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Design and Analysis of Modular Fixture for Machine Vice

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Abstract

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 and ANSYS APDL package. 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.

Keywords: Screw less machine vice, CATIA, ANSYS, Abrasion resistance

1. INTRODUCTION:

A holding device (American English) or vice (British English) could be a mechanical equipment accustomed secure associate object to permit work to be performed thereon. Vises have two parallel jaws, one mounted and also the alternative movable, rib in and out by a screw and lever. The following are the various types of vices such as

Wood working:

Woodworking vises square measure connected to a bench, usually flush with its surface. Their jaws square measure fabricated from wood or metal, the latter typically moon-faced with wood, known as cheeks, to avoid marring the work. The movable jaw might embody a retractile dog to carry work against a bench dog

Engineer's vice:

An engineer's holding device, conjointly referred to as a vise or bench vise, is employed to clamp metal rather than wood. It's wont to hold metal once filing or cutting. It's generally fabricated from solid steel or malleable forged iron, however most square measure fabricated from forged iron. However, most serious duty vises square measure fifty five, psi solid steel or sixty five psi ductile iron. Some vies have a forged iron body however a steel channel bar. Forged iron is standard as a result of it's usually thirty ksi gray iron that is rigid, robust and cheap. The jaws square measure usually separate and expendable typically incised with serrate or diamond teeth. Soft jaw covers fabricated from metal, copper, wood (for woodworking) or plastic is also wont to shield delicate work. The jaw gap of associate engineer's holding device is nearly invariably a similar size because the jaw dimension, if not larger.

Machine vice:

Machine vises square measure mounted on drill presses, grinding machines and edge machines. Abrasive chop saws have a special sort of machine bench vise designed into the saw. Some hobbyists use a machine bench vise as a holding device owing to the low price and little size.

Vacuum vice:

A vacuum bench vise could be a hobbyist's tool, unremarkably wont to hold circuit boards, model airplanes and alternative tiny work. They mounted with a suction cup and infrequently have associate degree articulated joint within the middle to permit the bench vise to pivot and swivel. Jewelers additionally use vacuum vises to carry jewellery.

Pipe vice:

Pipe vises are a plumber's tool, typically accustomed hold pipes in situ for threading and cutting. There are two main styles: chain and yoke. The yoke sort holding device uses a screw to confine the pipe, and also the chain vogue uses a sequence for securing the pipe.

These are the various types of machine vice as described above. Hence in this paper attempt has been made to design and analyze screw less machine vice.

2. LITERATURE REVIEW

In this section the couple of literature articles are presented as given below:

Anuchandran et al [1] proposed automatic machine vice to hold the work piece and release the work piece after completing the machining process. The device was

controlled by microcontroller which was self programmed. In this set up sensor is used to identify the job and the signal is fed to the microcontroller as result the jaw holds the job. This type of vice completely reduces the human effort.

M.S.Kadam et al [2] proposed a Bench vice or fixture may be a production tool. The most aim is to find, support and fix the work firmly thus we are able to perform the specified machining operations. Feeler or thickness gauges and set blocks also are accustomed give reference of the cutter with the work piece. A bench vice should be simply fixed with the machine and therefore the table. As a result, the work is done. It is used for the opposite operations on most of the quality machining tools like drilling machine. Bench Vices square measure out there in numerous size and shapes starting from low cost and straightforward devices to terribly high-ticket and sophisticated devices.BenchVices may facilitate to change the formation operations that square measure performed on the special instrumentation. Considering the benefits of fixture and jigs, a fixture was designed to cater to our desires. we tend to square measure reaching to style a piece device which can} be able to hold the work piece in any direction. The one-part bottom assembly is absolving to rotate and alternative a part of bottom assembly mounted to bench. This kind of assembly can assist to high assembly that consist jaws. These jaws square measure likewise pipe vice bench vice. Lead screw is provided for engagement & disengagement of the jaws.

In line with **Kibbe, R.R [3],** drilling holes is one of the most basic of machining operations this is very regularly carried out by using machinist. Metal cutting calls for extensive pressure of feed on the slicing side. A drill press gives the vital feed stress either by means of hand or electricity pressure. The primary use of the drill press is to drill holes, but it can be used for other operations together with countersinking, counter boring, spot facing, reaming, and tapping, which are processes that modify the drilled hole.

Heidar Hashemi [4] et al proposed appropriate fixture design could lower process time, lower cost, and improves the quality of products. Fixture design plays an important role in the process of manufacturing. As per the design activity process, incorporating automation in fixture design plays an integral role in linking computer aided designs and computer aided manufacturing.

Sabareeswaran [5] et al planned that Fixtures square measure wont to find and hold the work piece throughout machining. They’re wont to accomplish the machining accuracy and high productivity within the producing method. Fixture, work piece and cutlery type a structural system and therefore the behavior of the system is dynamic. Throughout machining, engagement of cutter with work piece causes vibration ends up in distortion of labor piece that successively affects machining accuracy. The fixture-cutting tool-work piece system must be analyzed in terms of its dynamic response and is crucial to reduce the vibration. during this analysis paper, finite component methodology is applied to model and simulate the machining operation and analysis is used to seethe amplitude of vibration. Then, genetic algorithmic program is planned to reduce the amplitude vibration by optimizing the machining fixture layout.

From the above literature survey it was clear that several authors have contributed their own views about the usage of machine vice and its characteristics. Hence in this paper an attempt has been made to improve the efficiency of machine vice while handling the parts in addition to that a special type vice was modeled called screw less machine vice. Also the efficiency of model was compared against existing design with respect to FEM (Finite Element Method) results.

3. COMPARISON OF EXISTING SCREW -LESS MACHINE VICE WITH PROPOSED SCREW LESS MACHINE VICE:

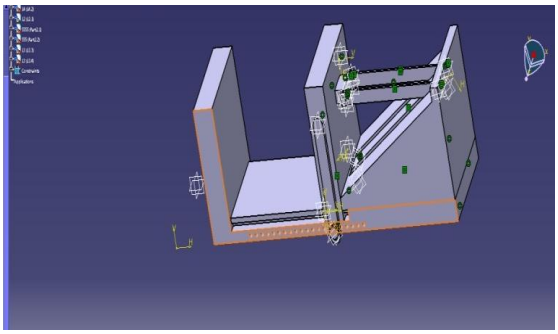

Fig 1. Existing vice

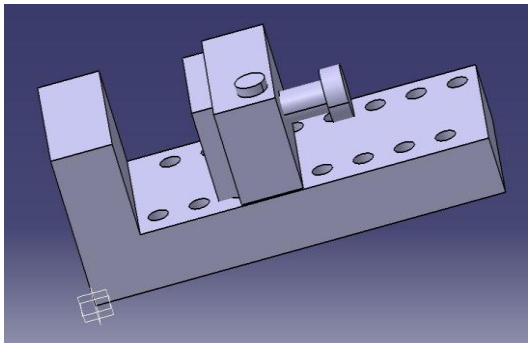

Fig 2. Proposed vice

In the existing vice as shown in Figure 1. It has certain demerits such as clamping force required to hold the component is not highly sufficient enough also the movement of movable jaw was restricted due to the presence of triangular block. In order to overcome the drawbacks of existing vice proposed model of vice was suggested. In the proposed model as described in figure 2. is said to be much simpler in design as compared to previous one. In this type attempt has been made to design a modular fixture which is highly flexible in nature. In the proposed model modular fixture was considered to be as movable jaw provided with Allen key slot this set up was easier than previous model. The main advantages present in the proposed model was minimizing the effects of clamping force since in this set up fixture was firmly

placed on the holes of base block very rigidly also the movement of Fixture was not restricted as like old model as shown in fig 1.

4. SENSITIVITY ANALYSIS OF EXISTING SCREW LESS MACHINE VICE WITH PROPOSED SCREW LESS MACHINE VICE USING ANSYS:

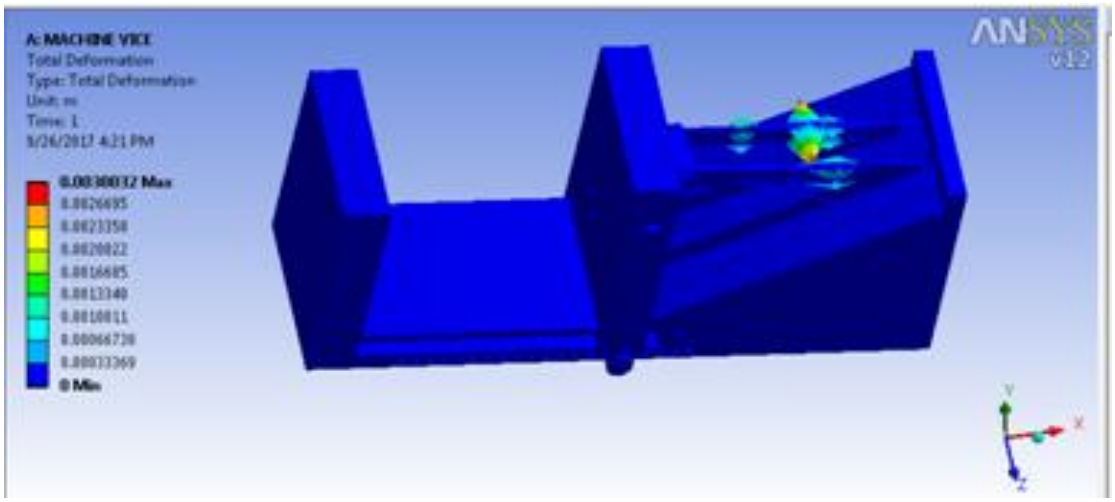

Fig.3. Total Deformation on clamp for existing model

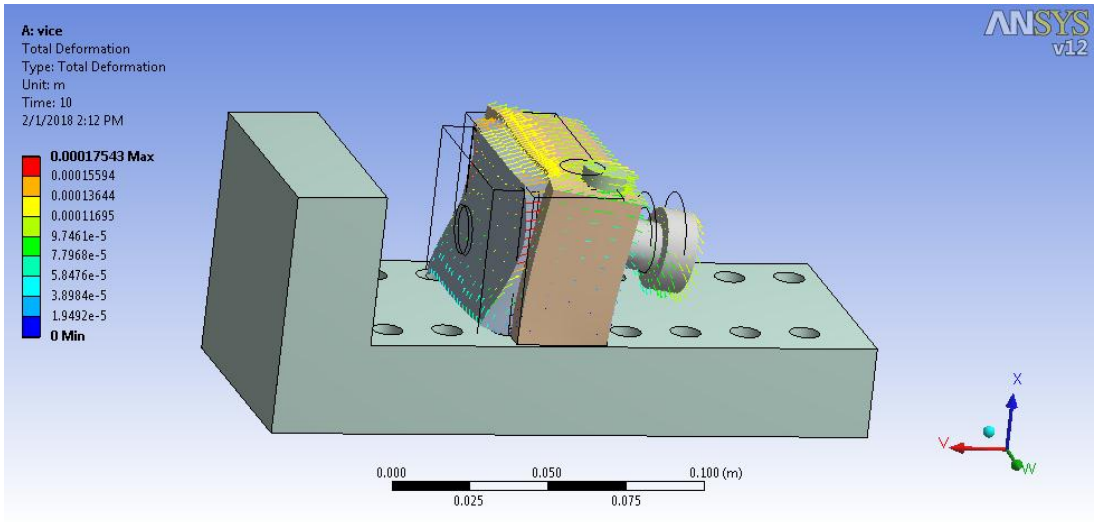

Fig.4. Total deformation for proposed model

In this analysis comparison was made between existing vice and proposed vice in terms of deformation when a load is acting on the vice as shown in figures 3 and 4 respectively.

In this analysis a load of 16000N was assumed to act on clamp part of existing vice as described in fig 3. Due to the applied load on the clamp the deformation takes place on the connecting plates which supports the cubic bar which is mounted on the triangular piece. In this analysis the deformation rate was measured to be 0.003 m was shown in the fig 3.

Similarly the same type of deformation analysis is carried out for proposed model as indicated in fig 4. In this type of analysis applied load is same like previous model. The direction of load acting on the fixture is in forward direction as given in fig 4. The rate of deformation was measured to be 0.00017m.

Inference from the results:

SL.NO	Existing Model Deformation (m)	Proposed Model Deformation (m)
1.	0.003	0.00017

From the above results it was clearly indicated that the deformation rate for proposed model is much less as compared to existing model. From this it is understood that the proposed model was considered to be highly robust enough to withstand loads as compared to existing model of vice.

CONCLUSION

Thus the proposed model was evaluated in ANSYS software by calculating the deformation rate for given load which is compared with the results of existing vice. From this analysis one can choose second model or proposed vice for fabrication. In this analysis the material considered for vice is cast iron based on that deformation results are obtained for both the models of vice.

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