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# DEVELOPMENT OF A HIDDEN BLADES FAN PROTOTYPE – CASE STUDY

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The prototype of the bladeless fan consists of:

### The theoretical part of the design

- Basic terms and definitions
- Prototype
- Modeling
- Construction

### The practical part of the production

- Creation of 3D models (virtual prototype)
- Creating a physical prototype
- Prototype analysis

## Basic concepts

### PROTOTYPE

- A prototype is the first, original form of a product or a part of it in an appropriate form intended for various forms of testing and use.
- Prototyping can improve product knowledge at almost all stages of the process.
- From the point of view of appearance, we distinguish between virtual and physical prototypes.
- Construction is the creative activity of thinking through a wide variety of systems.
- 3D modeling is the process of creating a mathematical representation of a three-dimensional object.

# To arrive at the prototype it was necessary to design the product

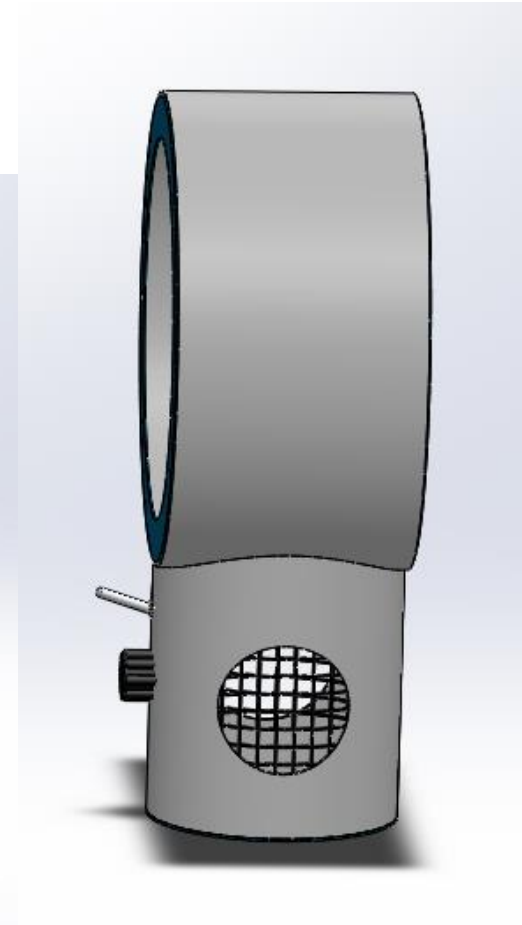
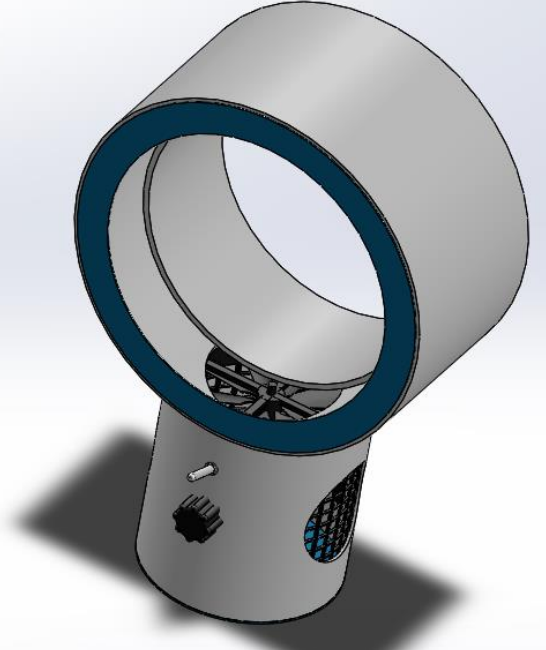
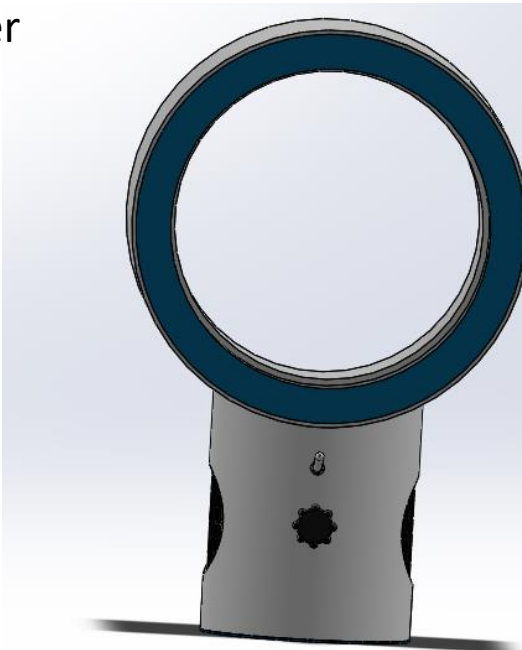
It was necessary to:

- make a literature research, search Internet sources in order to find the function, appearance, dimensions and materials of all parts,
- first make rough sketches of all parts and assemblies,
- make 3D models of all parts and assemblies, adjusting sizes and dimensions,
- make technical drawings of parts,
- build all the parts and assemble them to create a physical prototype.
- analyze the physical prototype.

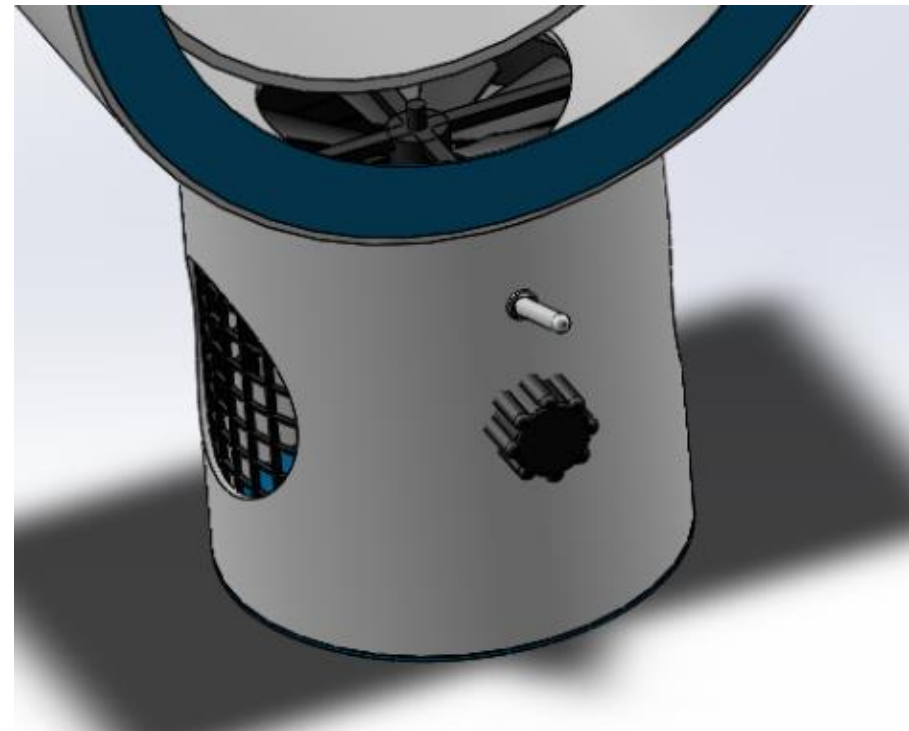
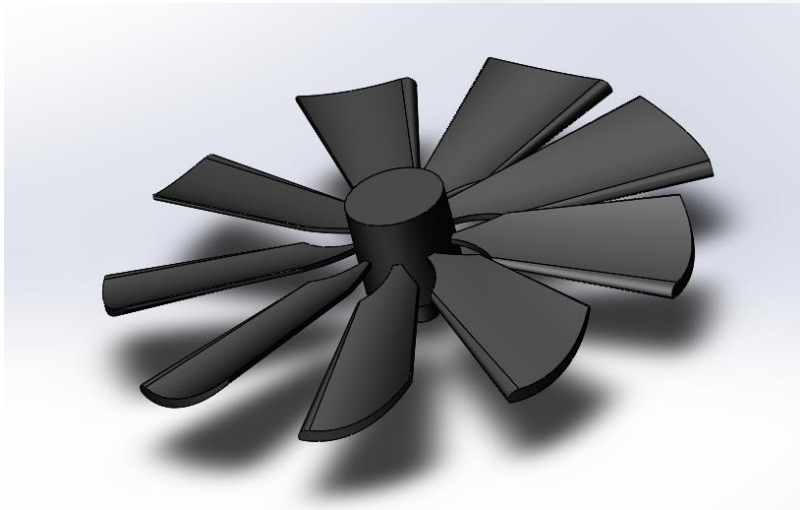
3D model and virtual prototype.

Basic parts of the fan:

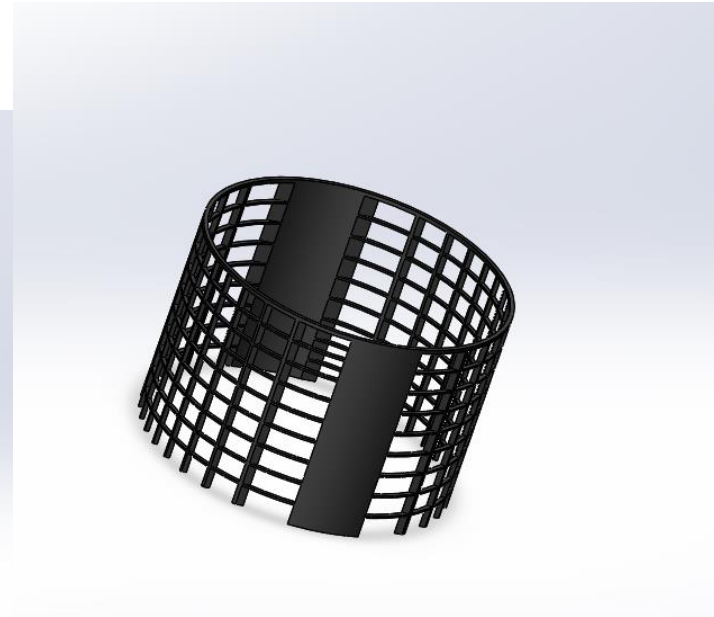
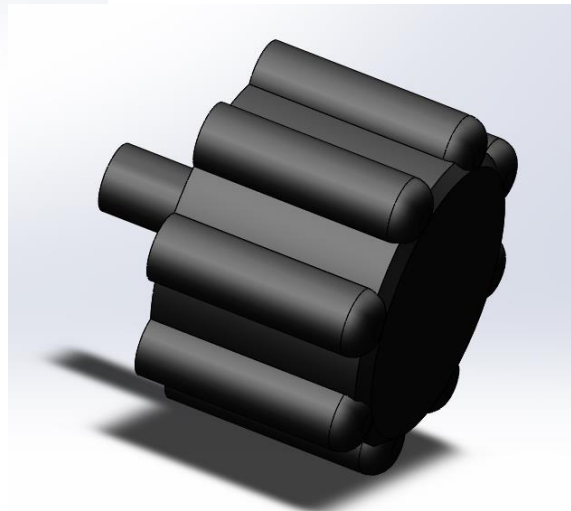
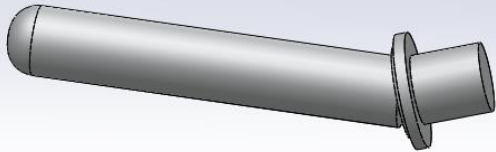
- external assembly
- small fan
- two rings
- net
- switch
- dispenser



A small fan with a pad is inserted into the lower part of the outer assembly



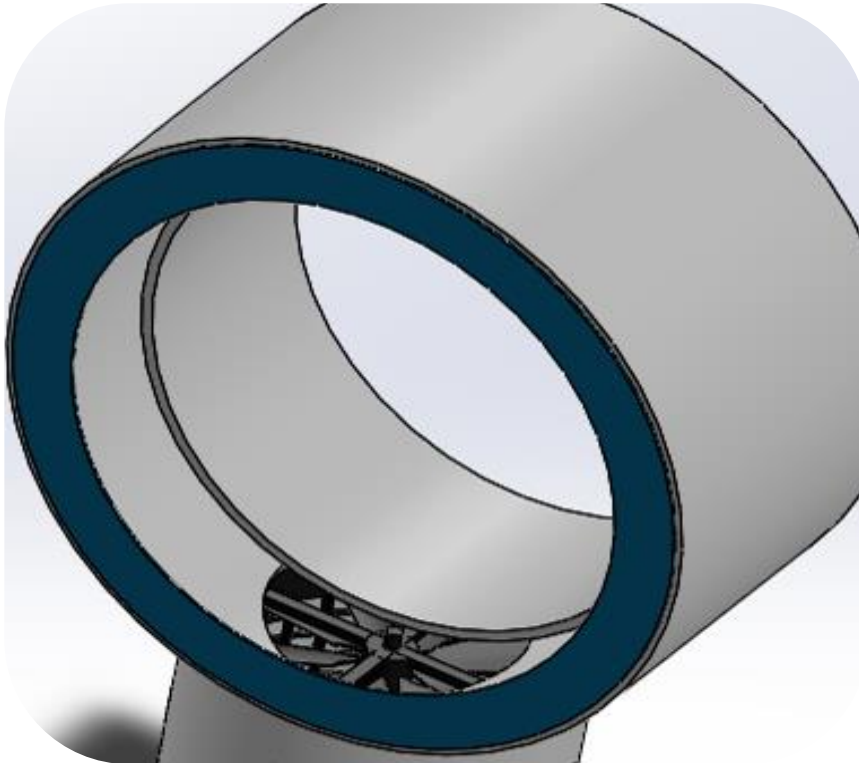
The switch and dispenser are located on the outside, and the net is inside the outer assembly



## Working principle:

- There is a motor that drives the blades in the lower part of the fan.
- The air is sucked in from the bottom through the holes, which is then expelled to the other side through the upper part of the fan.
- The motor is hidden in the center of the fan.

## Upper part of the outer assembly



## Creating a physical prototype

During the creation of the physical prototype, it was necessary to make some changes compared to the 3D model for easier production and the functioning of the fan.



## The first stage of production

The first stage is to insert a small fan into a 10cm pipe. The fan has an electric motor that drives it. The power of the motor is 15W, and the voltage at which it operates is 220V.



## The second stage of production

The fork serves as the outer frame of the fan. The next step is to insert the  $\Phi 10\text{cm}$  pipe into the upper part of the fork with  $\Phi 12\text{cm}$  to make space for the airflow. The pipe is fixed by means of a bypass with a diameter of 12cm and 3 screws.



## The third stage of production

The last step when making a fan is to drill a hole in the lower part of the fork, so that the fan can pull air, and install a net for a nicer appearance of the fan.





## Analysis of the physical prototype and possible suggestions for improvement

- This physical prototype fan has its advantages and disadvantages.
- Advantages:
  - it is very easy to use, easy to transport and performs well for the purpose for which it was intended.
  - There are some suggestions for improvement:
    - Instead of a fork to use some two pipes, because in the event of a failure of a small fan, this entire made fan would have to be disassembled, and if it were two pipes that are connected, it would not be a major problem.
    - Tools used for the prototype production are not entirely precise. We would get a better quality of this prototype and appearance by using some precision machines.

## Conclusions

- Before making a physical prototype, it is very useful to create a virtual prototype, in order to look at all the parts, the possibility of their installation in the assembly. Various analyses can also be done here:
- analysis of the material parts, mass, weight, economic analysis of production and assembly and so on.
- When a virtual prototype is created, it is much easier and clearer to create a real, physical prototype.
- If it was intended to go into the production of such fans, in addition to eliminating the listed defects, it would be necessary:
- develop a technological manufacturing process for each non-standard part (e.g. plastic injection molding technology, as most parts are made of plastic),
- analyze the possibility of sourcing raw materials,
- Analyze and design the assembly process and perform other analyses (e.g. production costs).