

MINI PROJECT

On

Design and Fabrication of a
spring Operated Vice for Drill
Machine

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Date- 23/04/2016

▪ Objective: - To fabricate a spring operated vice to be used on the vertical drill machine.

▪ Material required :-

- Aluminium bar
- Steel wire
- Extensible spring
- Bolts
- Nuts
- L-shaped clamps

▪ Machine/Tools used :-

- Vertical drill machine
- Hand drill
- Power cutter
- Hack –saw
- Pliers ,screw driver

▪ Introduction to vice:-

Basically, a vice is a mechanically operated device which is used to hold a work piece to allow work to be performed on it.

Normally, a vice has two parallel jaws; one fixed and other movable, the movable one is connected to a screw which goes

inside the threaded hole of the fixed jaw, thus when we rotate the screw with the help of a crank rod, the movable jaw moves and holds the object.

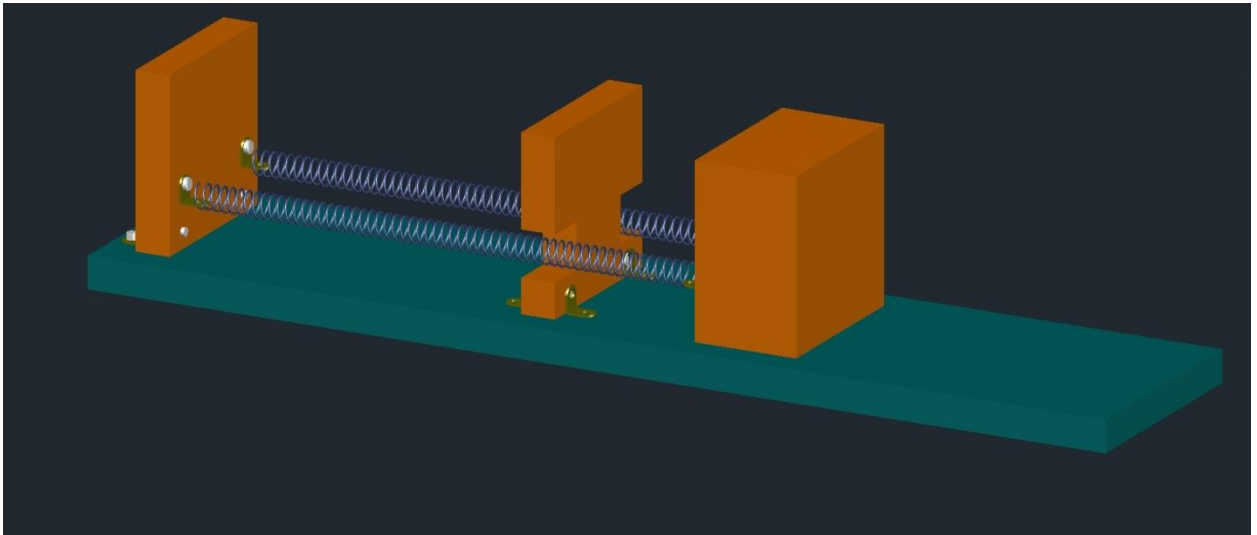
■ My Model of vice: -

I have tried to develop a different mechanism for the operation. I have used the ability of springs to store energy when extended/compressed and try to get back to original shape (natural length).

■ Schematic of my model: -

- My model mainly consists of following things: -
 - one aluminium rectangular bar
 - four square bars
 - one I-shaped bar
 - two extensible springs
 - L-shaped aluminium sheet
 - Steel wires
- On the one end of rectangular bar, there is one square bar which is attached on it through L-clamps.
- Through this bar, two springs are attached on the middle of its face with clamps.
- Springs pass through an I-shaped bar and are connected to a movable square bar with L-clamps.

- The natural length of the spring is equal to the distance between fixed square bar and I-shaped bar.
- Two steel wires are pass through both of the square bars and one I-shaped bar, by which we restrict the upward motion of the movable block.
- To restrict the lateral motion side by side we have attached a long L-shaped aluminium sheet.
- All the blocks and clamps are fixed with nuts and bolts.



Working of the model :-

- Initially the movable block is attached to an I-shaped block.
- When we applied the force on the movable block the springs get elongated.
- Then an internal force is generated on movable block which try to restore the position of the block.

- By this applied force the distance between the blocks increases.
- Work done by the external force is equal to increase in elastic potential energy of spring.
- This stored potential energy is used to grab the object.
- Internal force always wants to take the block in its initial position so it helps to grab the object perfectly.
- If we apply a force “F” on the block which is connected to the spring and the distance moved by the block is “x” ,then an elastic potential energy of spring “ $(1/2 * k * x * x)$ ” is developed where “k” is the spring constant of spring. Net energy is $(k * x * x)$ due to two springs
- Due to the external force “F” an internal force “ $k * x$ ” develop which try to restore the position of block. Net force is $(2 * k * x)$ due to two springs. This internal force is the only reason to grab the object.

■ Cost Report :-

Expected budget:-

- Aluminium bars:- around RS. 250/-

- Extensible spring:- RS.60/-
- Steel wires :- RS.30/-
- Nuts and bolts:- RS.75/-
- L-shaped clamp :- RS.50/-
- Drill bits :- RS.80/-
- Paint and brushes :- RS.40/-

Total expected cost= ***RS. 585/-***

Actual budget:-

- Aluminium bars:- Obtained from workshop
- Extensible spring:- RS.60/-
- Steel wires :- RS.30/-
- Nuts and bolts:- RS.75/-
- L-shaped clamp :- RS.50/-
- Drill bits :- RS.80/-
- Fare cost:-RS.150/-

- Paint and brushes :- RS.40/-

Total actual budget=**RS.485/-**

■ Difficulties faced :-

- I faced so many problems to find the extensible spring.
- I had to go Patna for buying small –small things like clamps and specific nuts-bolts.
- In the manufacturing of I-shaped design from a square block, I faced so many difficulties. At that time “WIRE-EDM” machine was not working, so I had to make cut on it by “hack-saw”. It consume so much time and labour.
- For some-time vertical drill machine did not work properly so I used hand drill machine. It took so much time to drill.
- I had done many searches for welding of aluminium in Patna but finally I could not find it so we use nuts and bolts for fixing purpose.

Further Improvment:-

1. To make the structure more rigid, we can use welding instead of mechanical fastening.
2. To restrict upward movement of the movable jaw, we used some sort of wires, but that is not efficient, instead of that we could have used some other sliding mechanism (circular rods fixed at both ends of the vice).
3. We can also make a handle at the end of the movable jaw to make it move more easily.
4. This model could not hold circular objects. For that I could have made internal triangle jaw at both ends that could hold circular objects.

Future plan:-

- While manufacturing of very delicate objects, when we need to hold them in certain positions, due to excess force from vice, they may lose their shape.
- Thus we can change in a very innovative model with the use of AIR SUSPENSIONS whose stiffness can be controlled and thus we can use our same mechanism in this method.
- We can also make this motor driven, the motor will be connected to a linear actuator which will make the movable end back and then the Air suspension will come into act.



Conclusion:-

I was able to make a prototype of my vice which can be further improved. I learnt a lot while this project. I learnt that both the designing as well as the manufacturing part were equally important. By this, I was able to increase my power of imagination as well as got good in working in the workshop.

I will try to improve this project further and can also take the ideas given by the faculty into account.

