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Machine Jig for Assembly of Take-Up Wheel Shaft of Friction Type Currency Counting Machine

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Abstract: *It is the project report on Design and Development of Machine Jig for Assembly of Shaft used in Currency counting machine. This was asked by the industry NITIRAJ ENGINGEERS LTD. Who manufactures electronic weighing scale, electronic fare meter and currency counting machines to design and develop a machine that will be helpful for them to assemble a shaft use in friction type currency counting machine. The project report consist of the problem statement, fissile solutions, and best method adopted for the following. A good machine for the industry will increase the production rate for them and reduce human effort.*

I. Introduction

Today's world is moving towards automation, and we should take in that too, by this motive we were asked to Design and Develop a Machine Jig for Assembly of Shaft used in Currency counting machine as this work was done manually and it is talking too much time, the production rate of that shaft is just 150 per day. So we are now developing the machine that will boost up the production rate up to500 per day.

Fig1-The Shaft to be assembled in currency counting machine.

II. Problem Statement

The assembly is done by workers manually so a machine has to be design for this assembly.
The current production rate of this assembly is 150 per shift. We have to double the production rate up to 500-600 per day.

III. Objectives

To reduce the man power.
Toincreasethe production rate.
Improve accuracy of assembly**.**

IV. Components (Details of Model) Of the Assembly

The company provided us with the following data-

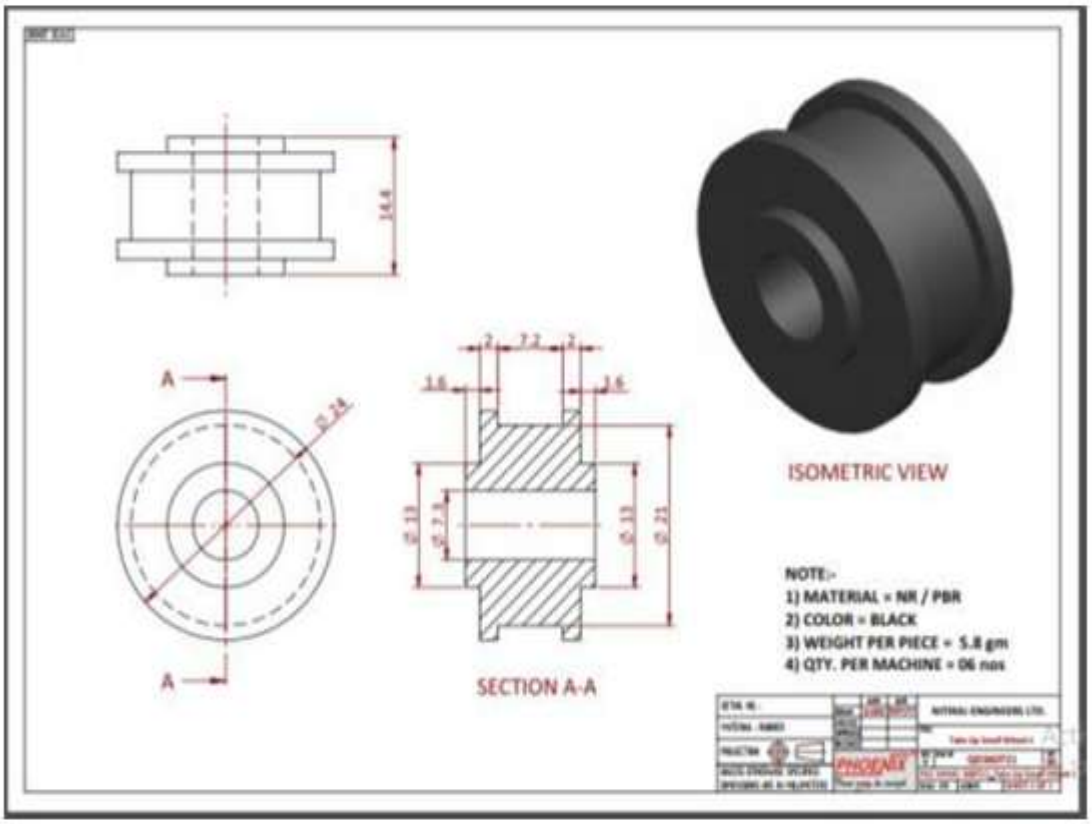


Fig-Industrial drawing sheet of small wheel.

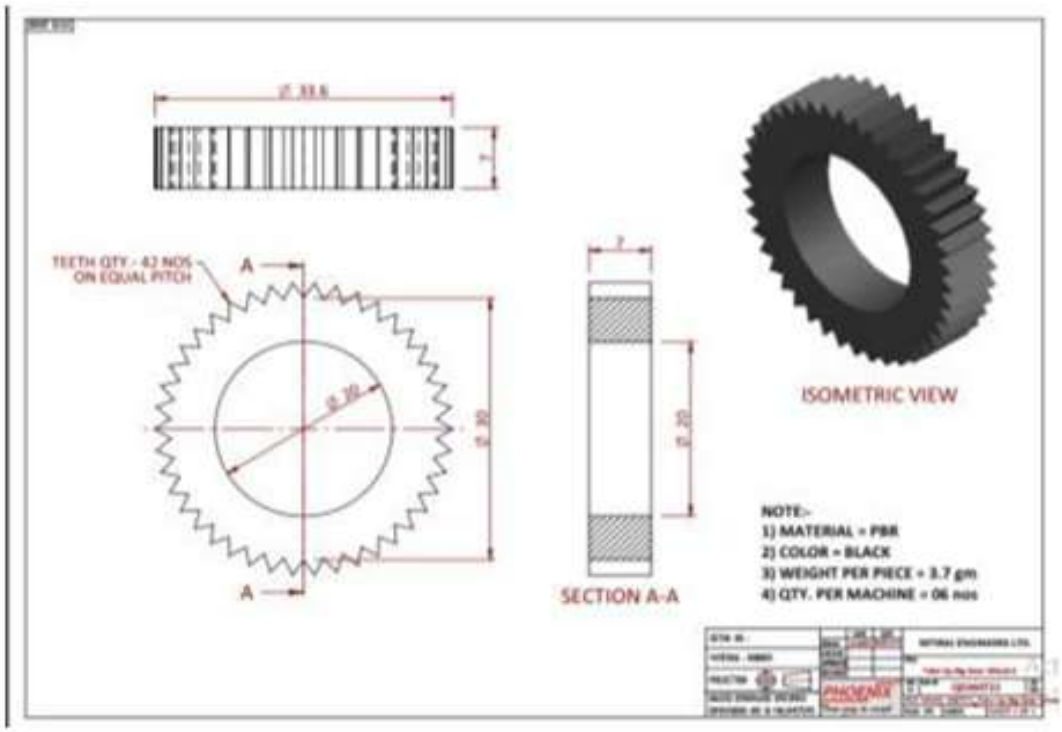


Fig- Industrial drawing sheet of gear.

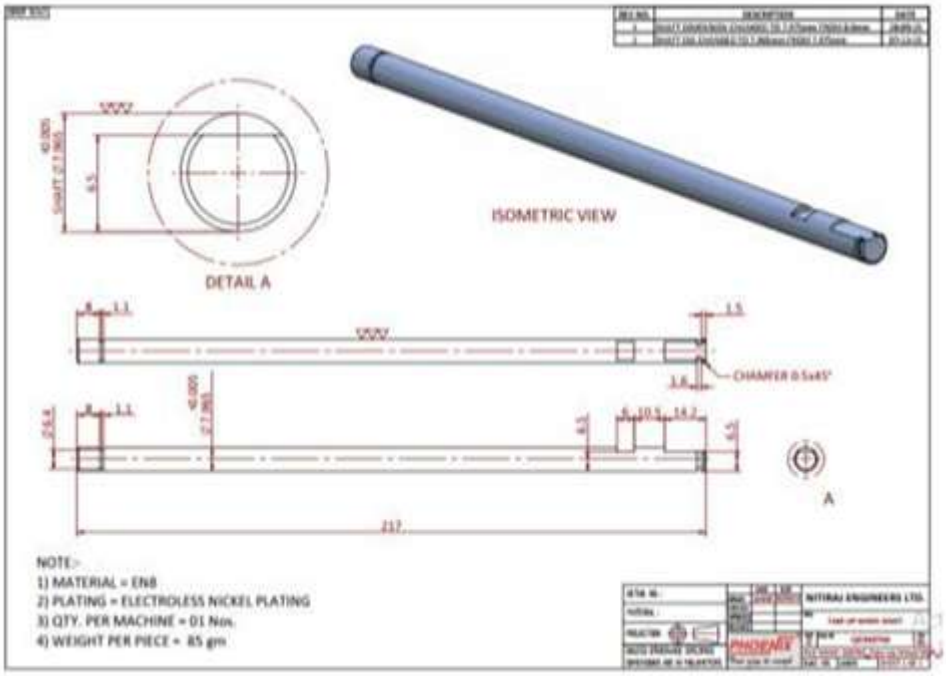


Fig- Industrial drawing sheet of shaft.

Concept of making of this assembly is that first we mount the bush on gear with the help of twisting moment and torsion force. Then make a die then (as requirement according to mounting of gears on shaft) gears are put into the die at the distance of 7 mm (there are 6 pieces required to put in shaft at a time). Hence we want a system that use to push the shaft into the all 6 gears at a time hence we develop a system which can push the shaft into the gears and also useful mass production

The way to get the correct specification of pneumatic components is to calculate the force required the on shaft that will be enough to push the shaft through hub.

V. Design of System

The processes we take in action for the project is step by step discussion-

The die design, the die design is very crucial step as we have to take the proper measurement assign by the company. Taking the measurement on the design software is a good step and

modern day use of technology. For the design creo-parametric software is used as it is the basic desigsoftware and ease of design making is good and it was a part of our BE curriculum.

VI. Die Design

According to the data given to us we specified the final die design using reverse engineering. The force required to push the shaft through all gear and hub assembly was calculated on the UTM.

The preferable materials for die are HCHCS/EN8/OHS

Fig- Isometric view of Die design

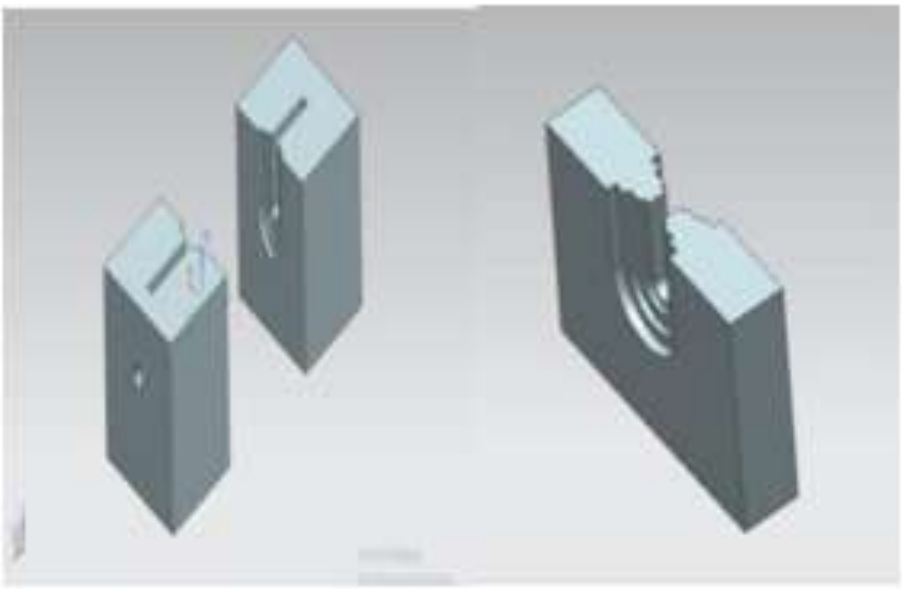


Fig - Inside cut section view of Die.

Fig -Top view of Die

The inside view of die tells us that the die has a hollow cavity that has exact dimension that of the gear and hubTwo holes of injector pins are also provided to take out the assembled shaft out of the die. This design has been approved by the company.The next major step towards the development of the machine jig was the method by which the moment of shaft by which it will enter the die and penetrate the gear and hub.The major to method that come to our mind to perform the operation is use of hydraulic and pneumatic system. The linear actuator can perform the operation but our major use of the machinewas to increase the production rate therefore we concentrated on pneumatic system as the hydraulic system is slow in operation as compared to the pneumatic system.For the design of pneumatic system we have to gather various parameters for the selection of correct pneumatic system components.

VII. Experimentation

The way to get the correct specification of pneumatic components is to calculate the force required the on the shaft that will be enough to push the shaft through the hub. The point of concern here was that we have to pass the shaft through not only one hub but 6 consecutive placed at a distance of 7 mm from each of them.
So, to calculate the force we used the universal testing machine,

Fig. – The experimental setup of the calculation of force.

For the above test we first need a fixture to hold the shaft in the UTM and that was a lengthy task as we have to design a fixture to hold the shaft properly in the UTM. After this we calculated the force required and the outcome for the similar were as follows-

Test Parameters
Total force to push the 6 hubs downward- 4.876kN
Displacement of hubs due to the force- 42mm
Cross-sectional area of 6 hubs that was experiencing friction- 1981.46mm^2

Therefore,
Total pressure required to push the hubs= Force/area= 4.876e3/1981.46=2.46N/mm^2
Total length of the shaft is = 217mm.

Diameter of shaft= 7.6mm

These calculated parameters will now be useful for us to selection of proper pneumatic tools.
Calculation of pneumatic cylinder For
diameter (D),

- **Pressure =Force/ Area**

$4.5*10\text{^}6 = (6.67*10\text{^}3) / ((pi/4)*D^2)$
D = 137.37 mm
And As per standard values from book SMC CATALOGUE FOR PNEUMATIC CYLINDER
We choose pneumatic cylinder of specification as follows,
Pressure applied by cylinder = 9000 N
(Maximum pressure taken because in actual practise they causes pressure drop and leakage or other small losses)
Diameter of cylinder = 140 mm
Standard bore diameter available- 125&160mm and stroke length-250mm
Selected diameter - 160mm and piston rod diameter - 40mm
Type of pneumatic cylinder = Double acting cylinder
Model type – (Model 182556F-01REV2)
Direction control valve – 4/3 DC valve(because used for mass production)
Hand lever operated

From above data

Selected Actual model of pneumatic cylinder use

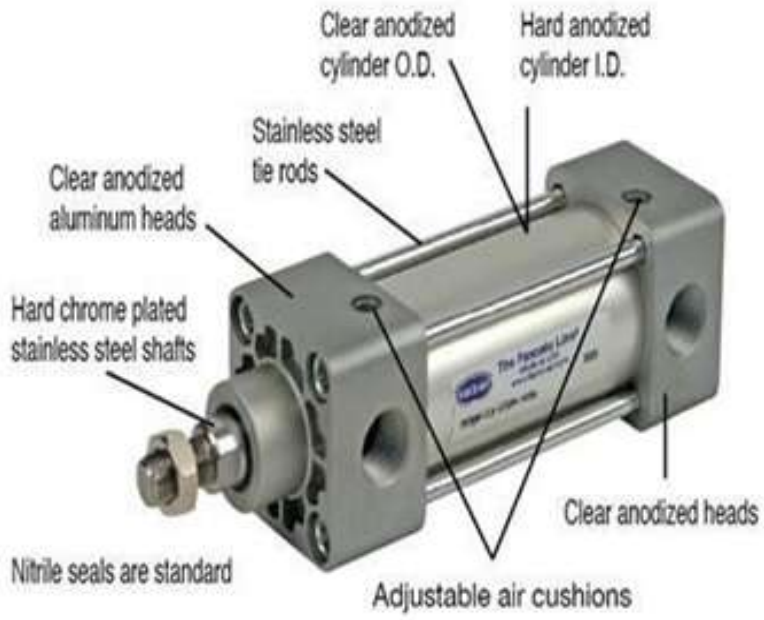
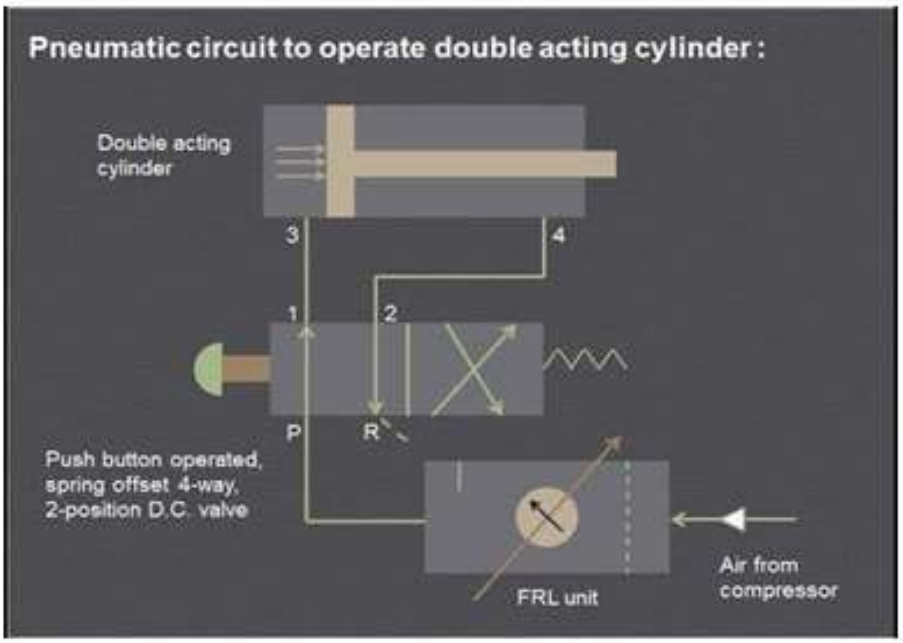


Fig - Circuit of pneumatic cylinder use



VIII. Result and Project Scope

The discussion of the project mainly focuses on the method to manufacture the die and testing of the process. The required output or the main aim of the project is to increase the production rate. Which has to keep in front of the eyes at every level?

There are various ways to manufacture the die, which include the ways like- casting, use of CNC machines.

Casting of the design of the die we need is quit a difficult to produce and a too much time consuming task, whereas the use of CNC machine for this will be a good option to produce it.

The most important task of this design and development of the machine jig is now the selection of material of die and a proper and trusted material supplier.

After the material come to us we have to find the CNC work doing company from where we can make the die.

A search of proper dealer of Pneumatic components is also in going process where the group is working. And have gathered the details related to it.

Scope of the project is anonymous as we are getting the knowledge of market conditions and how to keep a balance between the company, group members and project guide. If the machine goes well in one currency counting machine manufacturing industry we have a great scope of expanding the sale of the machine in number of industries of same kind

IX. Conclusion

Thus the world is moving towards automation and different technologies that are making the work of humans easy to do. It's our initial duty as an engineer to find the solutions to day to day problems occurring in the world. The project is a solution to hard work done by the labors of the industry and provide them an easy way to do that. The use of pneumatics in the machine jig reduces the environmental pollution and facilitate the company with easy of working. The estimated production of such assembly of shaft is 200per day while after the implementation of the machine jig it will increase up to 500-600 per day.

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