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Internal surface finishing of pipes by magnetic abrasives

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Abstract - *In various industries, the important flow transmitting media is pipe , pipe has both internal and external surfaces. The fluid is making direct contact with internal surface. Various research is done on the finishing of needles and surgical equipment's with diameter 2mm(outer). We are now dealing with the internal surface finishing of pipes of diameter upto 18mm to 20mm. The internal surface of pipe is important for fluid transmission, the finish plays important role in observing fluid behavior. The internal surface of pipe can be effectively finished with the magnetic particles and magnet with abrasives like iron carbide. The method is very easy and can be achieved to high surface finishing. In this project we are dealing with pipes except magnetic materials.*

***Key Words*: Magnetic Abrasive Particles, Permanent magnets, AC motor, DC motor, Rack and pinion, Pipe.**

1. INTRODUCTION

There are many research have been takes place for external surface finishing of pipes. It is required to achieve same surface finish for internal as well (for e.g. needle, capillary tubes, pipes etc.). So, this paper is concern with internal surface finishing of pipes by using magnetic abrasives with permanent magnet as this plays important role in flow transmission. In modern industries it is required to reduce various losses such as friction losses in pipes caused during fluid transmission due to internal roughness. To reduce these losses, it is necessary to create smooth internal surfaces of pipe. As friction losses causes reduction in efficiency of fluid flow, so by using this method internal surface is highly finished for smooth flow of fluid. This method is also applicable for removing scaling which occurs in pipes used in chemical industries. The scaling of pipes increases pressure losses, which reduces fluid flowing capacity in the pipes.

2. LITERATURE REVIEW

1. Mr. Junmo Kanga, Andrew Georgea, Hitomi Yamaguchia in 2012 stated that A high speed multiple pole-tip finishing system has been developed for finishing capillary tubes and finishing experiments have been performed with tube revolutions up to 30000min-1. In the single pole-tip system, the magnetic abrasive is stable and performs efficient surface finishing up to 30000min-1. Conversely, the magnetic abrasive and tool lapse into unstable conditions in the multiple pole-tip system at high speed due to high centrifugal force. This causes deep scratches and irregular asperities on the finished surface. In 2014.

2. Mr. Valens Nteziyaremyea, Yancheng Wangb and team have proposed that demonstrated the feasibility of MAF for the simultaneous internal and external surface finishing of 18-gauge 316 stainless steel needles used for biopsy operations.

3. The magnetic field and magnetic abrasive distribution must be determined to place the tube in a region with high H·gradH in the N-S90°configuration, which is indispensable for the internal finishing, and to obtain sufficient relative motion between the magnetic abrasive and the target surfaces. It was clarified that the amount of magnetic particles is critical not only for internal finishing but also for external finishing. The optimum amount abrasive for external finishing should be less than the amount that allows the masses to join over the tube.

4. Simultaneous finishing is possible using magnetic abrasive for internal finishing and magnetic abrasive or a rubber magnet with abrasive slurry for external finishing. In this study, internal and external surfaces were finely finished simultaneously from 0.4–0.5 μm Sato around 0.01μm Sa in 5min. Mr. G.Y. Lui and team have conducted a study investigated the hybrid process of EMAF which is used to polish Al6061 under different parameters. During the experiments, the removal weight, surface roughness and micro morphology have been measured to evaluate the state of the hybrid process.

3. PROBLEM STATEMENT

The problem is to design a model for internal surface finishing of pipes by using magnetic abrasives which is portable setup, having high accuracy and less time consuming. The aim of study is to provide internal surface finishing machine at lower possible cost. Model have capability to produce smooth internal surface having diameter upto 20mm

4. OBJECTIVES

- To remove scaling of pipes when subjected to scaling and chipping.
- To manufacture the model on internal surface finishing of pipes of various dimensions.

- To develop the portable setup for internal surface finishing of small as well as large diameter pipes.

5. METHODOLOGY

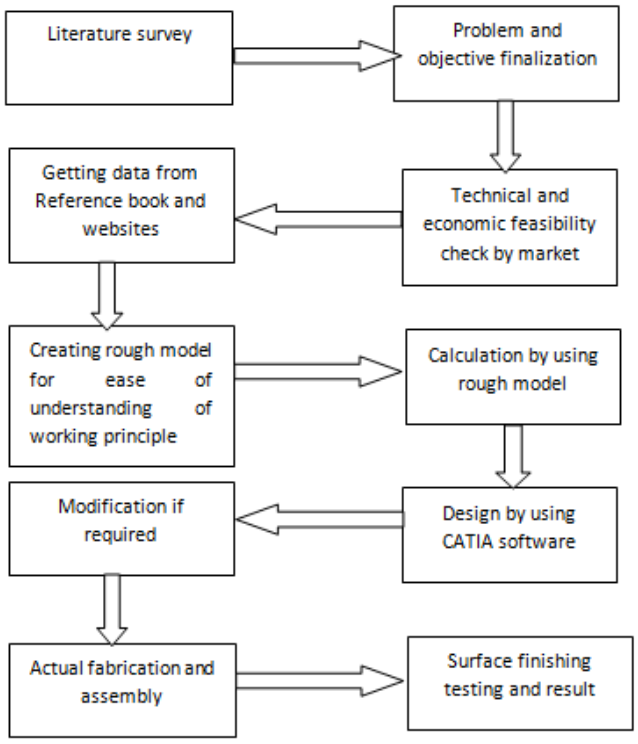

Chart-1: Flow Diagram of Methodology

6. DESIGNING OF MODEL

The various parts required for project is design and assembly of the same is created in CATIA. For knowing the working principle animation of same is created.

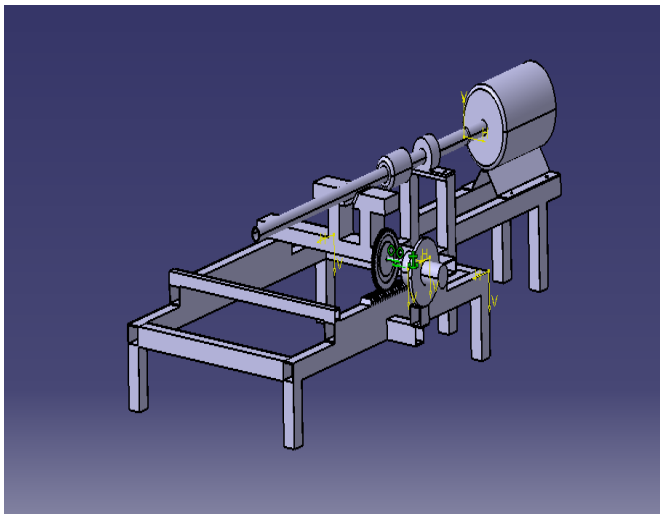

Fig -1: Assembly in CATIA V5 R16

7. EXPERIMENTAL SETUP

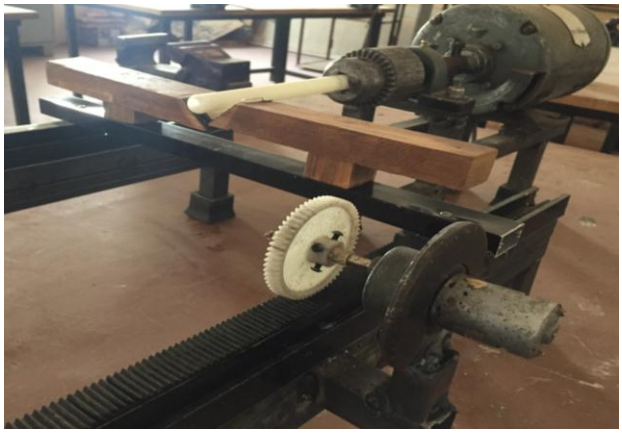

Fig -2: Actual Setup

Fig shows the schematic view of Magnetic Abrasives Finishing process with permanent magnets. Magnetic abrasives introduced inside the work-piece and magnets are placed at desired position. It works on the principle that when the ferromagnetic substance is coming in contact with magnetic field, the substance is attracted towards the magnetic field. During the finishing operation, work piece i.e. pipe is rotating in rotary motion given by ac motor and the linear motion is given to magnets by using rack and pinion arrangement. As results the magnetic abrasives as iron carbide are creates frictional force in the internal surface of pipes and generates smooth internal surface. The Neo-dymium magnets are used for this purpose. The internal surface was smoothly finished under all conditions.

8. EXPERIMENTAL PROCEDURE

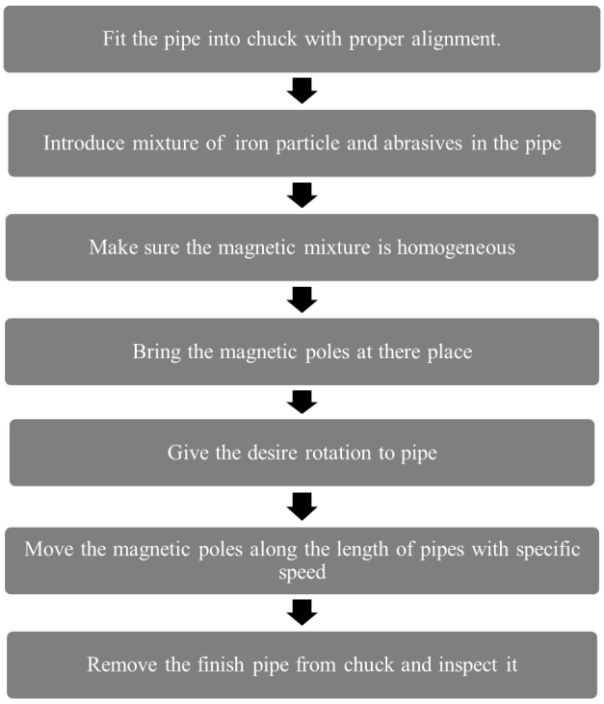

Chart-2: Flow Diagram of Setup

9. SPECIFICATION

Finishing target	Internal surface
Magnetic abrasive	20 gms, Iron Carbide Iron Particles: 80 wt% Abrasives: 20 wt%
Magnets	Neo-Dymium magnets
Work piece	Plastic Pipe (any other tubes except magnetic)
Work piece revolutions	1440 rpm
Finishing length	80-100 mm
Finishing time	10-15 min

Table-1: Specification

10. TESTING OF PIPE

Testing of pipes is done on Surface Roughness Measuring Instrument.

Fig-3: Photograph of roughness checking machine

Ra = Average roughness value

Rz = Average maximum height of the profile

Ppk = Maximum profile peak height

- The internal surface finishing of initial pipe surface before finishing

  Ra-0.832 µm

  Rz-5.859 µm

  Ppk-0.596 µm

- The internal surface finishing of the medium surface finish of pipe

  Ra-0.485 µm

  Rz-2.940 µm

  Ppk-0.653 µm

- The internal surface finishing of the fine surface finish of pipe.

  Ra-0.449 µm

  Rz-3.192 µm

  Ppk-0.680 µm

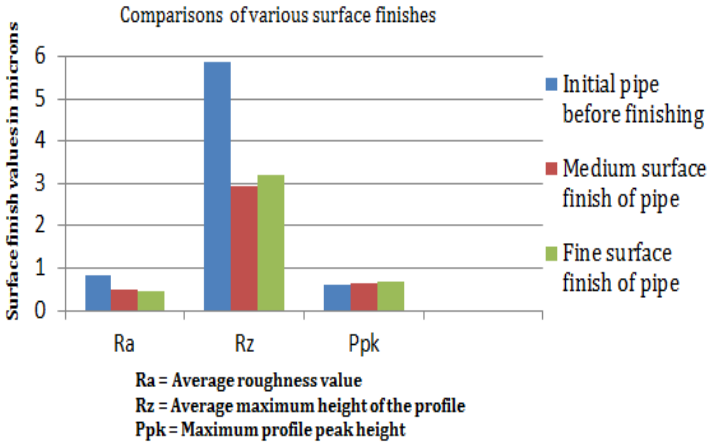

Chart-3: Result

11. CONCLUSION

Design and manufacturing portable setup for internal surface finishing of pipes successfully completed. It is concluded that this model is working properly under required condition with good surface finish. It is successfully able to give smooth surface finish having diameter upto 20mm.

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