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Design and Development of Fractal Gripping Attachment

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ABSTRACT

A regular vice is great if you want to clamp rectangular objects, but it can fall down a little with more complex shapes. So in this project we have designed an attachment for a bench vice to clamp any complex shape. And we are developing this attachment for the parallel grippers of robotic arm, In this attachment we can hold any complex shape in the vice, and if we attach this attachment design and locking to grippers of robotic arm it will be easy to carry any complex shape component. Mostly this attachment will be useful for pick and place robotic arms and woodworking industry.

1. INTRODUCTION

We are developing "Design and Development of fractal gripping Attachment" a new mechanical project. This project provides a attachment with fractal geometry to clamp or to grip complex shaped component.

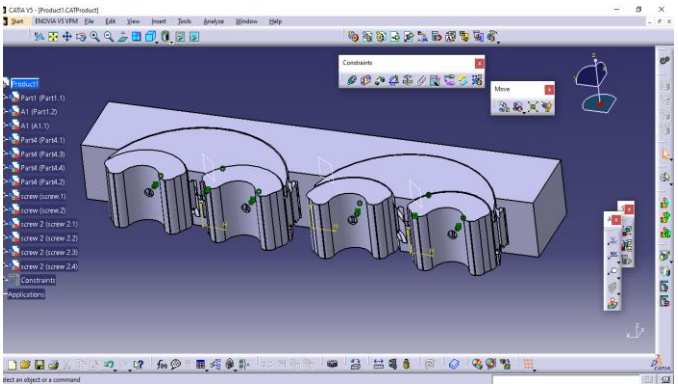

Fig 1:Assembly of gripping attachment

Fractals geometry appears the same at different scales, so the geometry of this attachment will be same and the semi-circles locking into larger one and all semi circles are rotatable and oscillatable and has an intimate contact, engagement with components of any shapes.

2. LITERATURE REVIEW AND OBJECTIVE

P. K. KUNZE : Firstly proposed the fractal geometry and developed Device for obtaining intimate contact with engaging ,or clamping bodies of any shape. The device forming the object of the present invention purposes to effect by means of rotatable and oscillatable cheeks, an intimate contact, engagement with or clamping of bodies of any shape, the contact being effected at as many points as possible, where by owing to the reactions or the automatic adjustment to the position of equilibrium of all the cheeks, if the latter are symmetrically arranged, the pressure is uniformly distributed over all points of contact, while if the arrangement is unsymmetrical there is: a greater pressure to one side.[1]

Khole Gourav, Londhe Sagar, Uttarwar Pratiksha : Reduction of human effort is must.Reduction of human Effort and enhancing safety plays a vital role while designing and fabricating the Machine vice which is used to hold the components during heavy machining works A fixture is a special purpose tool which is used to facilitate production (machining, assembling, and inspection operations.) Fixtures provide a means of manufacturing interchangeable parts since they eliminate the necessity of a special setup for each individual part. Fixture is bolted or clamped to the machine table. It is usually heavy in construction.[2]

P.Sivasankaran : In recent times there are many modern advancements came in the area of fixture design and assembly. In this paper attempt has been made to design and analyze the modern screw less machine vice using CATIA. The drawbacks of existing vice were overcome by new screw less machine vice. In the existing system of machine vice, the lead screw will tend to undergo frequent wear and tear due to abrasion resistance problem as a result jaw of vice lose its grip to hold the work component. In order to overcome such type of problem dowel pin type movable jaw was designed in such a way in order to incorporate into the base block of movable jaw.[3]

Mohammed.Khadeeruddin , T.V.S.R.K Prasad,Raffi Mohammed.The parallel jaw gripper has at least two fingers which can be moved towards each other along one axis. Usually, the fingers can be moved independently from each other in order not to shift the object, but they are only able to perform simple operations like open and close. Thereby, a longitudinal or side movement is impossible. A parallel jaw perform, a manual control to steer the gripper must be possible for enabling the highest flexibility.[4]

Mr.Shrikant M.Choughule and Prof.D.B. Waghmare: Basic Principle of Rapid Prototyping Processes RP process belong to the generative (or additive) production processes unlike subtractive or forming processes such as lathing, milling, grinding or coining etc. in which form is shaped by material removal or plastic deformation. In all commercial RP processes, the part is fabricated by deposition of layers contoured in a (xy) plane two dimensionally The third dimension (z) results from single layers being stacked up on top of each other, but not as a continuous zcoordinate. Therefore, the prototypes are very exact on the x-y plane but have stair-stepping effect in z-direction. If model is deposited with very fine layers, i.e., smaller z-stepping, model looks like original. RP can be classified into two fundamental process steps namely generation of mathematical layer information an generation of physical layer model. Typical process chain of various RP systems.[5]

2.1 Objectives:

i. The original geometry of this project is used as a fractal vice so now, this geometry will be develop as an attachment.
ii. To reduce man power.
iii. Only one attachment for clamping any complex shape.
iv. The future development of this geometry can be useful as an attachment to robotic parallel grippers.

3. METHODOLOGY

Firstly by the reference of P. K. KUNZE fractal vice the drawings of locking will be develop then the jaw of our attachment will change according to the tool where it will be assembled. All drafting and 3D modeling will be done on Catia software then after analyzing STL file format will 3D print all the parts of attachment and after the successful trail it be fabricated.

3.1 Planning and Data Collection:

To identify all the information and requirement such as hardware and software, planning must be done in the proper manner. The planning phase have two main elements namely data collection and the requirements of hardware and software.

Data collection is a stage in any area of study. At this stage I planned about the project resources and requirements, literature studies and schedule to get more information in this study. All the materials are collected from journal, texts book and research papers gathered from libraries and Internet.Within the data collection period I have found the study about the vises and robotic grippers on the Internet and done some research about the project related. Once I got the project manual, I tried to find out some new locking for this attachment and other materials.While planning, I have done the research about the project related, which including with study about the some new designs and locking

3.2 Working:

Two holes which are use to attach various attachments of the vise are presented to some machine vise. So we are going to attach this attachment to the vise to both the jaws of bench vise with help of screw. As the working of this parallel jaws one jaw is fixed and other is moveable with the help of handle, Later this jaws clamps the components. Similarly after attaching this fractal attachment it will clamp the component and as its oscilltable and rotatable working it clamps any irregular geometry.

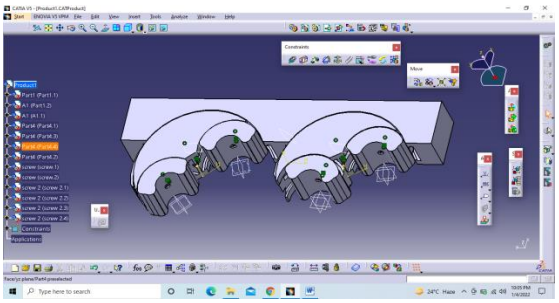

Fig 3.2.1 Simulated View

Parallel grippers are use to pick and place the production components and they can be of any shape, so as we are going to attach this attachment to bench vise we are developing the attachment for parallel grippers. Where we can vary the size according to the size of grippers. As the name parallel gripper working is same as the bench vise so the clamping the irregular components will be easy for the attachment.

3.3 Advantages:

1. So far Woodworking industry have many complex shapes.
2. Bench vice fails while clamping non parallel components.
3. Fractal attachment can clamp component of any complex shapes.
4. Fractal attachment can be very useful for spherical components where bench vice is not.
5. Further this geometry can be useful for clamping as well as in pick and place grippers.

4. DESIGN AND MECHANISM

The smallest part that is B1 shown in figure will grip the component and all the semi circles have rotational moment about there centre, So that the moveable jaw can grip component accordingly. All the semicircles are locked with bolts.

. **Working When Attach To Bench Vise:**

Two holes which are use to attach various attachments of the vise are presented to some machine vise. So we are going to attach this attachment to the vise to both the jaws of bench vise with help of screw. As the working of this parallel jaws one jaw is fixed and other is moveable with the help of handle, Later this jaws clamps the components. Similarly after attaching this fractal attachment it will clamp the component and as its oscilltable and rotatable working it clamps any irregular geometry.

Working When Attach To Parallel Robotic Gripper:

Parallel grippers are use to pick and place the production components and they can be of any shape, so as we are going to attach this attachment to bench vise we are developing the attachment for parallel grippers. Where we can vary the size according to the size of grippers. As the name parallel gripper working is same as the bench vise so the clamping the irregular components will be easy for the attachment.

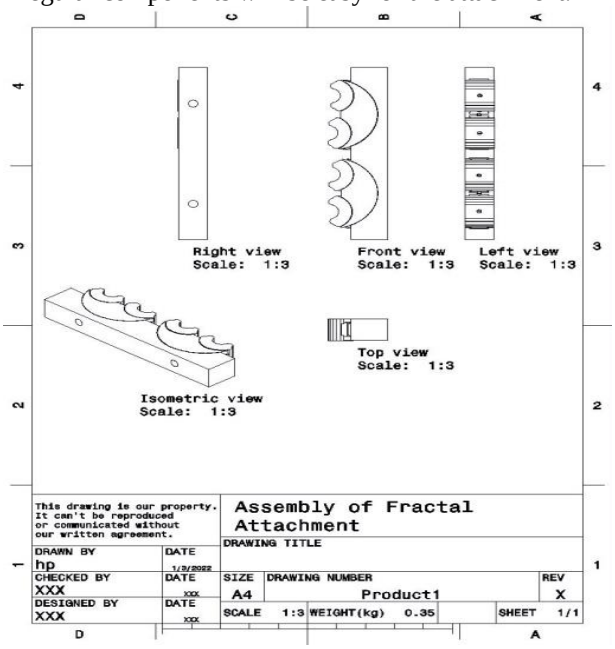

Fig 4.1 Assembly sheet

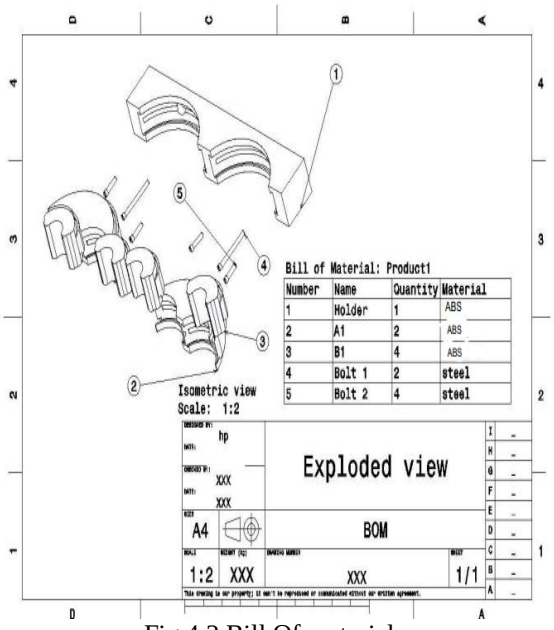

Fig 4.2 Bill Of material

4.1 Payload and parameters:

Maximum Clamping Range After attaching fractal attachment Maximum clamping range of 8 inch i.e. 200 mm bench vise is (300 mm) And the attachment takes space of Approximately i.e 100 mm 50 mm from each end so totally the maximum clamping range is 300-100 = 200 mm So the totally Clamping range will be 200 x 200 mm This will be the clamping range of the vise after attaching the attachment. The hole distance of holder is at 140 mm Jaw height is 30 mm same as the height of 200 mm bench vise.

4.2.1. Properties of ABS material:

Mechanical properties:

Elongation at Break	10 - 50 %
Elongation at Yield	1.7 - 6 %
Flexibility (Flexural Modulus)	1.6 - 2.4 GPa
Hardness Shore D	100
Stiffness (Flexural Modulus)	1.6 - 2.4 GPa
Strength at Break (Tensile)	29.8 - 43 MPa
Strength at Yield (Tensile)	29.6 - 48 MPa
Toughness (Notched Izod Impact at Room Temperature)	200 - 215 J/m
Toughness at Low Temperature (Notched Izod Impact at Low Temperature)	20 - 160 J/m
Young Modulus	1.79 - 3.2 GPa

5. EXPECTED OUTCOME

The future is of automation human hands are replaced by robotic arm so this attachment is very useful in parallel grippers

As well as the woodworking is all depended on clamping so this attachment is very useful when it is attached to bench vice.
As well as if this bench vice the production tool will get a single solution of attachment.

NOMENCLATURE

A1 = Semicircular disc 1

B1 = Semicircular disc 2

KN = Kilo Newton

STL = Standard Tessellation Language

GPA= Gigapascals.

MPA= Megapascals.

ABS= Acrylonitrile Butadiene Styrene

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