

# Gas Nozzle Lock for School Chemistry Labs

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## Problem:

Recently in my high school there was a minor gas leak. This sparked many concerns among teachers and students alike who feared the worst could have happened, especially in the chemistry labs. Whether out of mindless toying or intentional, many students turn the gas valve knobs on and off inside the chemistry classrooms. This can pose a major problem; if the main gas valve ever is on, gas can leak from the student valves and into the classroom and school and possibly cause harm to anyone inside if not caught in a timely manner. I would like to solve this problem in order to prevent anyone from getting injured within my school due to a gas leak from the chemistry labs.

# Research:

When researching things that have already been designed and manufactured for the problem I am trying to solve, I found three main and consistent designs. One that completely cover the gas nozzle and keeps it from being touched until removed. Some that attach to a base point near the handle and then locks onto the handle in order to keep it in place. And finally one that does not keep the gas nozzle from being turned on, but rather encases the nozzle where gas would come out in order to keep students from vandalizing the valves themselves.

Even though none of the gas locks already created were meant for locking student chemistry lab gas nozzles in order to prevent them from being turned on, I was still able to build ideas off of them.

Sources: <https://www.tradeshopdirect.co.uk/ball-valve-lockout>  
<https://www.flinnsci.com/gas-jet-safety-caps-delta-faucets/se1035/>  
<https://www.masterlock.com/business-use/product/482>

# Constraints and Requirements

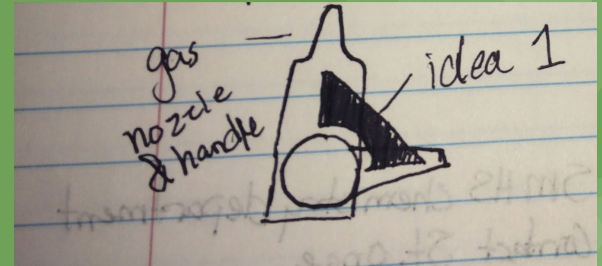
After discussing with one of the chemistry class teachers in my school the idea of potentially making a gas nozzle lock for classrooms the following constraints and requirements were decided upon.

- The design must hold the knob of the gas valve perpendicular to the valve itself in order to remain in the off position.
- The design should be the least wasteful possible, yet be strong enough to withstand students trying to remove or break them.
- The design must be 3D printed
- The design should be simple, effective, and reusable.
- The design should be cheap to make.
- The design can be universal for both left and right side gas nozzles but is not required, just desired.
- The design should not be bulky due to the fact there are electrical plugins near some of the gas nozzles.

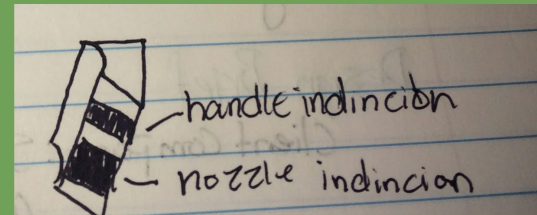
# Brainstorming and Designs:

My original idea for the design was a simple wedge like design that popped onto both the handle and the nozzle itself. This would keep the handle from being turned towards the nozzle but it would still be able to be turned back and away from the nozzle at more than a 90 degree angle which posed an issue. Because the idea did not fit all of the requirements I did not make it into a prototype.

The basis of the rest of my designs was for a design in which the knob slides through the top hole and the nozzle is slid into the indentation on the other mirrored extension of the first



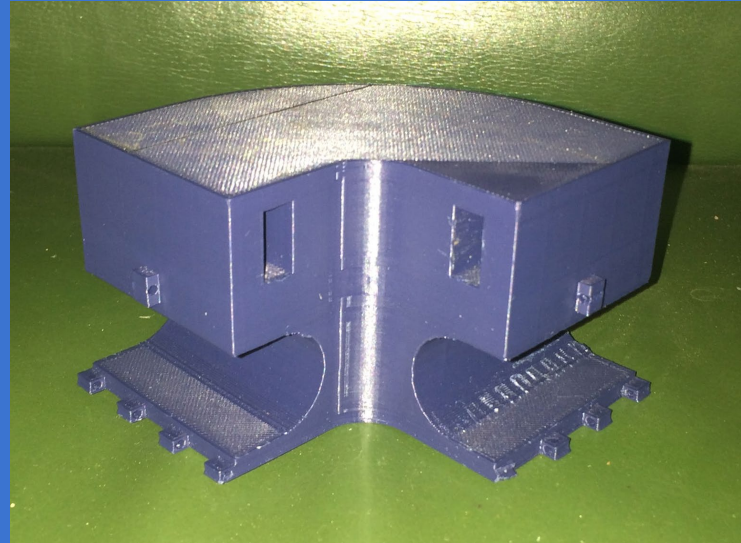
Sketches are not to scale and are only concept sketches.



# Brainstorming and Designs:

My second idea for a design was similar to my first idea in the way that the design would still pop onto the nozzle. The handle would now be encased in the design and a second piece would act as a hinge to lock the nozzle in place. The design was also made to be universal and fit onto either side with holes and slots on both sides to ensure this.

To the right is a photo of the prototype. It did not work and had to be redesigned due to the fact the top holes for the handle were too short. The design was also too bulky.

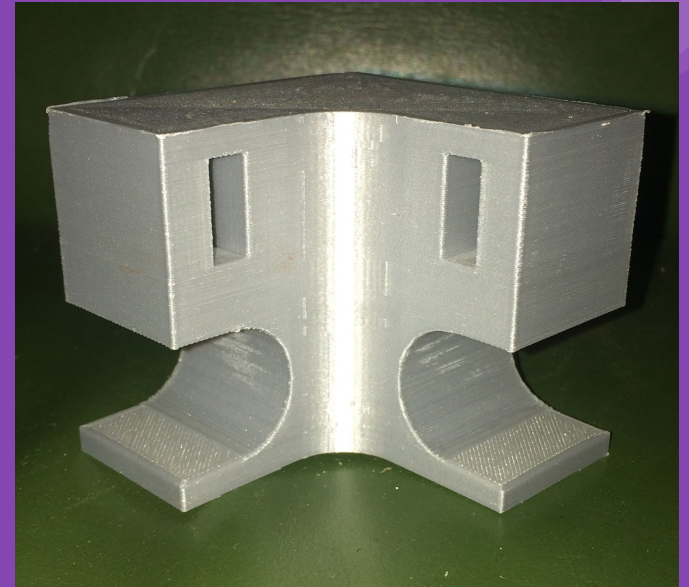


# Brainstorming and Design:

My third idea was basically the same except for the holes for the handle were made slightly larger and instead of a hinging design, two small pieces would jut out from the outer wall on either side of the design above and below the slot for the nozzle. These would be used to put a zip tie or reusable cable tie in order to lock the nozzle into place inside of the design. The new design was also not as thick and less bulky compared to the second.

Please note that in the prototype the pieces for the zip ties were not added in because I wanted to be sure the general main aspects of the design would work first.

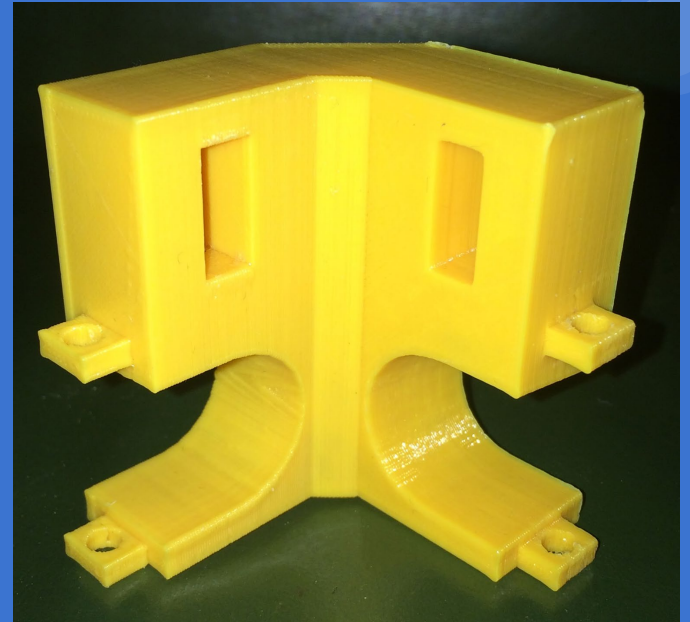
To the right is my prototype which was redesigned to cut out unused portions of the design in order to save on costs and time. The top portion of the nozzle slot was also redesigned and made slanted in order to better grip the nozzle.



# Brainstorming and Design:

The fourth idea was for a similar design with the mirrored sides closer together than before in order to better hold onto the gas nozzle inside of the slot designed for it. The design was also made less thick and a large portion of unused material was taken out of the back.

To the right is the prototype which was only redesigned in order to bring the two mirrored sides closer together to create a snugger fit on the gas nozzle and handle.





# Brainstorming and Design:

My fifth and final design was similar to the last in design. The only two differences were the mirrored pieces were moved closer together again and the pieces for the zip ties or reusable cable ties was made thicker in order to be more sturdy and less likely to break.

To the right, going from left to right, are an isometric view with measurements of my final design, the prototype, and a demonstration of how the gas nozzle lock would appear.

