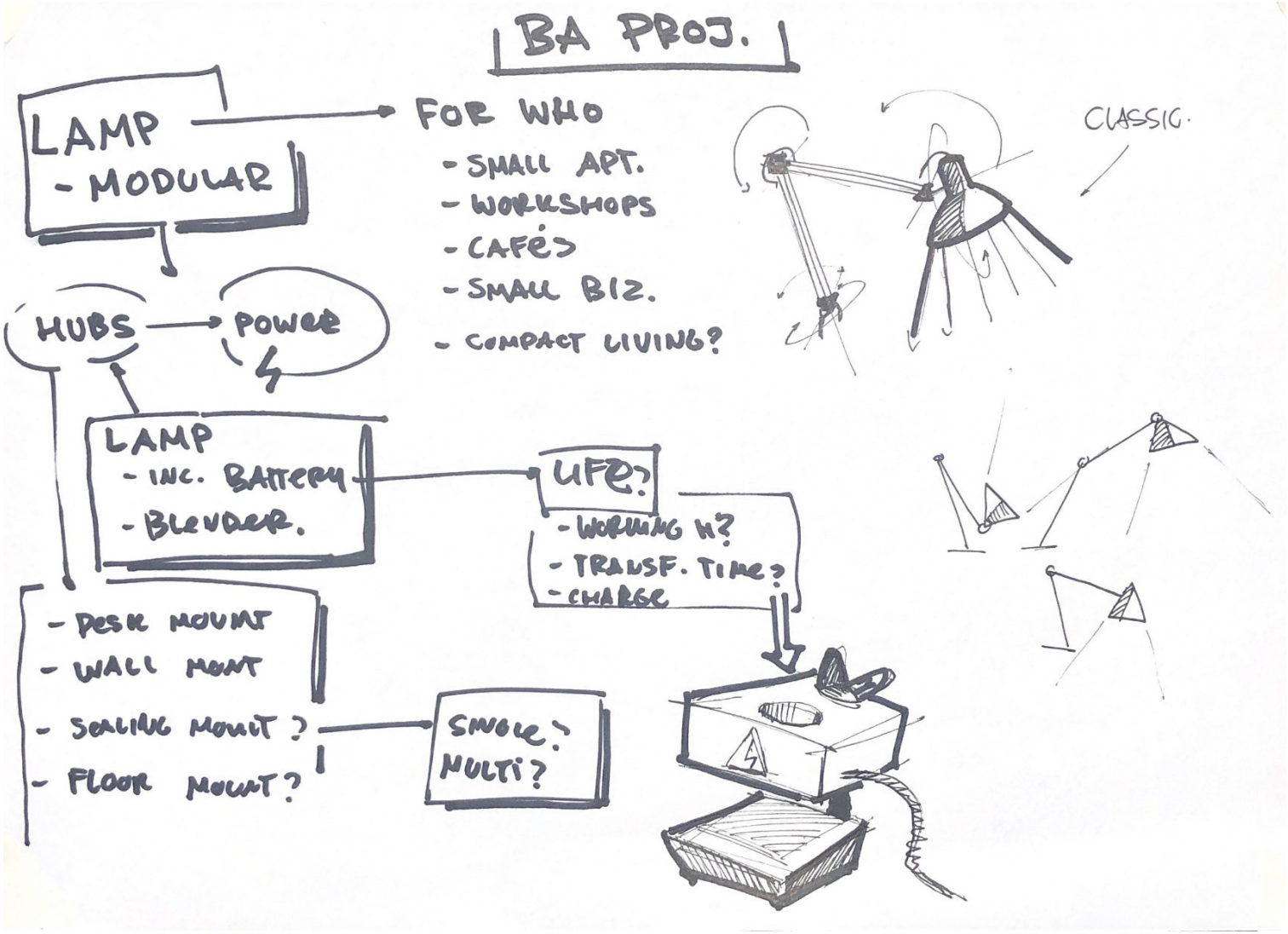
The relocation of Markus TERTIAL lamp was quite much easier compared to relocating my lamps, since all of them were screwed firmly to the designated surface. But when we work together we used to work on the coffee table or even the floor for some bigger projects. That's when the lamp had to move around the house a lot. Next constraint was the power source. Since the lamp only had a 0.5m power cable, it could only be connected in a few areas around the space we were preparing to work in.


DR W B CALDWELL'S
SYRUP PEPSIN

Initial Idea

Initial idea was to get rid of the cable and make the power to the lamp go through the mount. It would make it possible to move the lamp around effortlessly, without needing to plug the cable in, which in itself is quite annoying. You would also not have to carry the heavy foot mount, as the mounts would be pre mounted in the desired locations by the user. For the connector itself, I was originally looking for a solution similar to the way mini-jack connectors for audio can be connected: they can be connected in any position and while connected, they can be rotated freely with unlimited rotations possible in every way.





Brainstorming notes from this stage

Brief

To make a mounting solution for swing arm type lamps, which would also house the main power source, replace the cable from the lamp to a designated, permanently attached to the lamp connector and route the cable to the mount instead.

The brief summarized in 3 points:

1. Lamp mount which is able to be mounted on:
   - *Horizontal position (horizontal surface; table)*
   - *Vertical position (vertical surface; wall)*
2. Make an electrical connector which is able to perform unlimited rotations.
3. Rerouting original lamp cable to a connector in the lamp mounting pin.

Analysis

Market Research

During the research phase I scrolled through countless pages of eBay, Amazon and other major sellers as well as pinterest for any design ideas of what could or have already been done. I was mainly looking for portable lamps of any type, but a vast majority were battery driven, camping, construction or technical type lamps. There was nothing quite fitting in what I was aiming for.

While doing market research I also found out, among all the swing arm type lamps, a huge majority use the same dimensions of the mounting pin, which makes it easier for me to develop the connector part later.

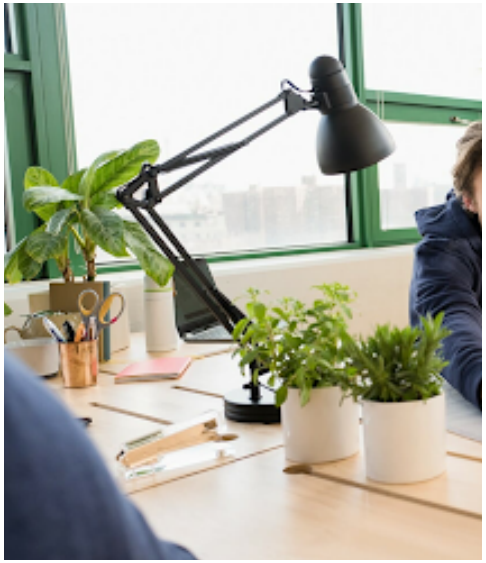





Target User Enviroment

I did not have a certain type of person in mind when designing the product. It was the environment of the potential buyer that would set the general target group for the product. I already knew that by default the swing arm type lamps are used mostly in office and workshop spaces, but I saw an opportunity in expanding to other environments as well. Generally I wanted to expand the place and use of the swing arm lamp by the PORT:ABLE product from general office and workshop to be more dependent on users' own needs. It would allow it to use it as a semi-portable lightsource, which could replace the amount of lights used in the potential buyers' environment.

In this stage I also started to sketch various other mounting types, for example: a ceiling mount for multiple lamps and floor mount for expanding the visual style, the possible new use in interior design and the possible everyday use of the swing arm lamps. These ideas would be scrapped later on during the project, as the time was limited, but would be later addressed in the Further Development phase.

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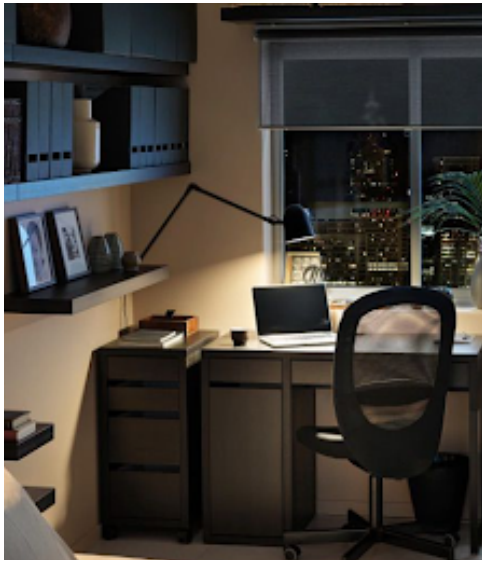


Massive inspiration in this project was the studio of a danish artist Tenka Gammelgaard. In her studio she has a ceiling mount for multiple swing arm type lamps, casting light on every significant part of the room.

The portability of the lamp is what drove the entire project forward. I did not aim for changing the swing arm lamp, since the mechanism and visual style is, at least in my opinion, near perfect. By making it portable, the lamp would be more in the center, instead of being just a light source on the desk. The lamp would follow the user to where the user wanted to do things and needed light. It is a very abstract approach, but expanding the initial line of features of the lamp leads to broadening the use possibility.

Synthesis

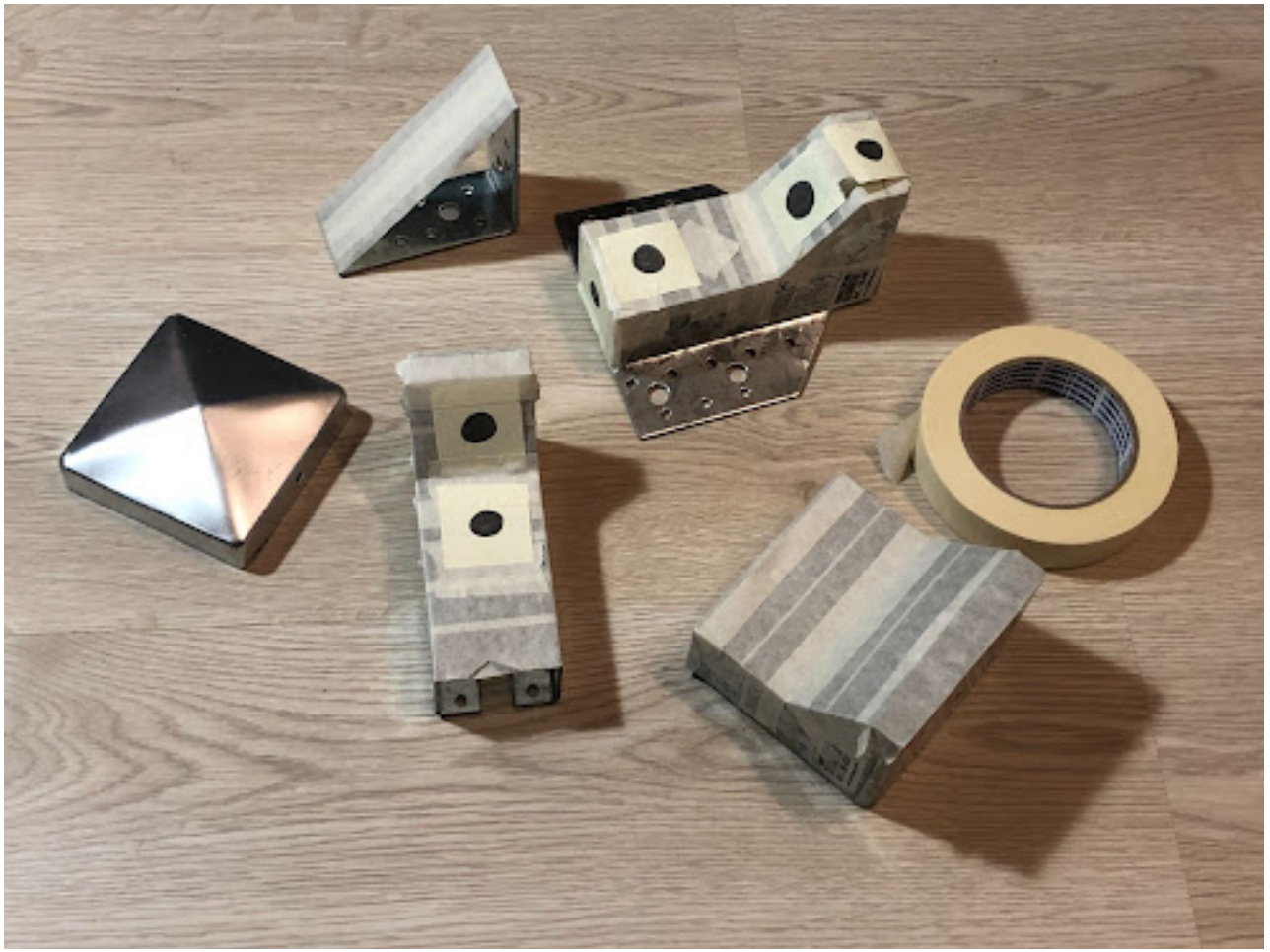
Ideation Phase

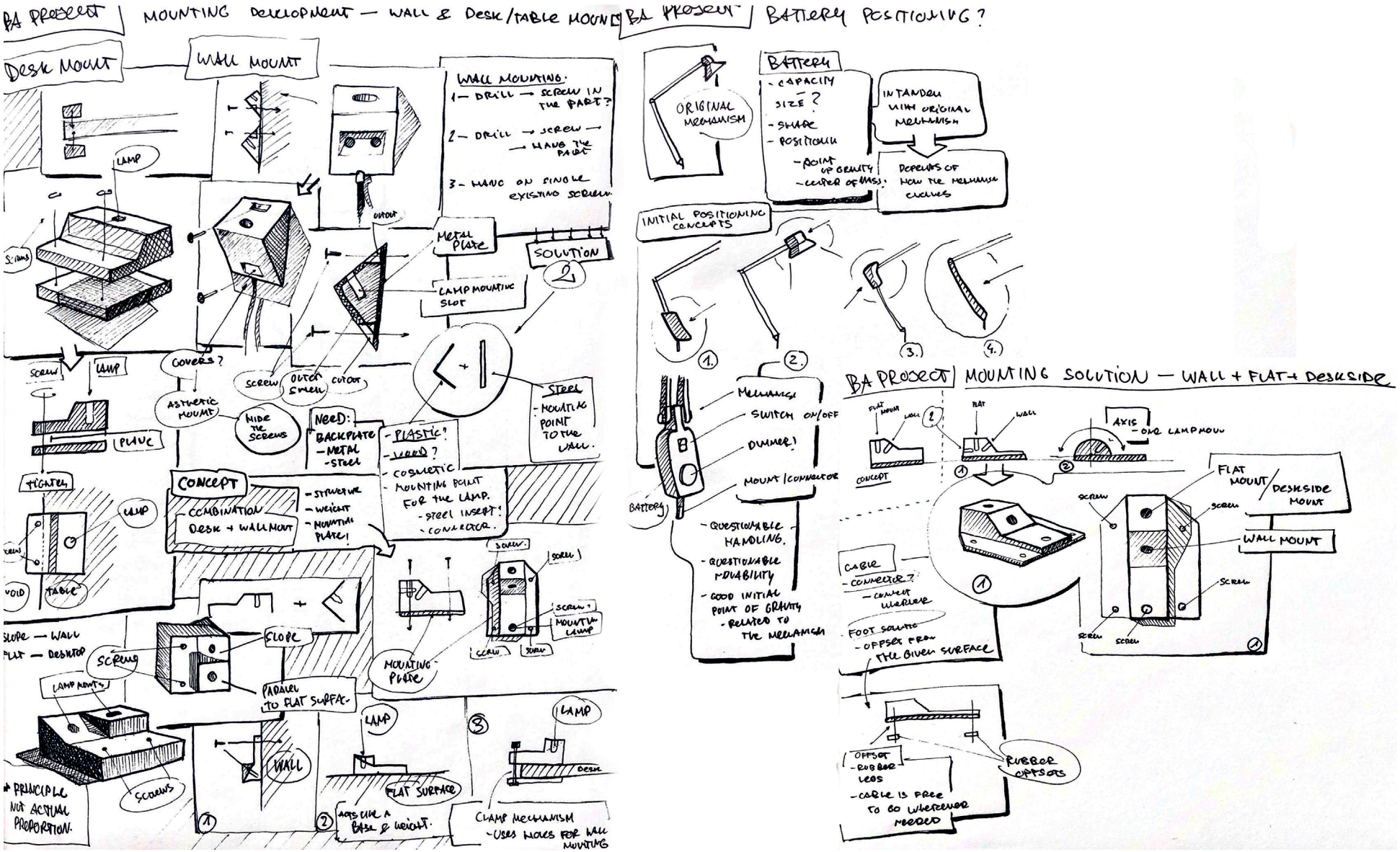
The ideation phase began with a trip to a local hardware store, where I went looking for parts and tools for the project. I found a bunch of mounting for wooden planks in the building materials section, which, due to the low price, I bought one of every type I would find to be possibly useful. I used masking tape to create simple shapes and volume. Then I drew some circles on pieces of paper, which I taped in spots where I would logically place a connector hole: on some shapes I put a single one, on some multiple.

Sketching phase began simultaneously as I did the simple shapes from the plank mounts. I began with simple shapes as cubes and rectangles, adding necessary features such as angles for different mounting positions. I also experimented with shapes from a side view. Later on I started combining and adding defining features from different mounts onto one shape to create a universal mount.

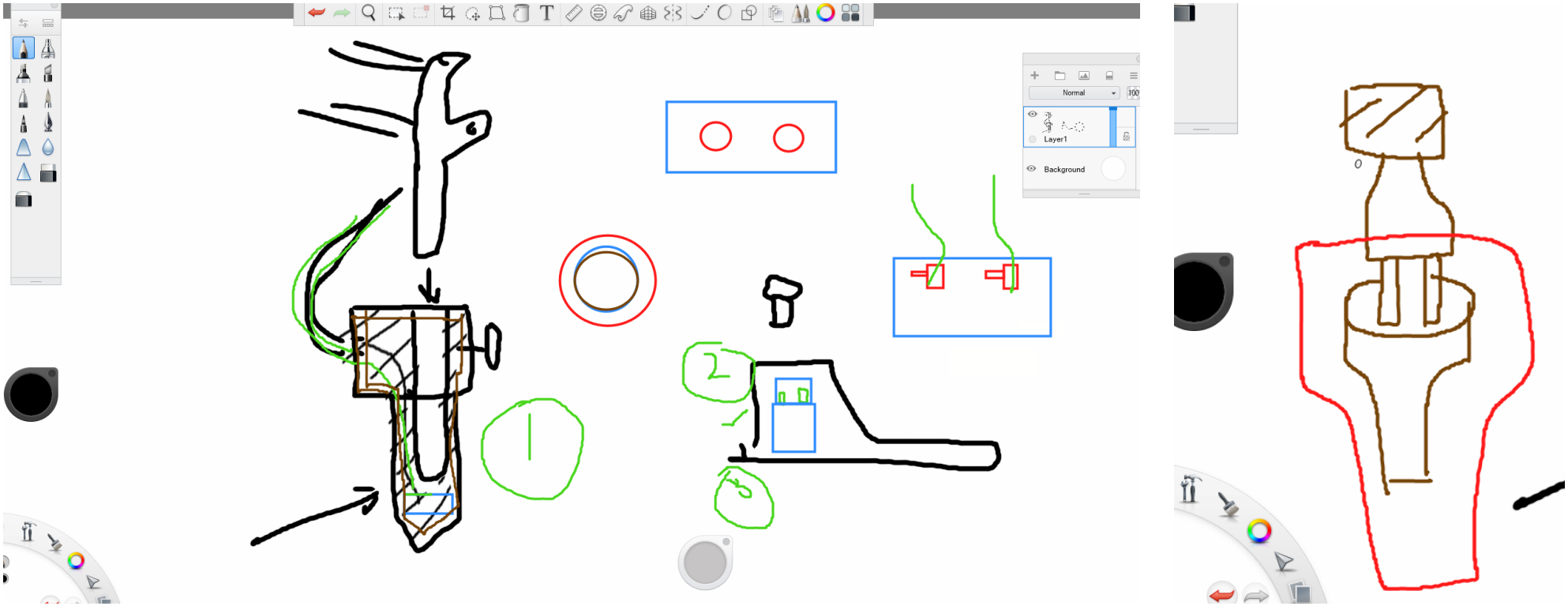
During this stage I also started to think about the possibilities around making the lamp completely portable, like a torch. I started considering adding a battery to the lamp or making an attachable battery, but this idea died quickly, as the lamp would need a complete redesign of the mechanics of the lamp. The concept started to be overwhelming, as I tried to combine too much.

Finally, after supervision with Jasjit Singh I decided to settle on making a mount for a flat surface, a deskside and a wall. I also decided to focus on only one mount and possibly move the ceiling mount and floor mount to the Future Development part, as my time was limited.



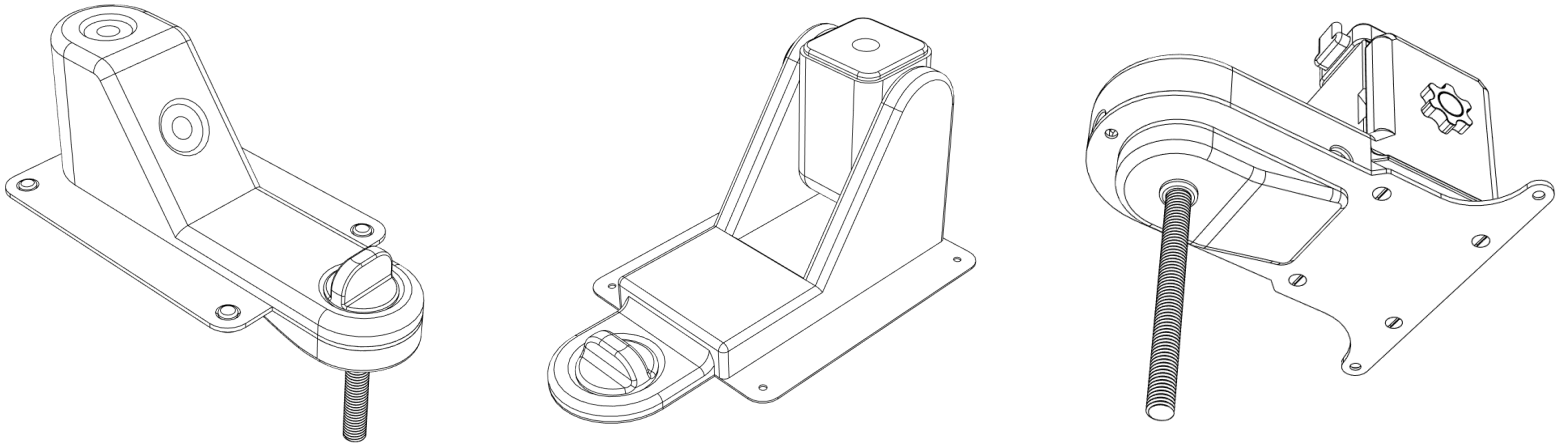


Scan of some of the sketches during this stage. To the right are the first sketches of the first concept.



Scribbles done by Jasjit Singh via Zoom during one of project supervisions during this stage of the project

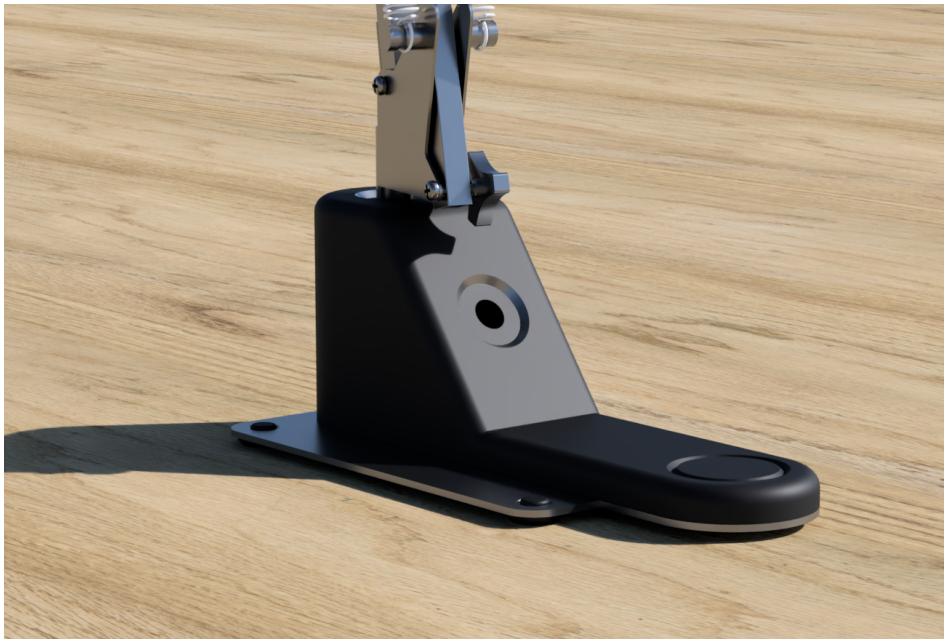
Concept Phase

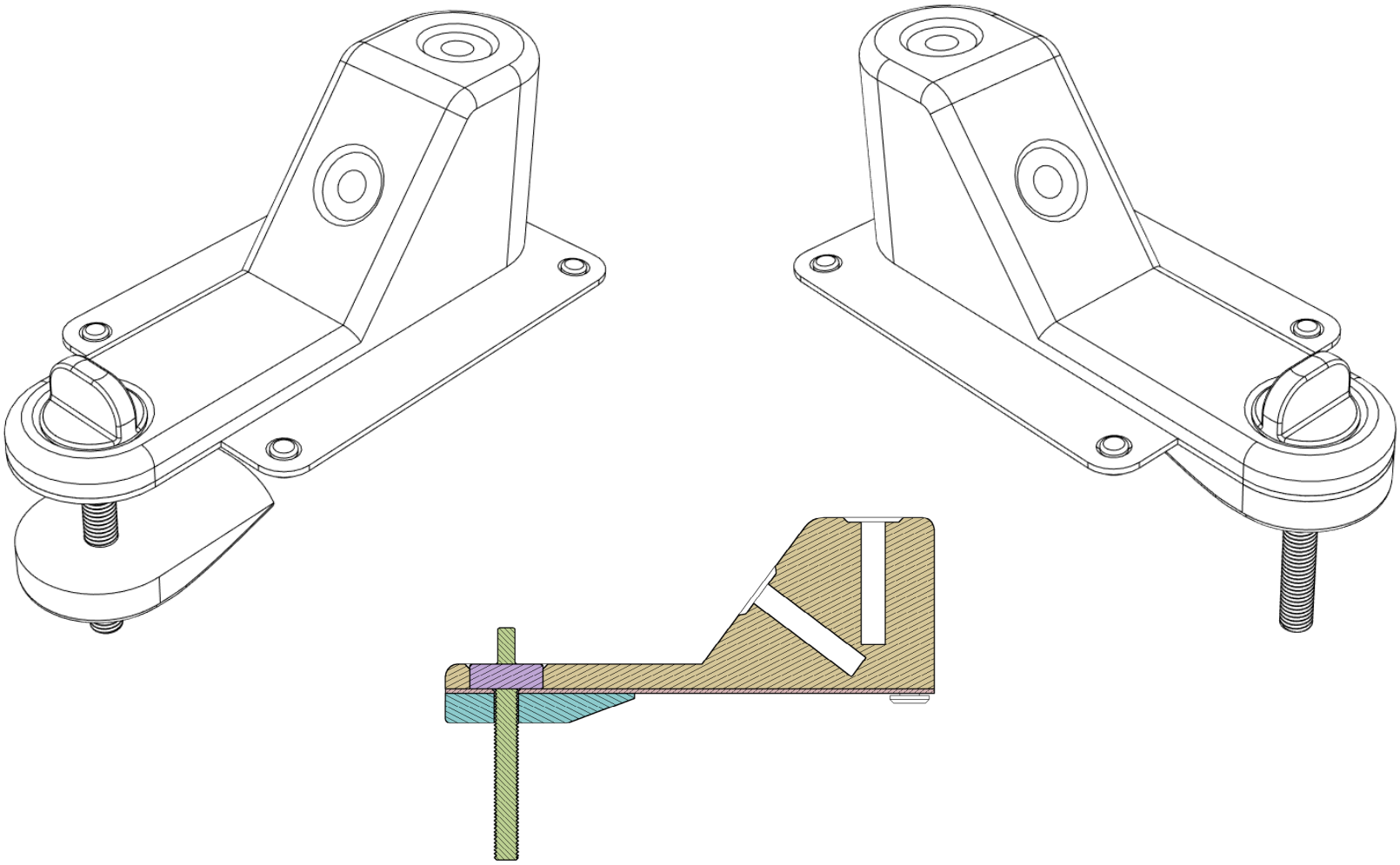


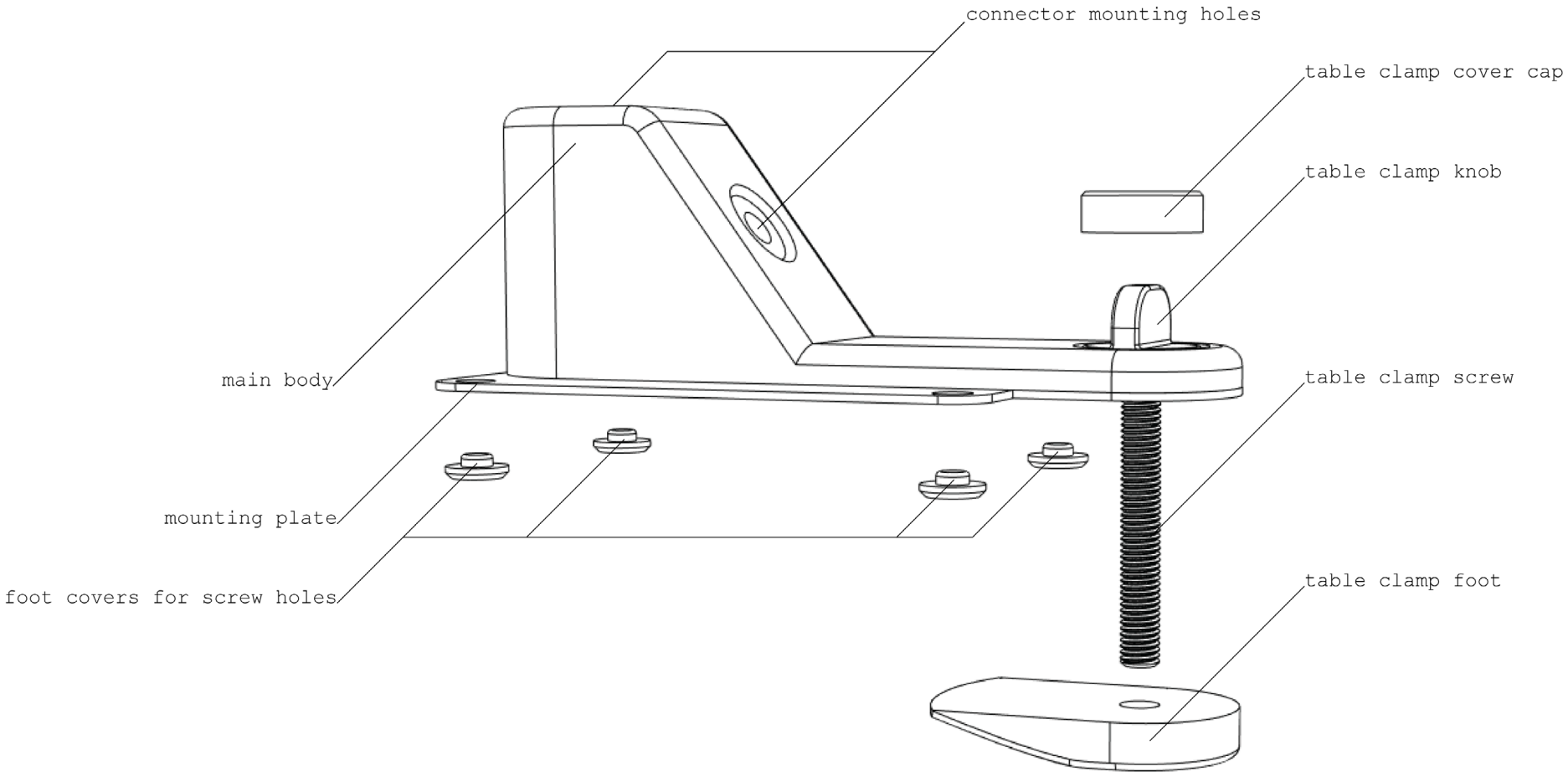
First Concept

First concept was a stand with two stable connectors, which when mounted horizontally, would use the hole at the top for mounting the lamp. When mounted on the wall the lamp would use the side hole. Advantages of this concept are that the mount would not use any moving parts and could be done in 3 major steps. Disadvantages are that the wall mount would force the lamp to be in only one position, due to the angle of the pin. The other issue is that the holes would be too close to each other, which would create major problems later on during the connector development.

CAD renders of the first concept.



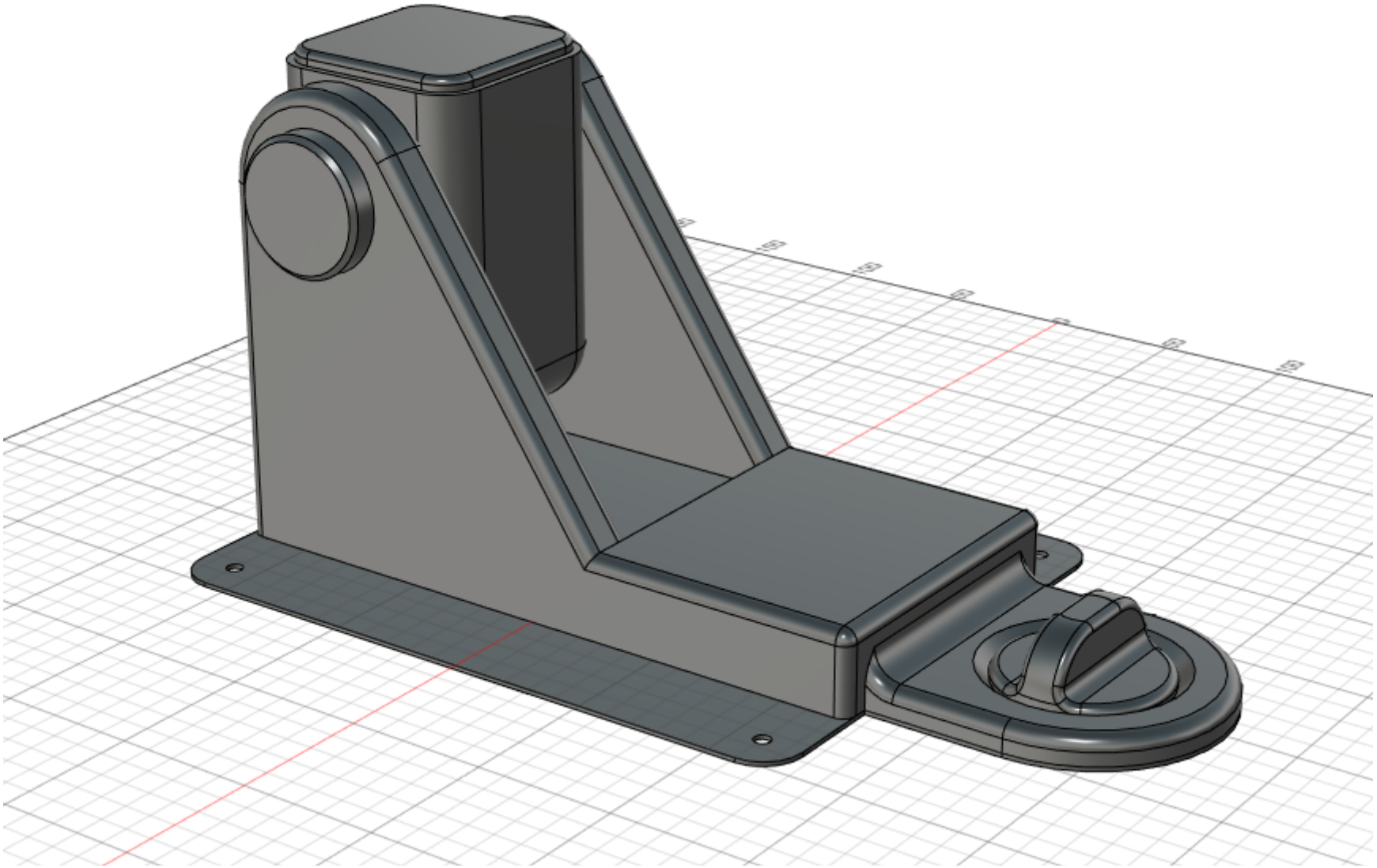


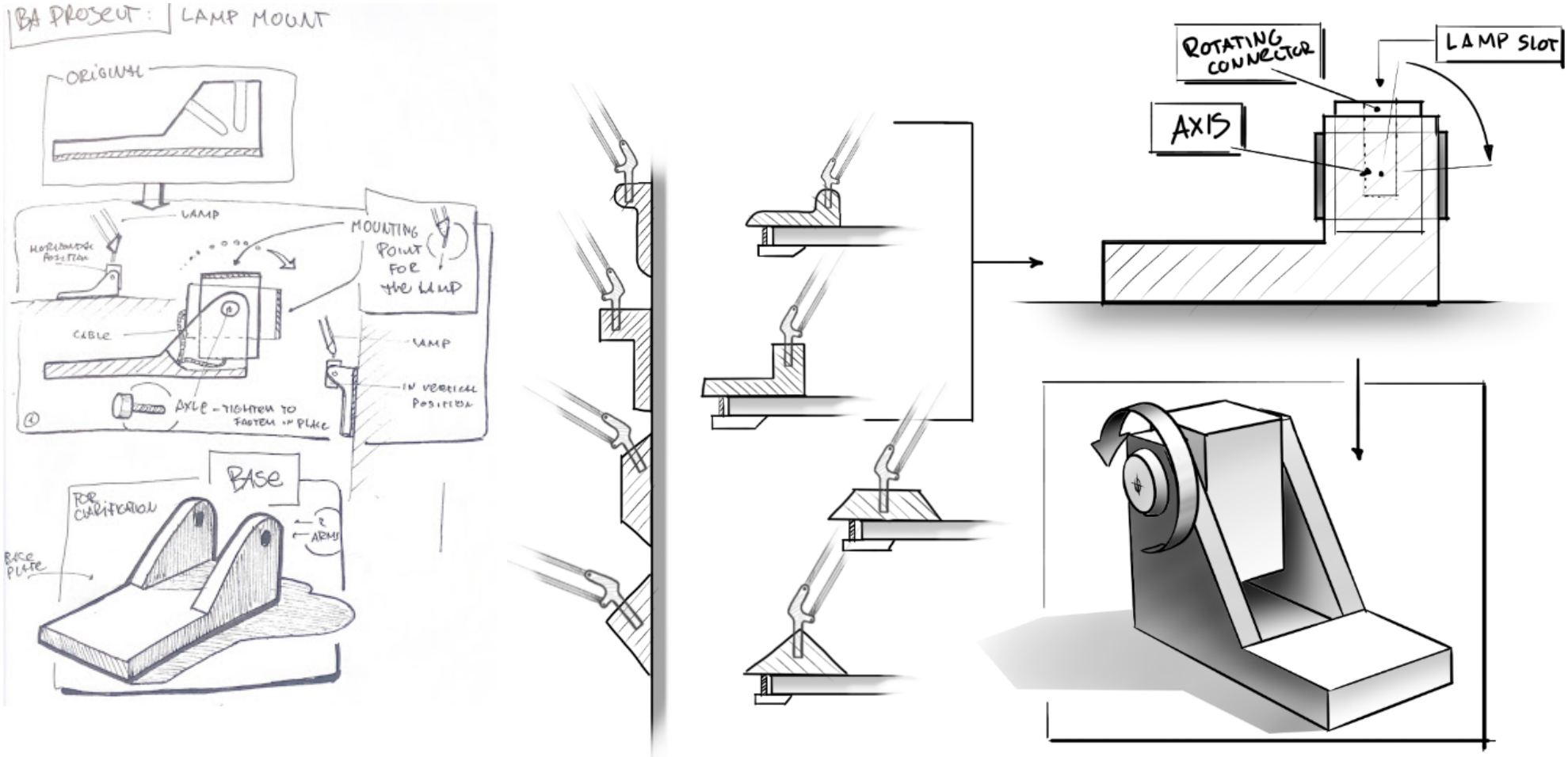


Showcase of all the exterior parts.

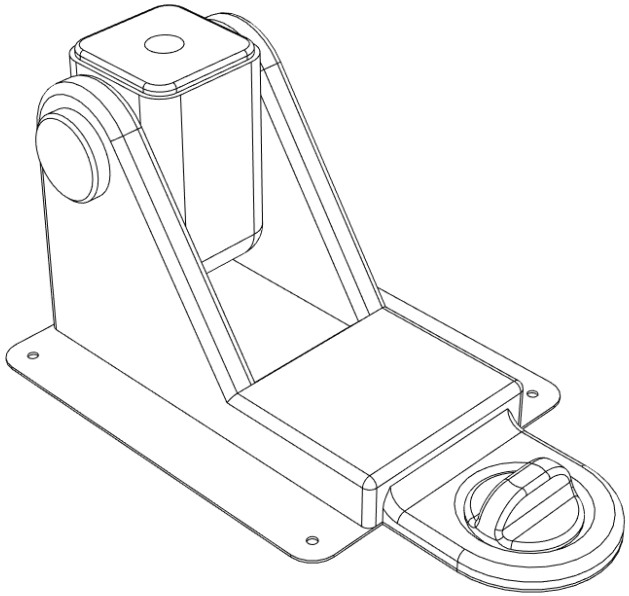
Second Concept

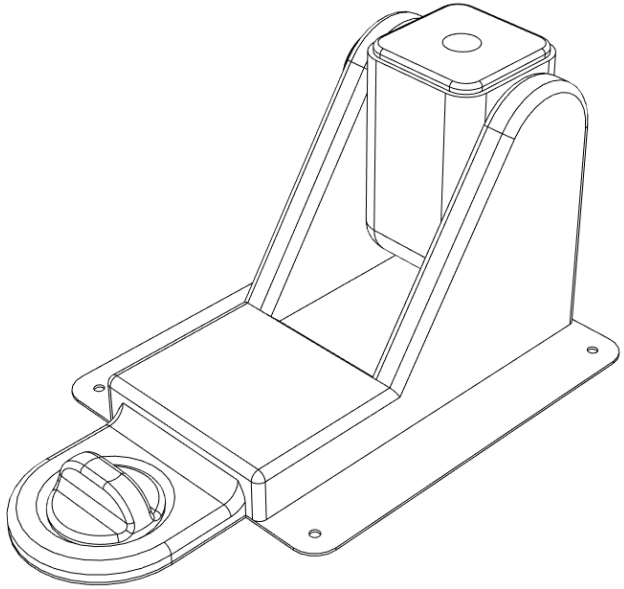
Second concept was developed after the first kickoff presentations. Major change was that I removed one connector hole and replaced it with a single hole on a rotating block. It made it possible to adjust the angle of the connector hole, depending on the angle of the surface it was mounted to, so the lamp could always be mounted horizontally straight up. It removed the major issue from the first concept and made it simpler to manufacture by reducing the number of connectors.

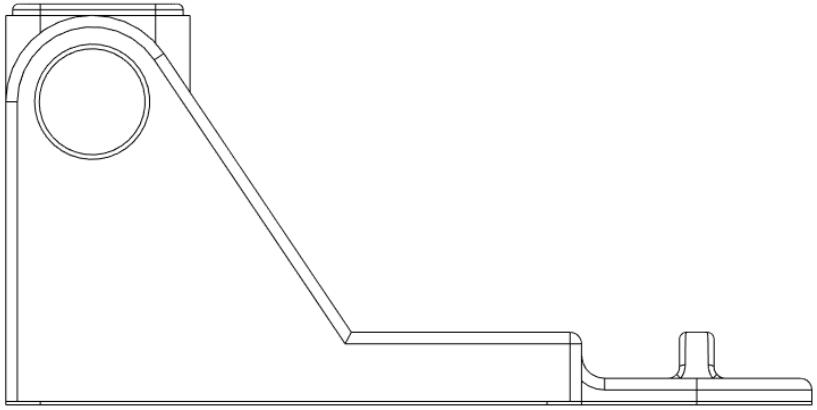


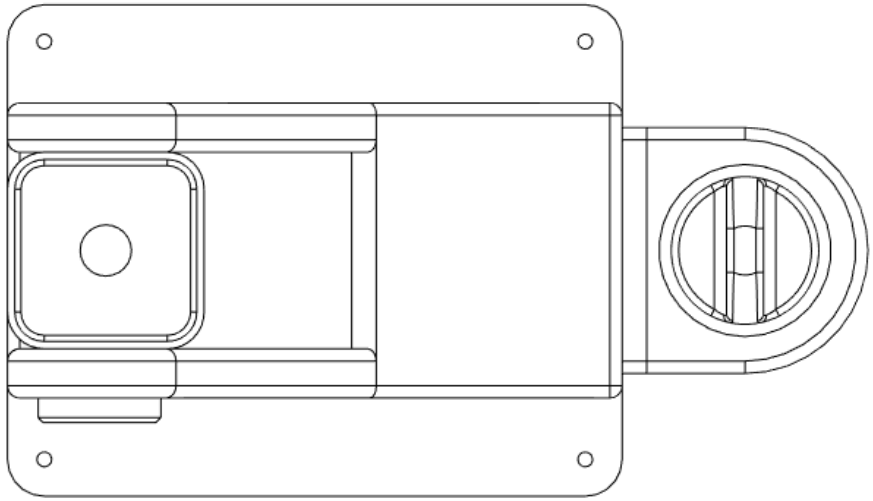


Sketches during the development of the second concept.





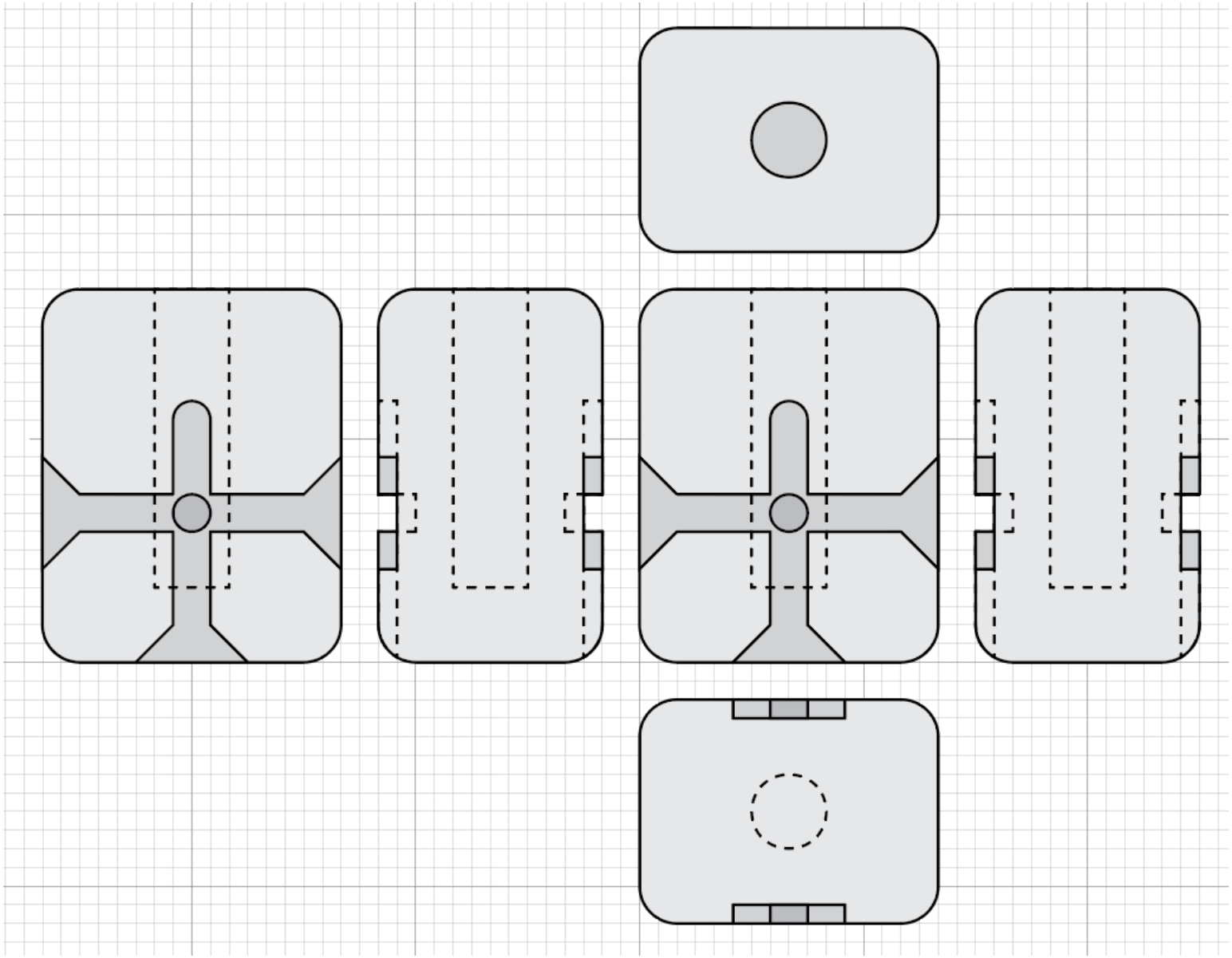




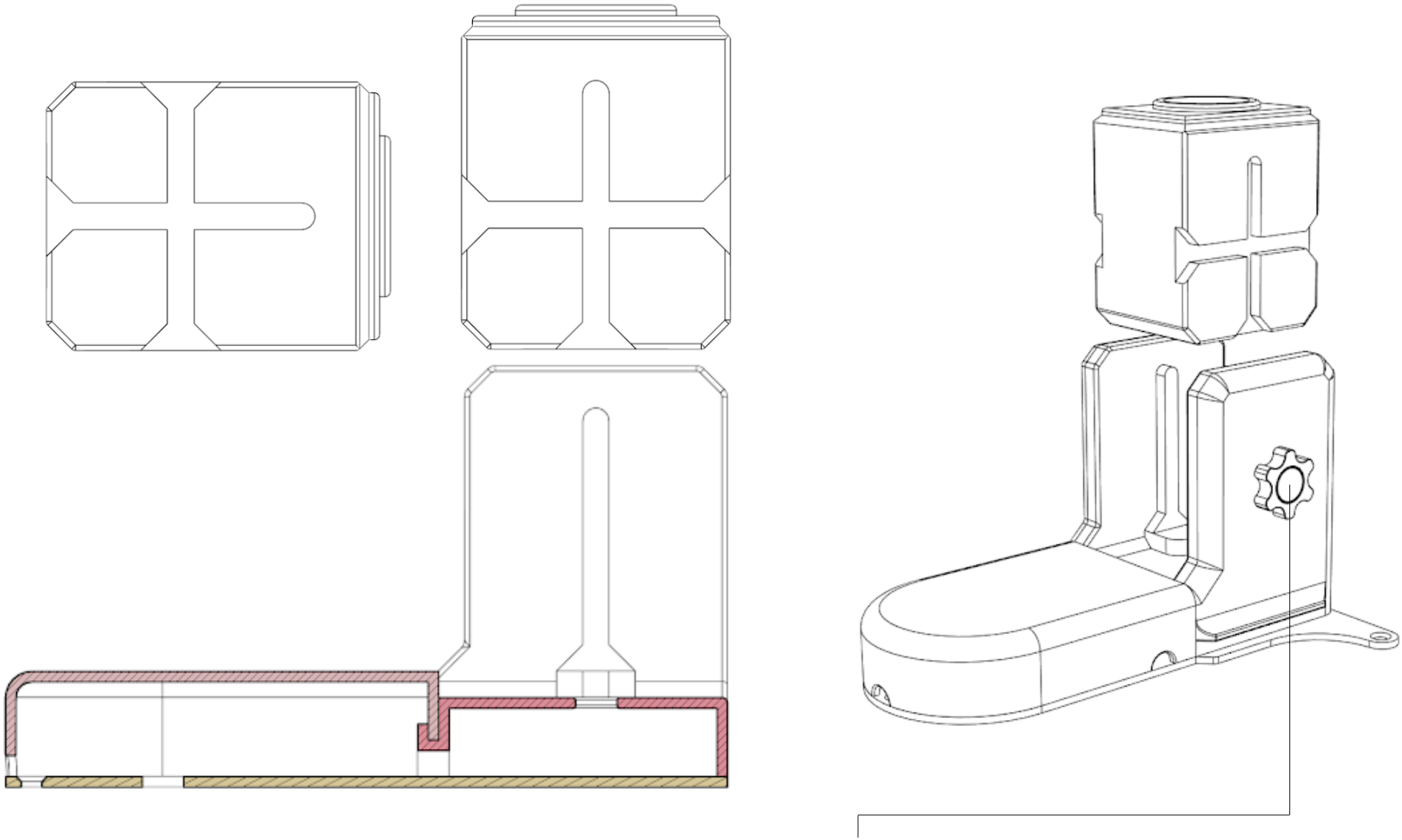
Third Concept (Final)

Third concept was developed after a supervision with Jasjit Singh. He made a lot of good points while criticizing the second concept, as why would there be a rotating part on something simple as a lamp mount. His point was that there were too many unnecessary features, as by the brief, one of the goals is to make it possible to mount it on a horizontal plane and a vertical plane.

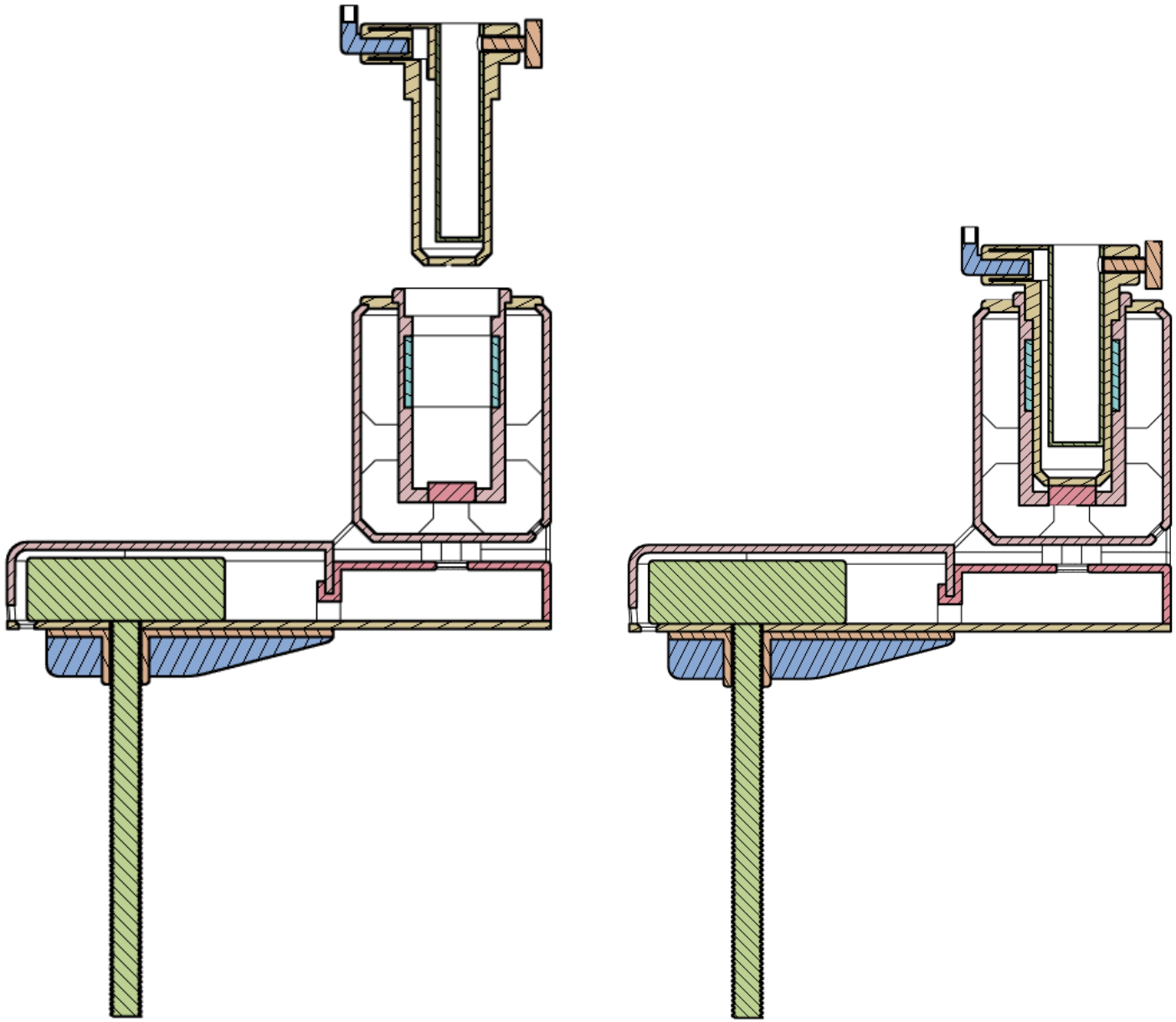
And so the third and final concept was born, thanks to brainstorming with my younger brother Jan Garstka who has a more technical approach to issues. He came up with an idea to separate the connector (adapter) piece from the rest of the mount and have the user attach it only in two possible settings: one for horizontal use and one for vertical use. I quickly sketched it out and shortly after made a CAD model to see the possibilities. I kept on building and adding features to this CAD, finalizing and solving small issues on the go and it became my final concept.



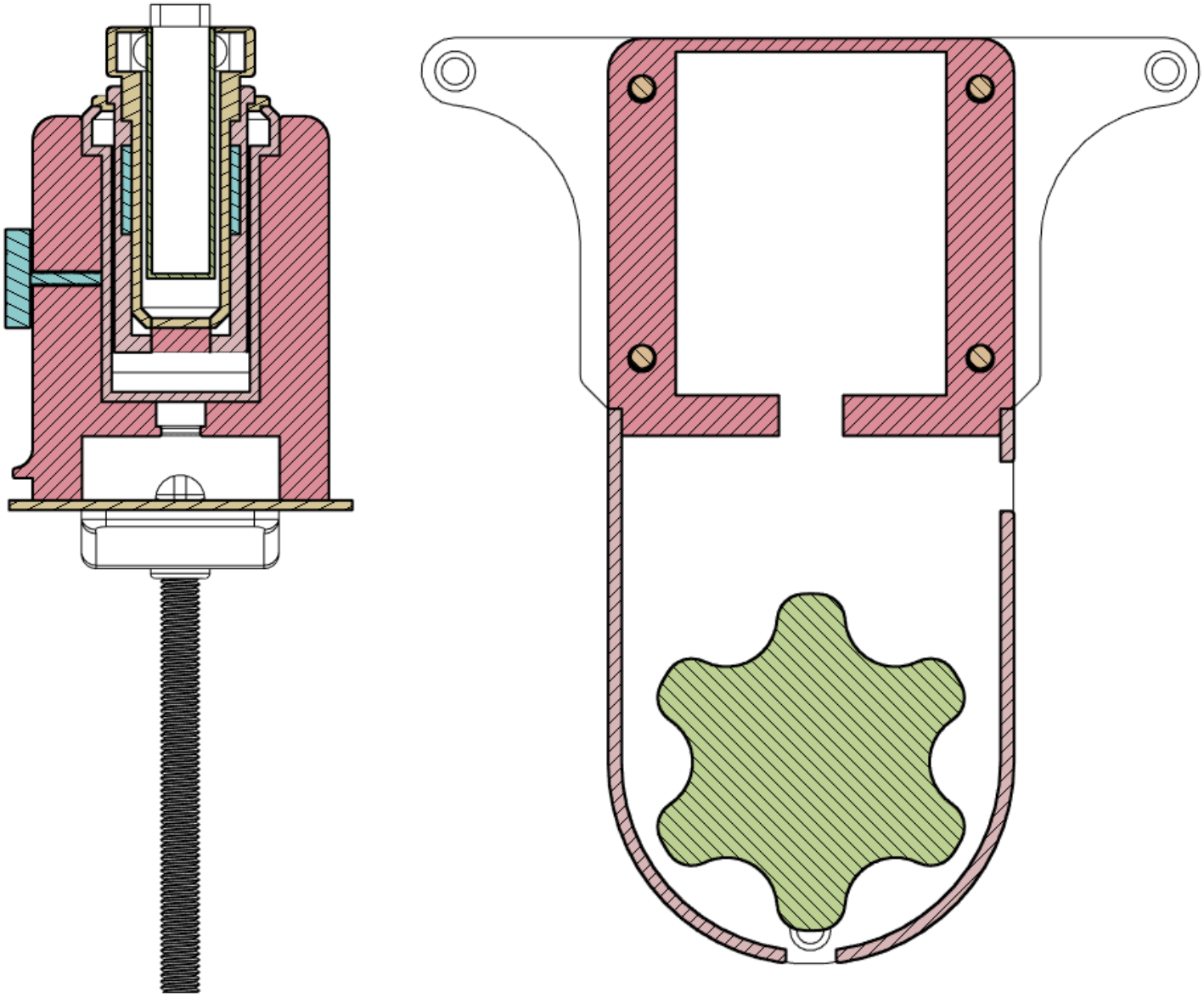
First CAD drawing of the sliding adapter housing from the brainstorming session with Jan.



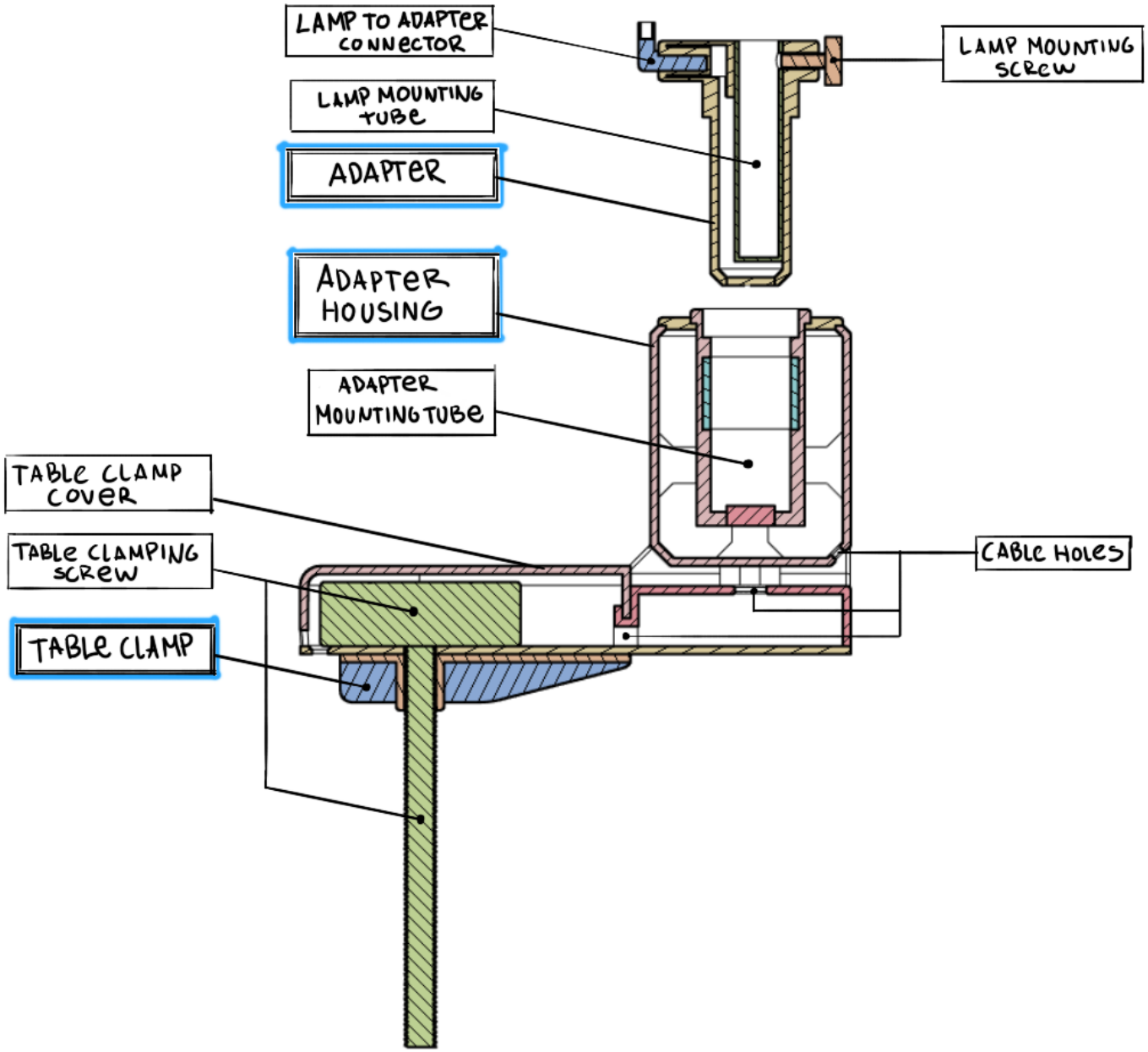
Adapter housing ejected and showcased in avaible mounting positions. The screw on the side is for tightening the housing in position.



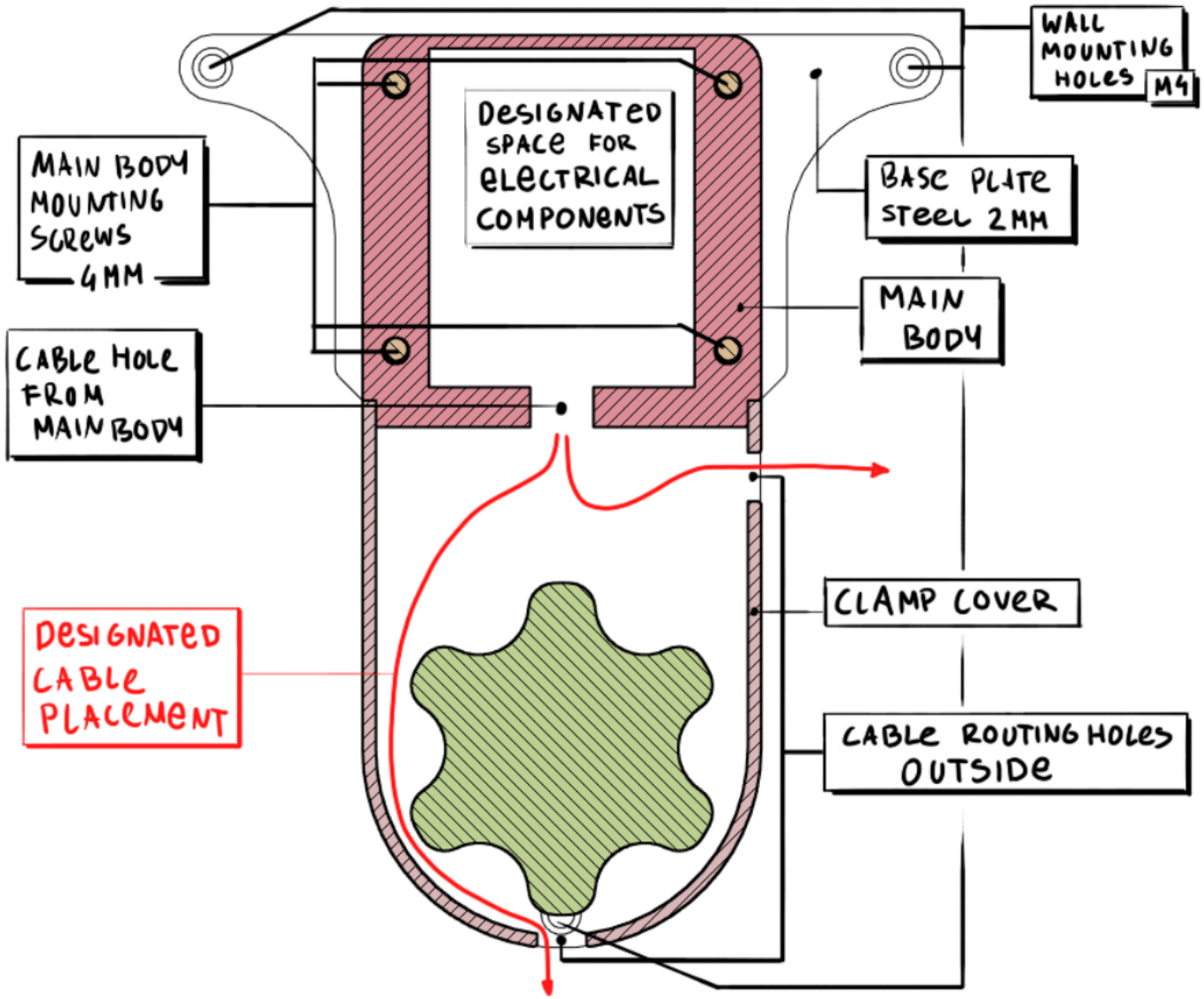
Cross section of the mount with adapter housing attached for horizontal mounting, connector ejected (left) and mounted (right)



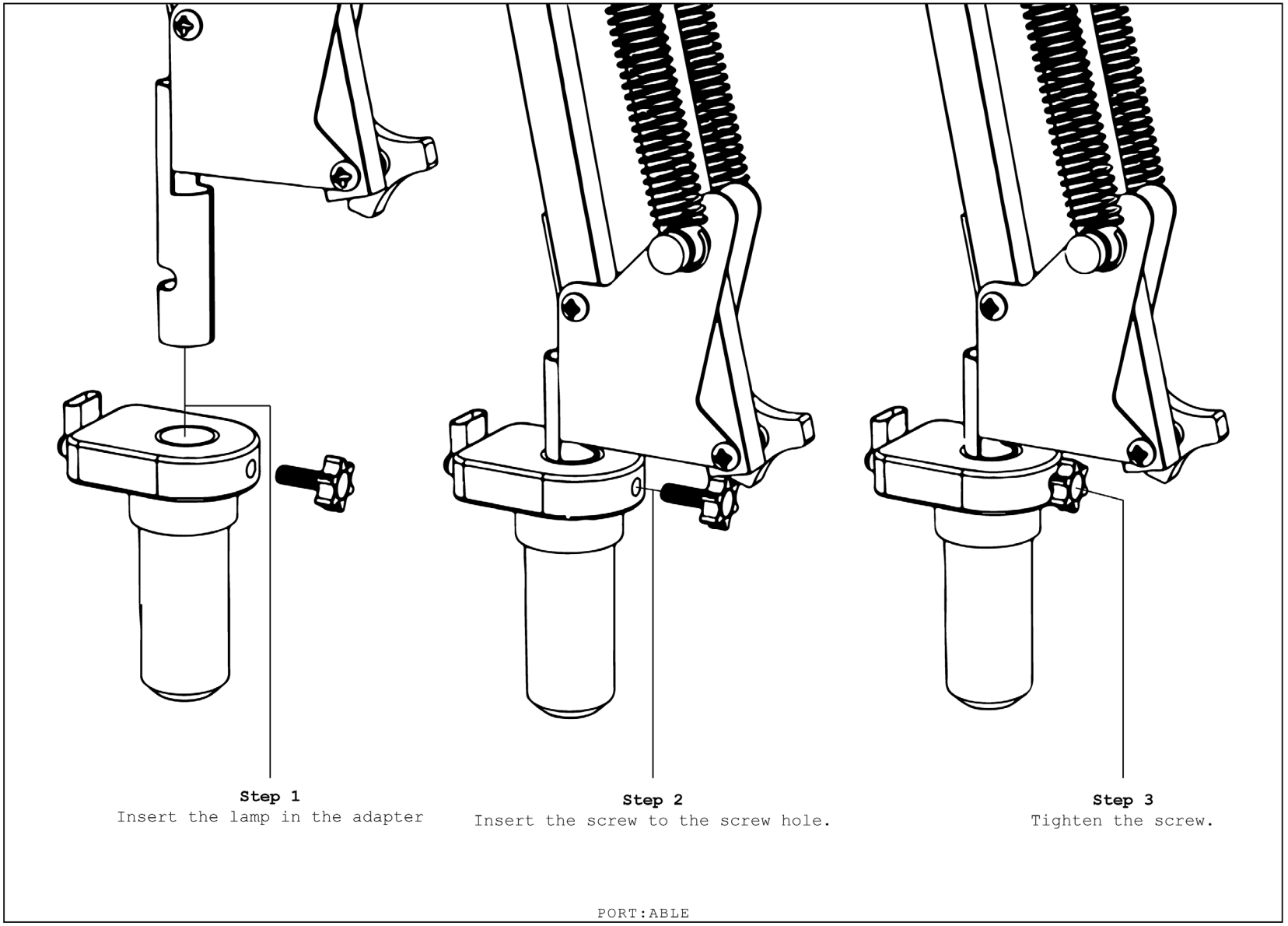
Front and top cross section of completly assembled mount.



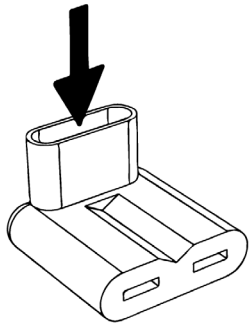
Explanatory sketches for cross sections (side view).



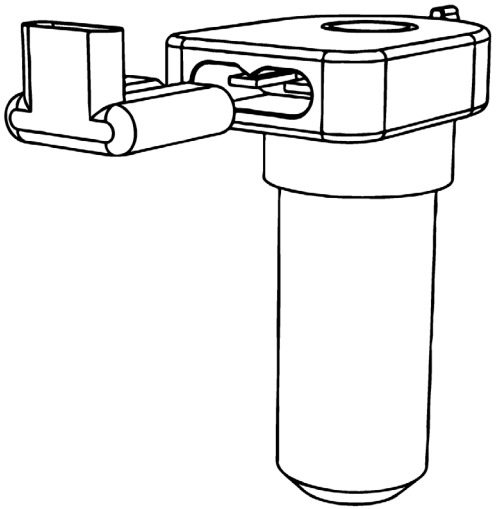
Explanatory sketches for cross sections (top view).



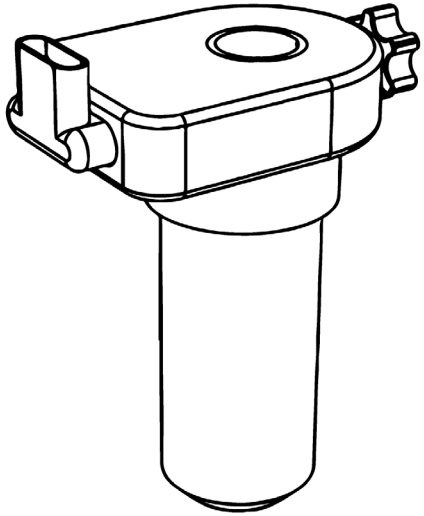
User manual for mounting the lamp in the adapter.



Step 1
Cut the cable and insert it in the cable plug as shown.



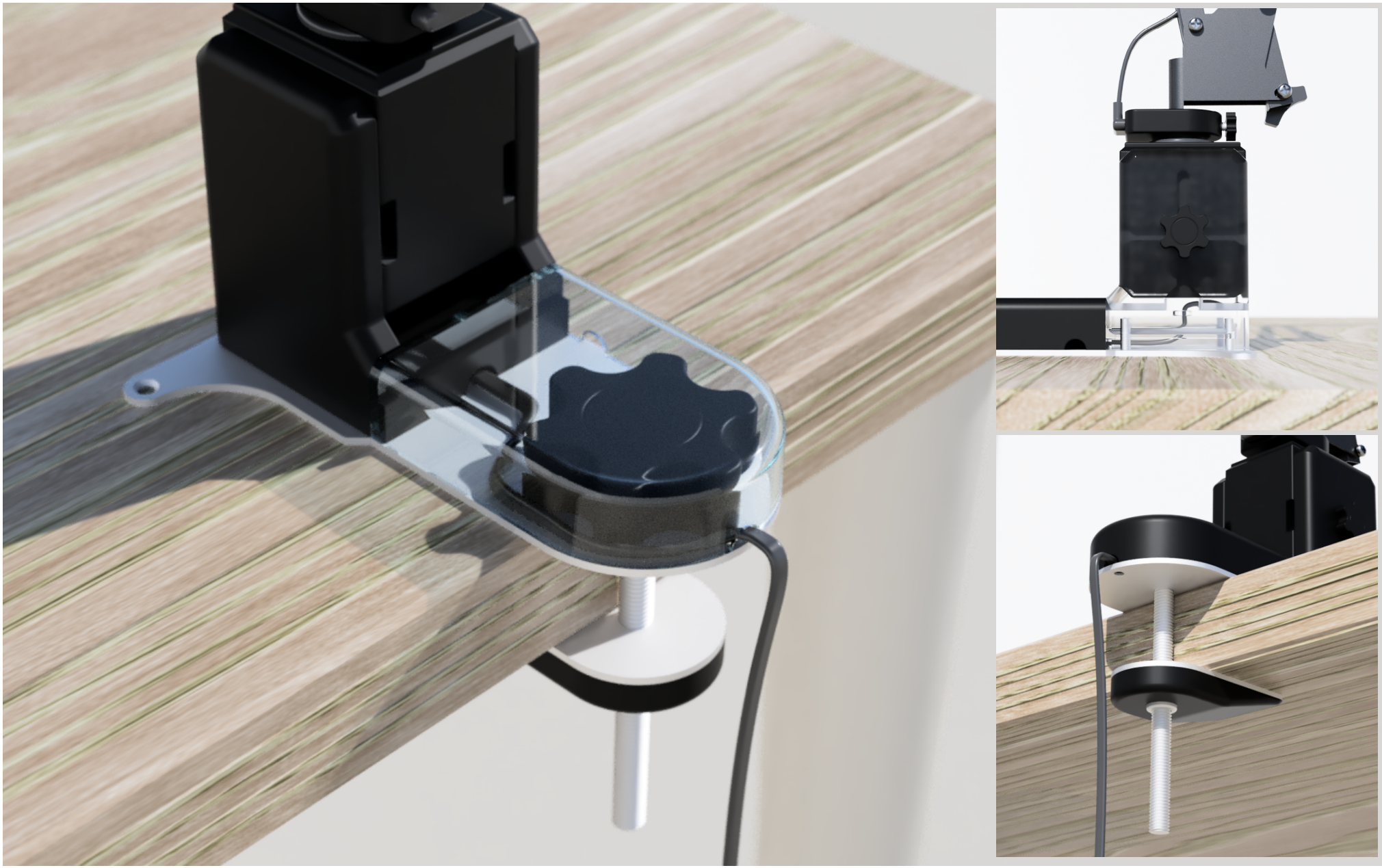
Step 2
Connect the plug to the adapter.



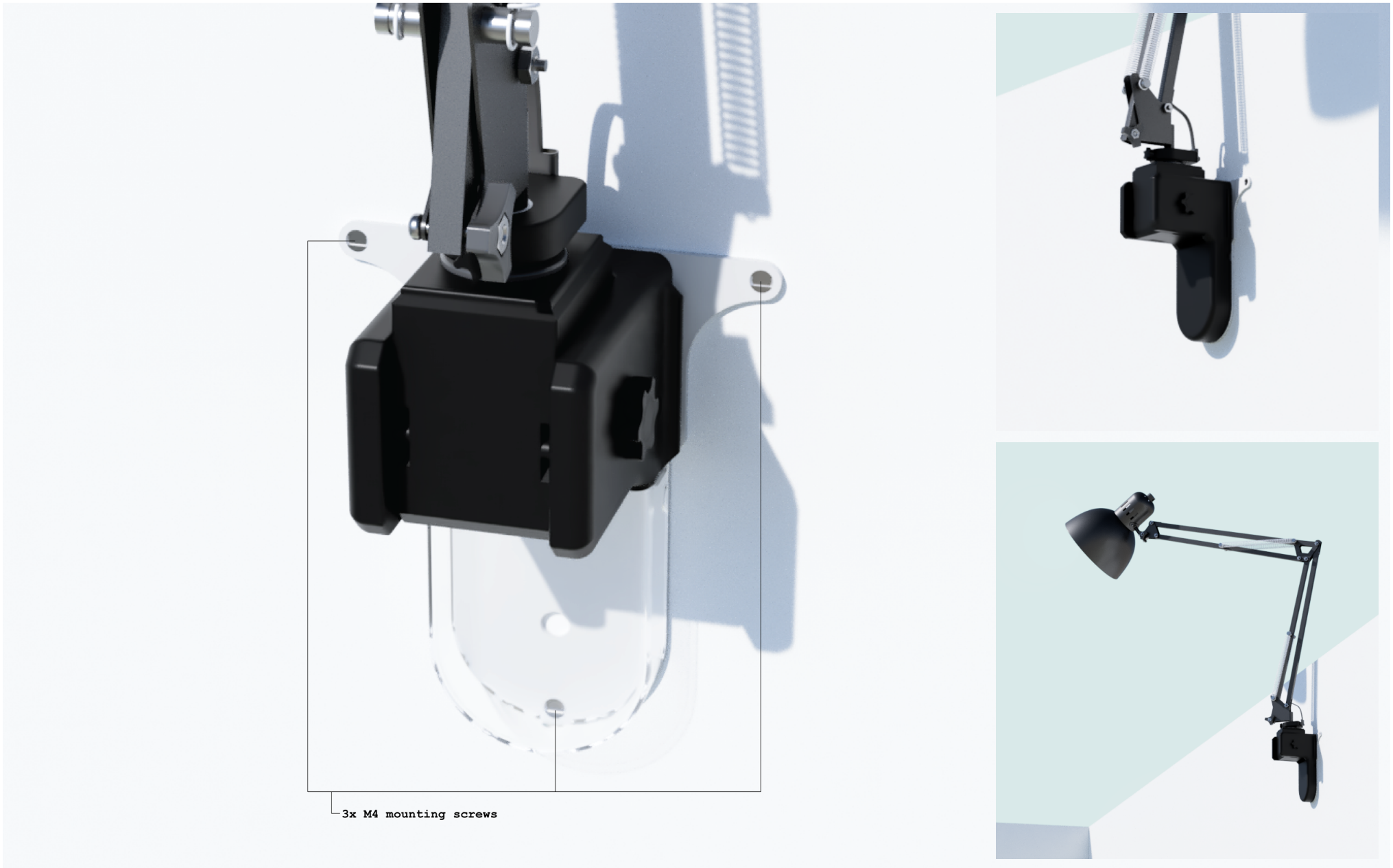
Step 3
Result.

PORT:ABLE

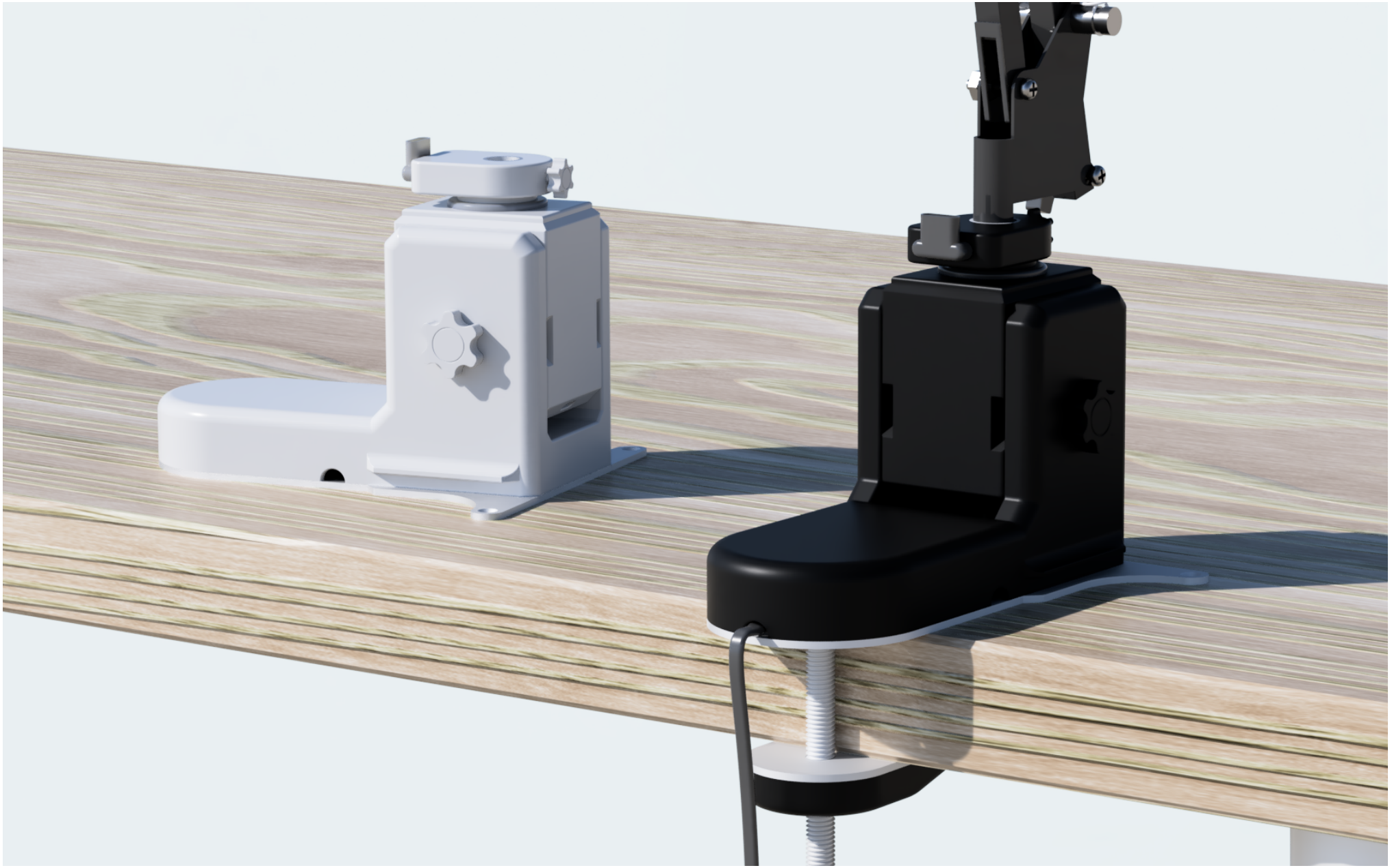
User manual for connecting the lamp cable to the adapter.



Cable route showcase while mounted on a deskside.

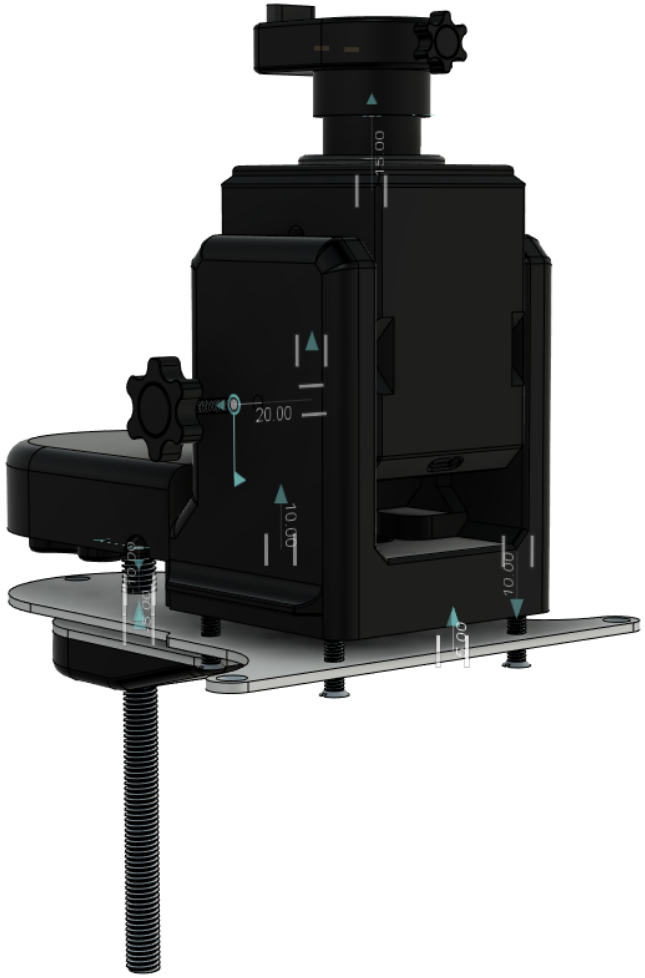


Wall mounting explained using 3 M4 screws

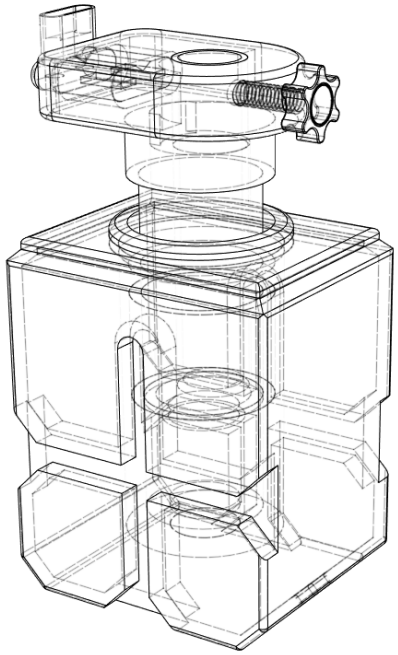


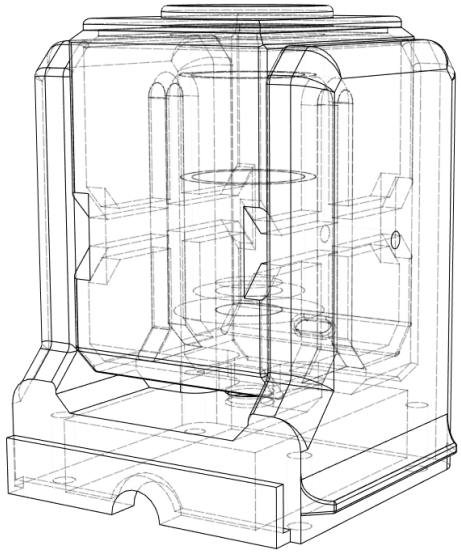
Realisation

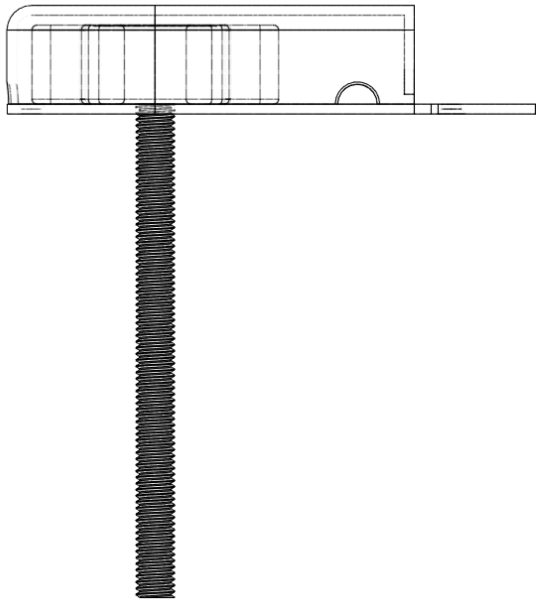
Prototyping

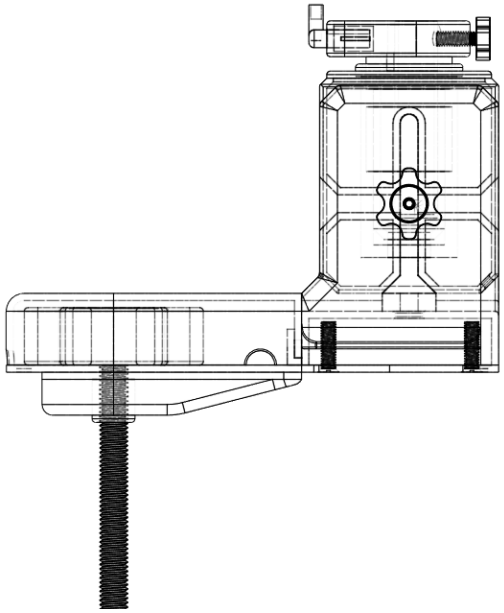


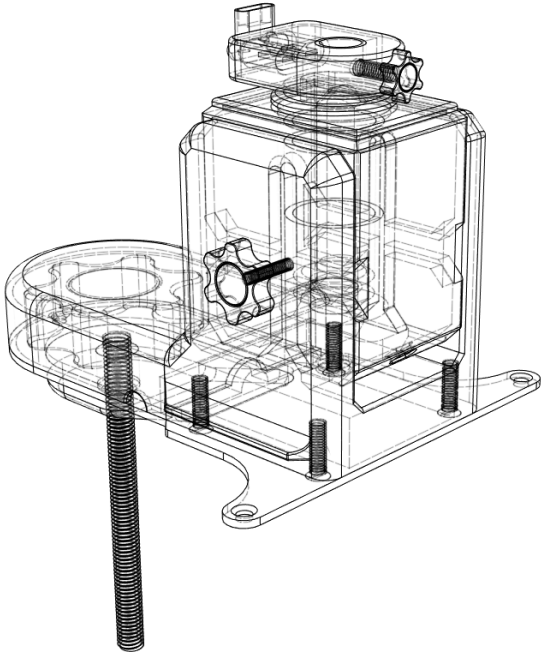
Prototyping began in the Automation part of Autodesk Fusion, where I mainly checked for clearance issues and spacing.

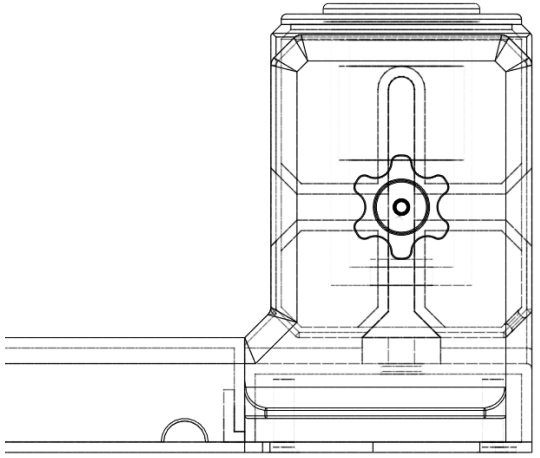




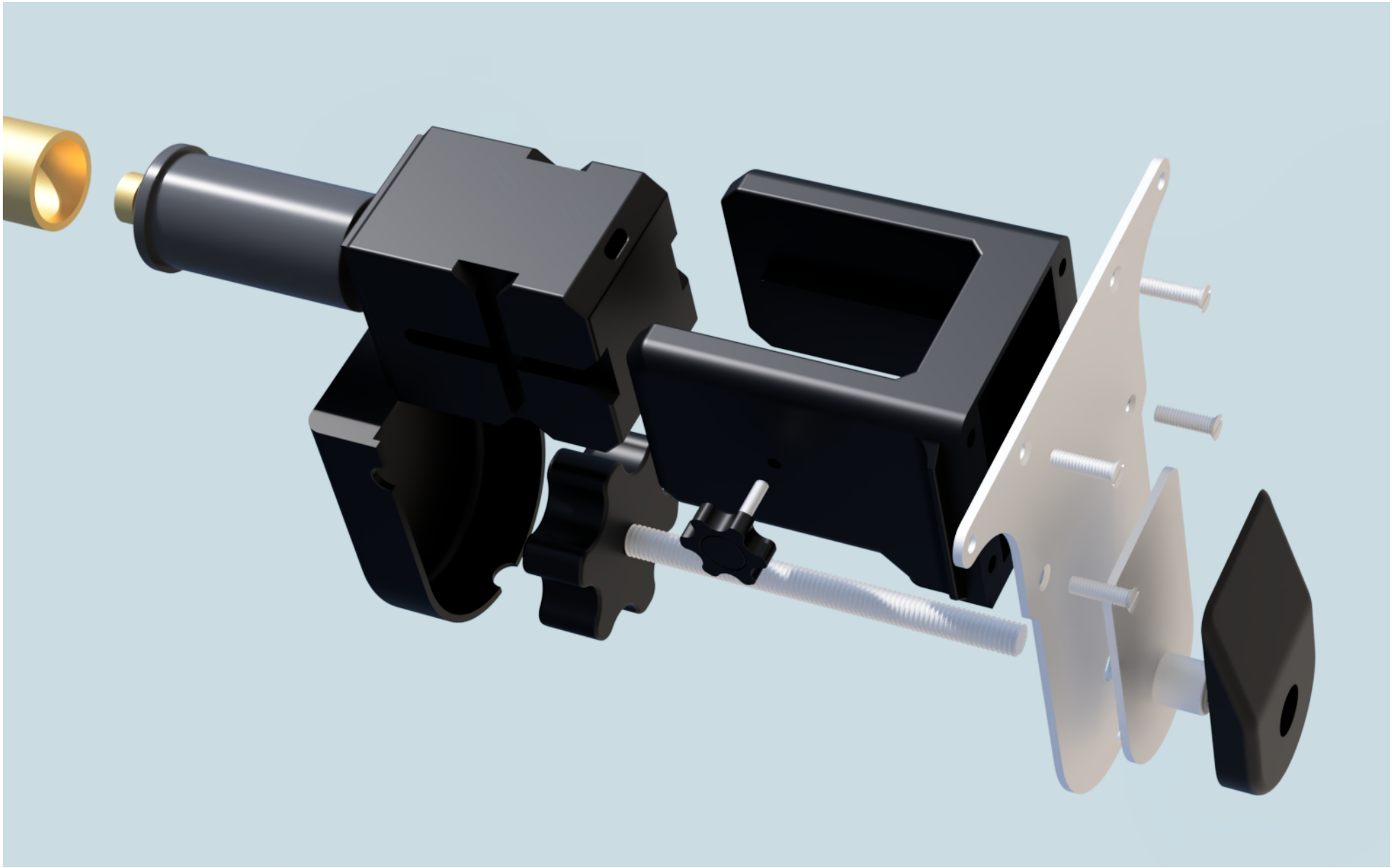








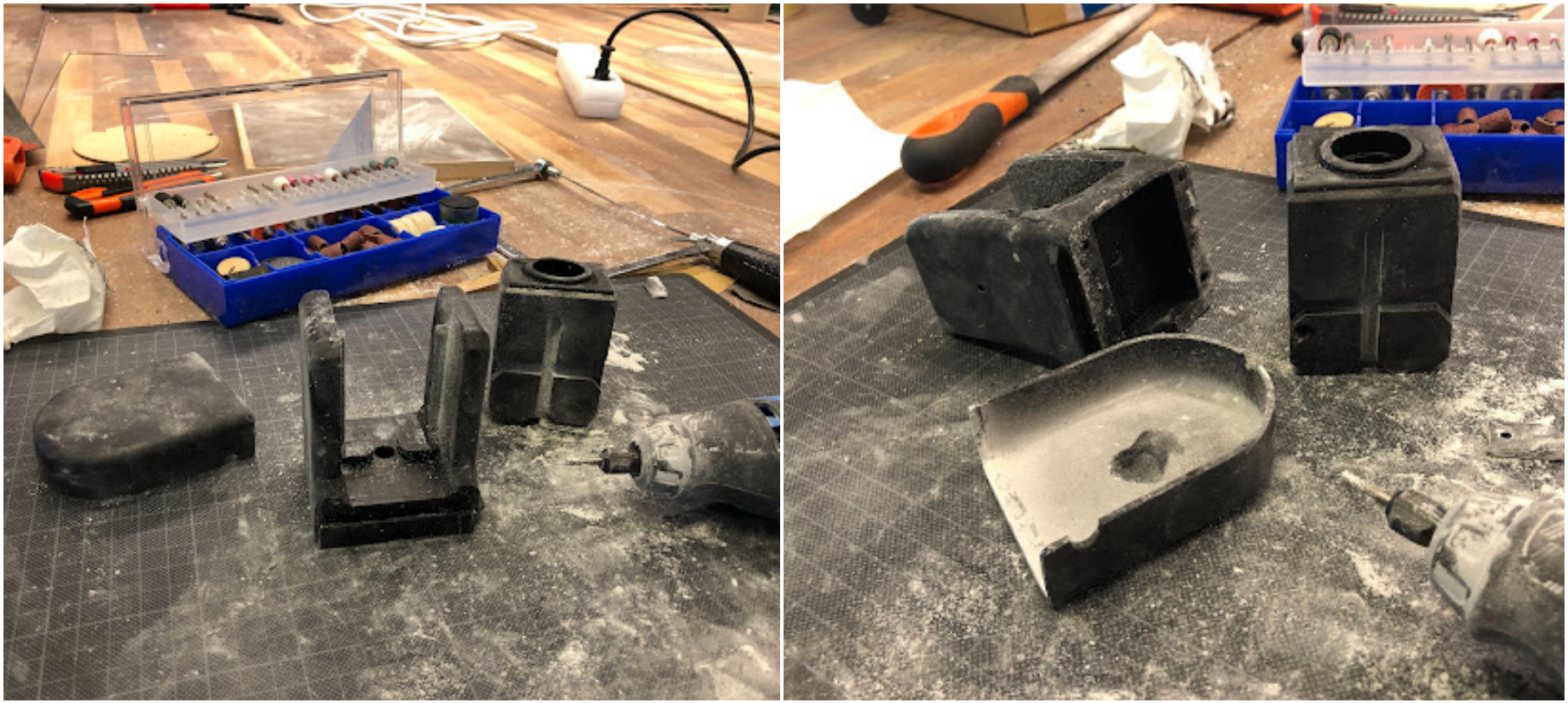
Exploded view of the final CAD.



My first prototype was a model printed in epoxy. I decided to test epoxy, since I heard many good things about this technique, such as how detailed the prints can be. My friend who decided to help me print it had plant based photopolymer resin, which in theory, is a safer and much more environmentally friendly choice of material than traditional epoxy. The model turned out pretty bad. The model was crooked, Inside geometry of the model caused some areas to expand, others to move while printing. Due to major misalignment issues, the model was not sufficient to test every feature I planned to test, but it gave me a feel for the scale of my product and all its parts, which I was very happy about. Finally I somehow assembled it to a complete prototype, but the model was just so hideous I decided to reprint it in another medium.

For the base plate I used 3mm plywood which was cut using a laser cutter. For all the metal parts, I used two sizes of threaded rod which was cut to spec and attached to respective parts: table clamp part and tightening screws for the housing and the adapter.

Resin and the printer model used to build the first prototype.



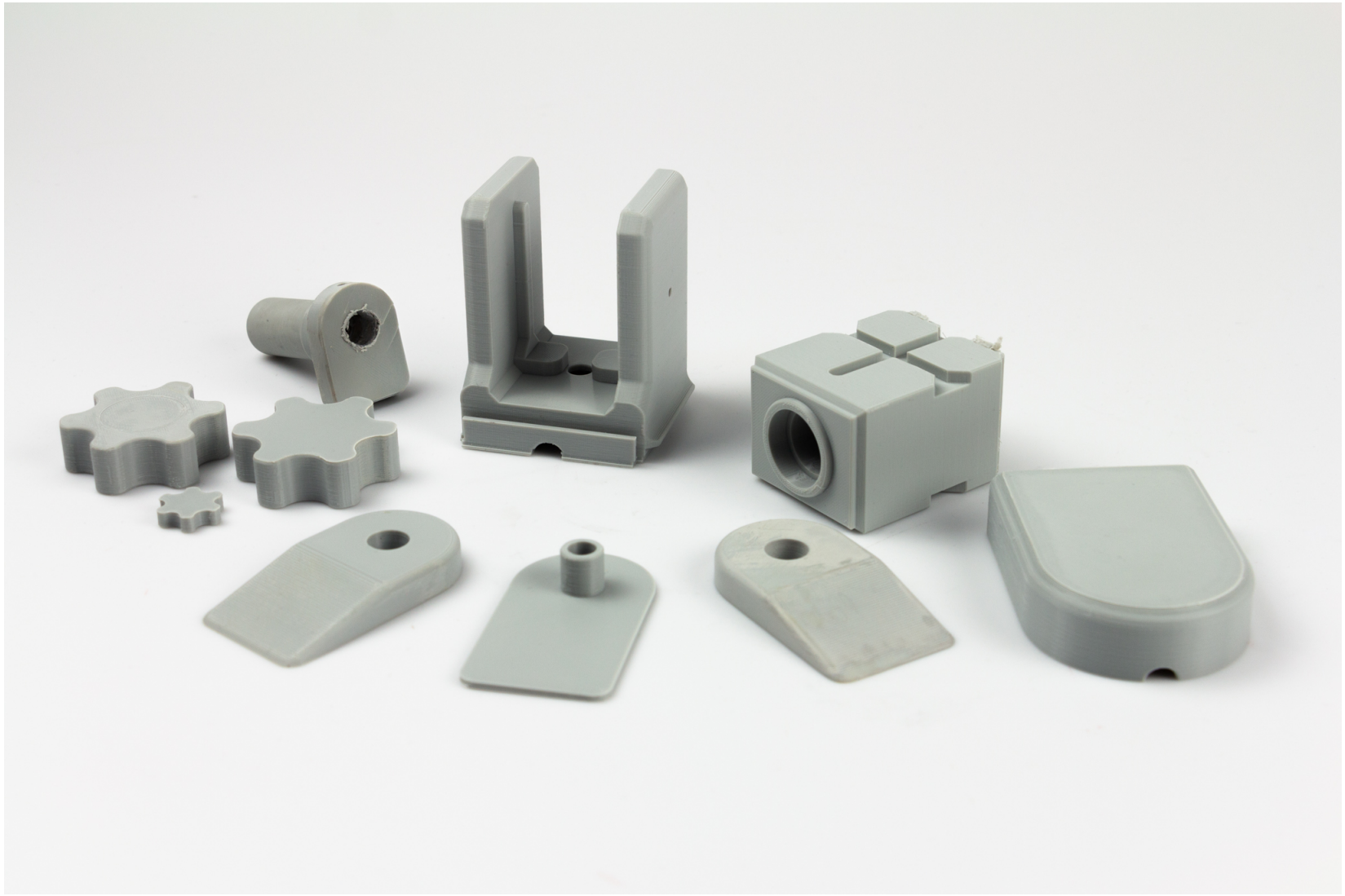
Prototype nr. 1 building process.

Prototype nr. 1 done.

Detailed photos highlight the poor quality of the resin print. This prototype was not sufficent as a final result.

My second prototype was the same model but printed in common PLA filament, on a traditional 3D printer. This model turned out to be much more rigid and the geometry was correct. Due to my bad work with specifying the tolerance and leaving room for possible thermal expansion while printing, the connector hole was too tight to fit the connector perfectly. But other than that the model turned out great as a display prototype.

I sanded and later painted the model in flat black and assembled it. The result is shown in the Final Product part.



Finalization

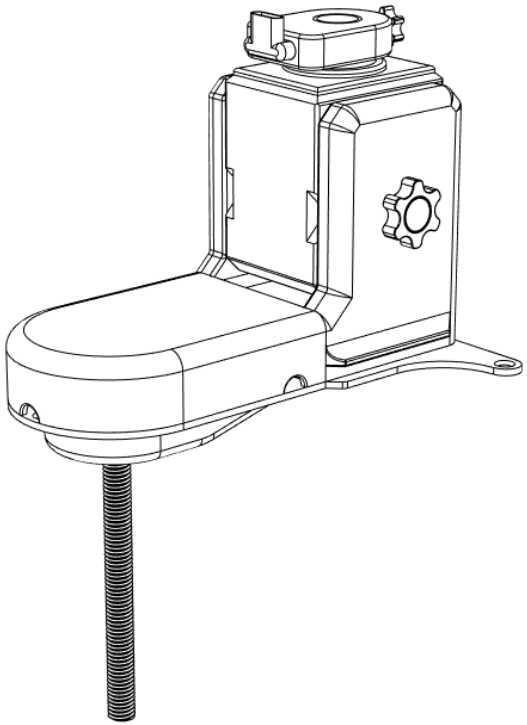
Electrical Issues

As I was developing the connectors, I reached out for help from my dad, who used to work as a control and regulation technician and he gave me the majority of feedback for how I should approach this part of the project. He advised me first to not to do this, as it is quite dangerous to make a working prototype of this type without any electrical experience.

I also reached out to some friends from Formula Student, who are electrical engineering students. They all advised me to buy a prebuilt connector, but the issue is that none of the available connectors on the market was fitting for my application.

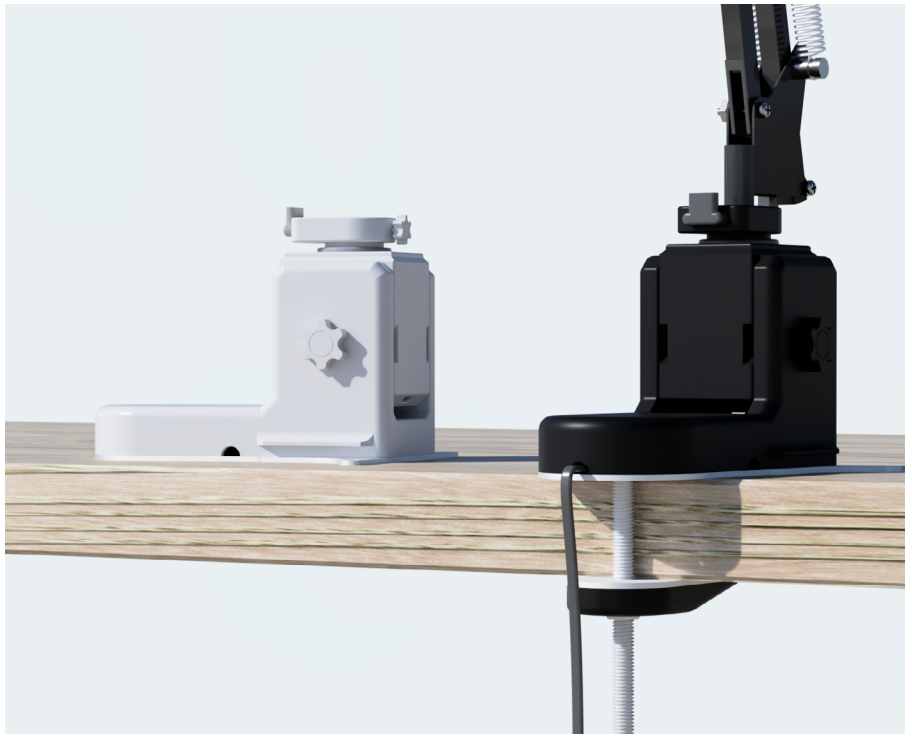
Shape

I did not put a lot of thought towards the shape, since a major focus area of the project was mechanics, so I went for a very simplistic design language. The shapes are mainly square and blocky, but to break up the harsh edges. I made 45° cuts alongside the top edges of the connector housing part and rounded down the outer edges to get rid of unnecessary material and make the mount look more friendly to the eye. I wanted to make the mount look neutral, to make it fit with whichever environment the buyer would intend to install it in to. I choose to hide the table clamp behind a cover, which would also house part of the cable.



Color Variants

Color palette chosen for this product is simple as well. I chose to go with black and white variants of the product, as the mount should not be in the center of attention in the room or take focus away from the lamp. It is a tool which highlights the design behind it, not the visual aspect. Black and white are the most common colors, so if a lamp is mounted, for example, on a wall, the white is an obvious choice, so the mount would blend in better.



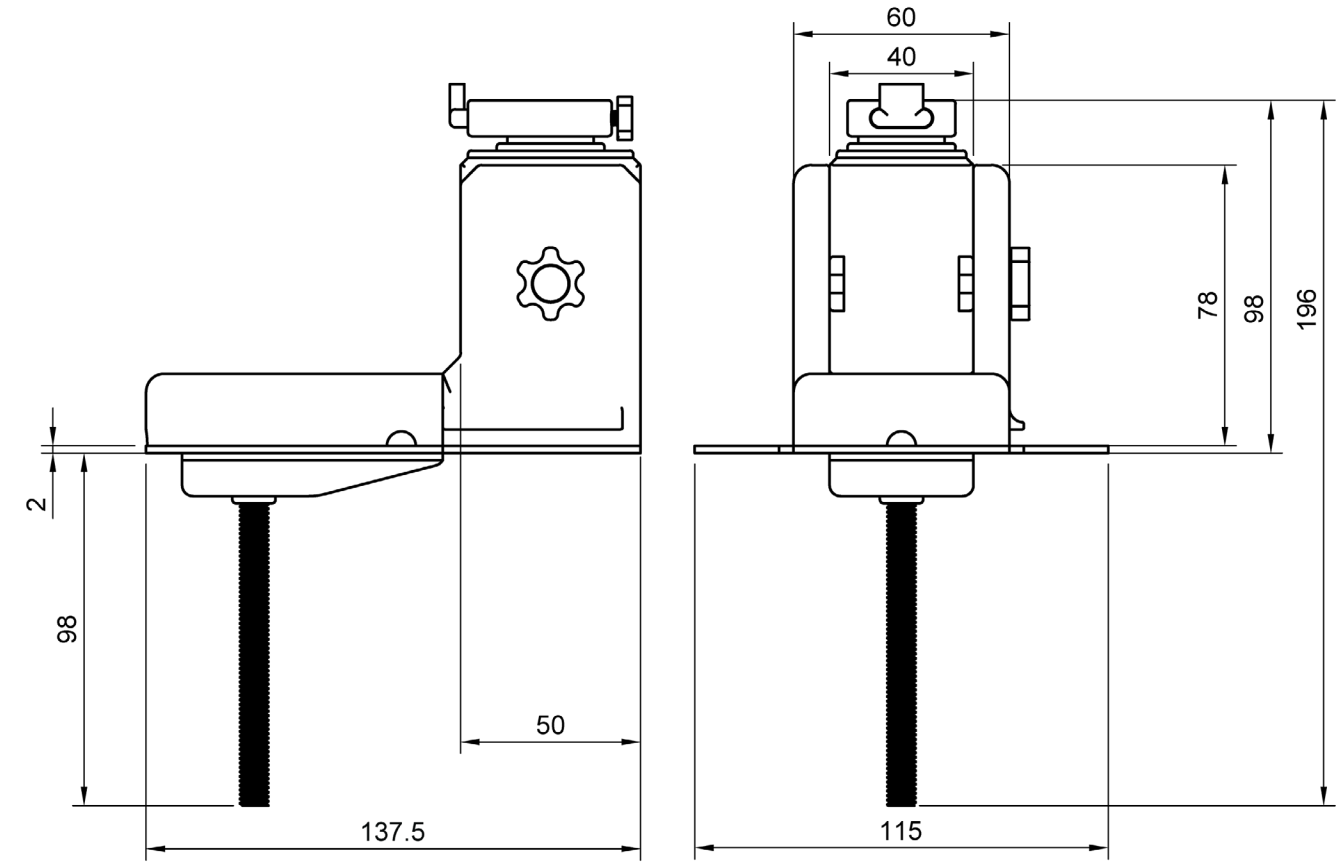
Material Choice

For the material choice I went with a basic 2mm aluminum plate for the base and the threaded part in the table clamp. For the body and all other parts normal PLA plastic would be sufficient and relatively inexpensive. The screws are a normal threaded rod cut to spec and attached to the screw heads. For assembly there would be 4 M4 screws required to attach the main body to the base plate.

Material Finish

The choice of material finish on all parts was matte for both color options. The reasoning being that matte finish conceal scratches and wear and tear damage better than a polished finish.

Technical Drawing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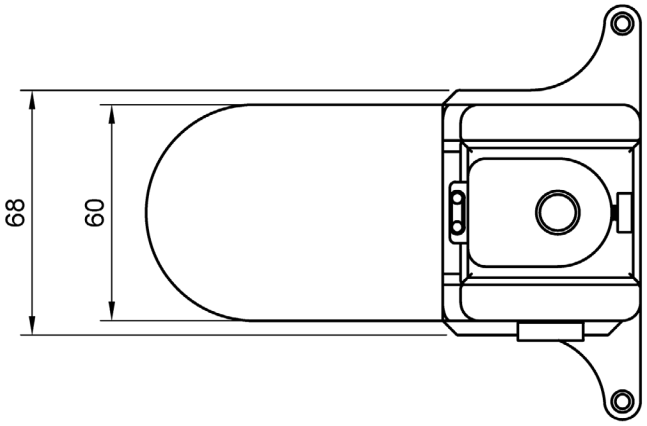
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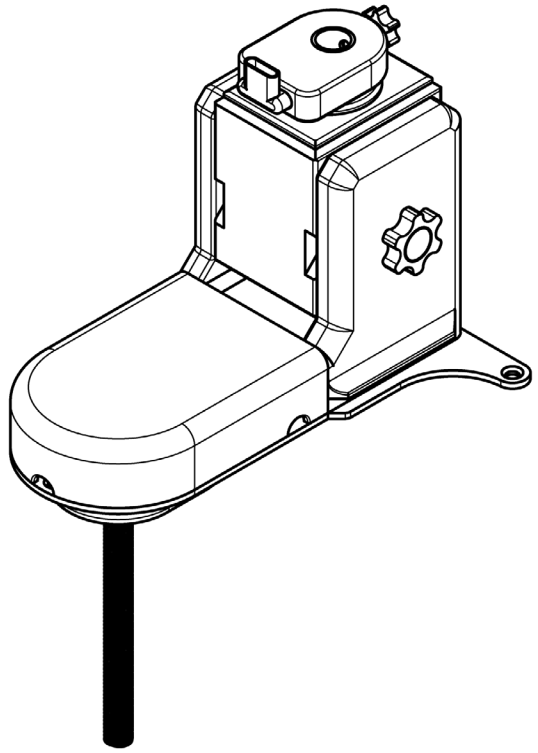
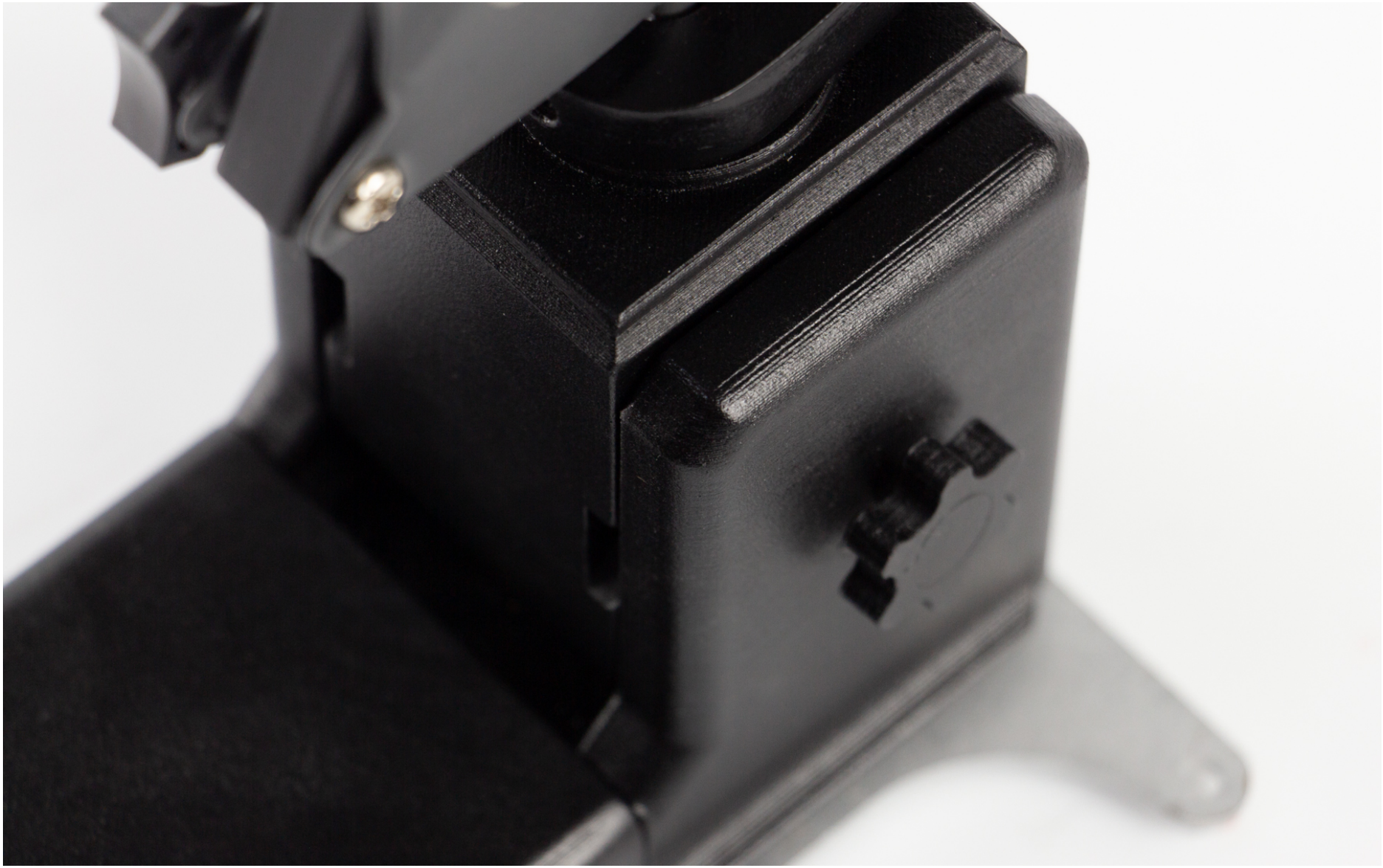
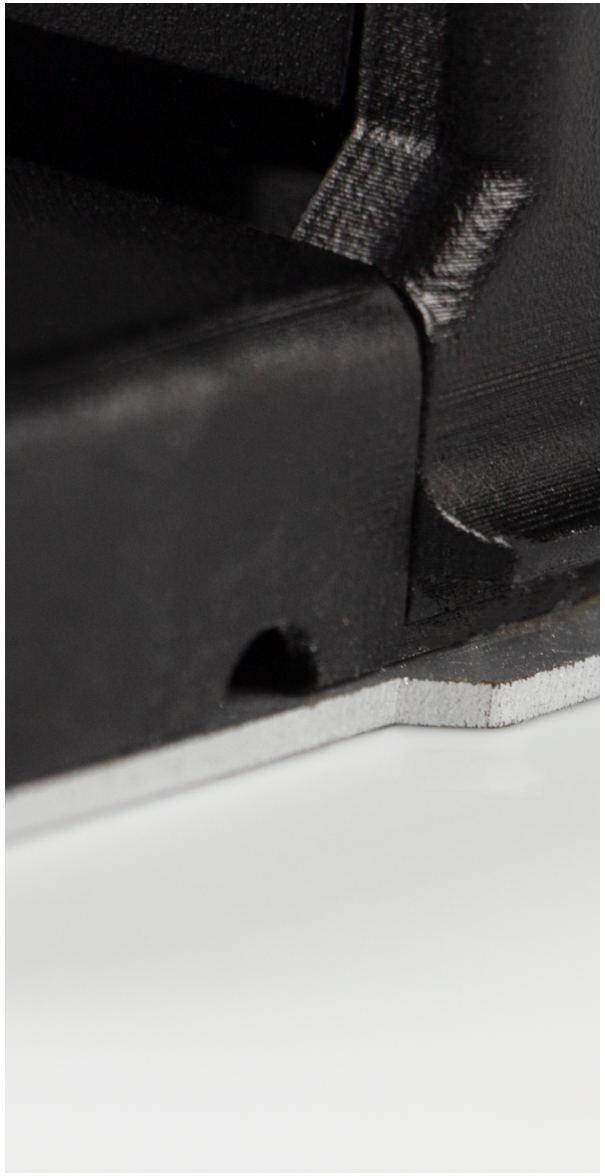


Final Product





Evaluation

Future Development

Electrical Aspect

For development of the electrical part, I started to look at mini jack connectors, since that's where the initial idea attached to the electrical aspect originally. I soon found out that even the biggest jack type plugs and sockets are not able to handle the voltage I needed and were not big enough for my application. The concept was still the same, but I was forced to develop a connector of my own.

During the later phases of the project, after learning the basics of electronics, it turned out to be a much larger task than expected. I decided to leave it for the future development part, because I realized that it is impossible for me to achieve it in the remaining time frame.

Baby Safety

I realized too late that the connector hole is wide enough to fit even an average adult finger, which raised a major concern. For this part in future development I would design a mechanism which would only allow the adapter to enter the connector hole and block everything else.

Connector

The connector part is an issue as well. I would redo it if I had an electrical engineering degree, but for the time being this would be better off to solve for experienced engineers.

Cable Cutting

The part where the user cuts the cable during mounting the lamp in the adapter is also not very pleasing. The fact that the lamp can only be used with the PORT:ABLE product is not very user friendly and I would resolve it as a part of future development.

Reflection

This was a major project in my career as an upcoming designer, not because of the weight that comes with it being the bachelor project, but as a learning opportunity in many aspects. I did learn a lot about new fields, universal knowledge during the research and so on, but most importantly I have gotten a good insight of my behavioral patterns in my work. If I could do the project again from the beginning with that knowledge, I would approach everything differently. Majority of the project was done in CAD, which I would preferably not do again. Instead I would like to focus more on physical prototype making and experimenting. I would also try to explore other branches of my idea, such as experimenting with the arm mechanism or doing a new type of shade. In the ideal world it would all fit in the timeframe. The second issue is that my planning was not quite helpful, as I approached the issues in the project as they came up and tried to solve it on the go. I would change that and try to be more analytical if I had the chance to do the project from the beginning again.

Overall the project was a great experience. Thanks to the amazing teachers and supervisors, the project really helped me to grow as a designer, both showcase what I am capable of and what I lack and have to work on. Supervisions with Jasjit Singh always help me center my focus on what is important and what I need to drop. Claus, Charlotte and Anna gave a very insightful critique and clear comments every time they had a chance to, which I am very grateful for.

Sources / Reference Index

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Thank You

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