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IMPROVED METHOD OF RIB LEVELLING IN AP IMPELLER FABRICATION

Improvement of Machining

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Abstract —*Manual process of rib leveling is replaced by machining process to reduce the time and effort of the human work. The machining is done in a vertical boring machine. During machining process the stability of the welded rib reduces. Hence Ethylene Propylene Rubber is placed in between the ribs to increase the stability of the welded rib. By using this method, the rib surface was levelled and obtained a good surface finish. The same operation can be done in a horizontal boring machine with the help of fixture; the fixture helps to hold the job vertically during machining*

Keywords-*Rib leveling , impeller, weld rib, surface finish, fixture.*

I. INTRODUCTION

Rib is one of the parts in AP impeller fabrication. The ribs are welded in the load disc. Due to welding distortion the rib height varies throughout its length which becomes complicated when placing cover plate during fabrication. Hence they are leveling the ribs manually. By using vernier height caliper the tapered surface has been marked. Then gas cutting will be done to remove the tapered surface. To make a good surface finish the grinding operation has been used.

II. PROBLEM DEFINITION

Rib is one of the parts in AP (Axial Profile fan) Impeller fabrication which is used as a stiffener to connect the flange with hub. In AP Impeller, the ribs are welded in the load disc. Due to heating and cooling cycle of welded metal distortion occurs in it. This causes change in height of the rib throughout its length which becomes complicated when cover plate is placed over the ribs during fabrication. Hence ribs are levelled manually by using gas cutting and grinding operation to get a good surface finish. This manual method of rib levelling is a tedious process.

2.1 Axial profile(reaction)fan

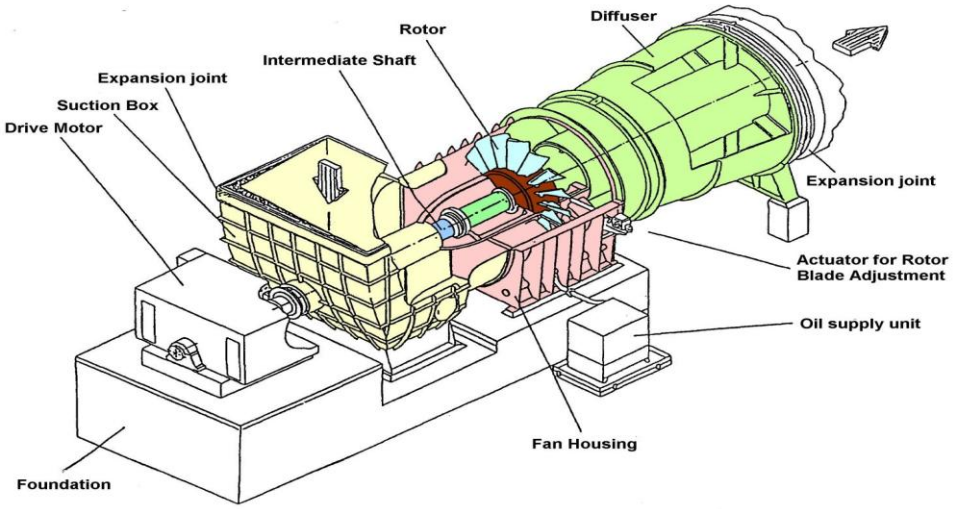


Fig 1. Axial profile(reaction)fan

III. F EXISTING SCENARIO

Rib is one of the parts in AP impeller fabrication. The ribs are welded in the load disc. Due to welding distortion the rib height varies throughout its length which becomes complicated when placing cover plate during fabrication. Hence they are leveling the ribs manually. By using vernier height caliper the tapered surface has been marked. Then gas cutting will be done to remove the tapered surface. To make a good surface finish the grinding operation has been used.

3.1 AP impeller

Fig 2. Axial profile(reaction)fan

IV. PROPOSED METHOD

Instead of using manual method of gas cutting and grinding operation, machining can be used to reduce the time and effort of the human work and to get a good surface finish .In our method the tapered rib surface is levelled by machining in a vertical boring machine. In vertical boring, the job rotates and the tool is fed against it. Ethylene Propylene Rubber (EPDM/EPM) has been used in between the ribs for stability, to avoid the displacement of welded rib during machining. By using this method, the rib surface will be levelled and get a good surface finish.During machining in vertical boring machine, the following constraints are occurs.

- Displacement of welded rib
- Interrupted cutting

4.1 Displacement of welded rib

- During machining the cutting force of tool may displace the welded rib.
- To avoid this displacement, we increase the stability of the welded rib by using rubber.
- Rubber is placed in between the welded rib.

4.2 Material chosen

- Steel
- Wood,
- Rubber

4.3 Ethylene propylene rubber (Epdm/Epm)

EPM is a copolymer of ethylene and propylene. This type can only be cross linked with peroxides. If during the copolymerization of ethylene and propylene, a third monomer, a diene, is added the resulting rubber will have unsaturation and it can then be vulcanized with sulphur. These rubbers are the so-called EPDM's.

4.4 Typical values

- Tensile strength: 3.0Mpa
- Elongation: 250%
- Specific Gravity: 1.4

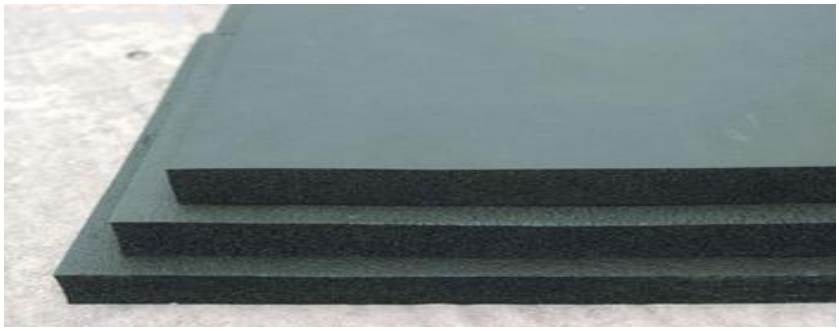


Fig 3. Ethylene propylene rubber

4.5 Product range

- Color: Black
- Thickness: 1~50mm

- Length: 10mtrs or 15mtrs
- Width: 500~1200
- Pattern: Smooth both sides

4.6 Vulcanizate properties

Table 1. properties

Property Type	EPM Property
Hardness (Shore A durometer)	30-95
Tensile strength, MPa	7-21
Elongation percentage	100-600
Compression set B percentage	20-60
Useful temperature range °C	-50 to +160
Tear resistance	Fair to good
Abrasion resistance	Fair to good
Resilience	Fair to good
Electrical properties	Insulator

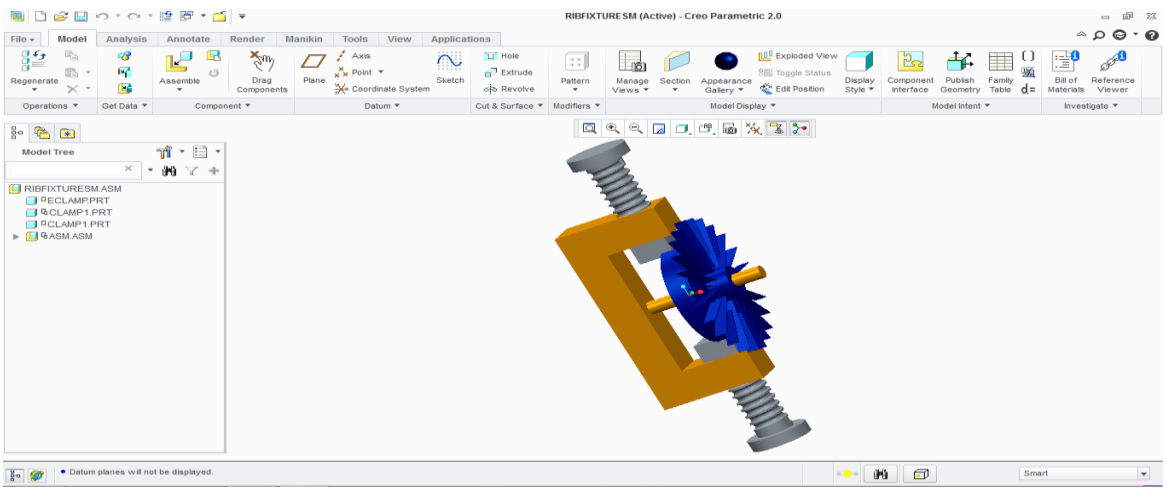
4.7 Interrupted cutting

An interrupted cutting in turning occurs due to discontinuous cutting i.e. when the tool is not in constant contact with the work piece. This fluctuation in both thermal and mechanical load can negatively affect cutting edge integrity, productivity, and process security.

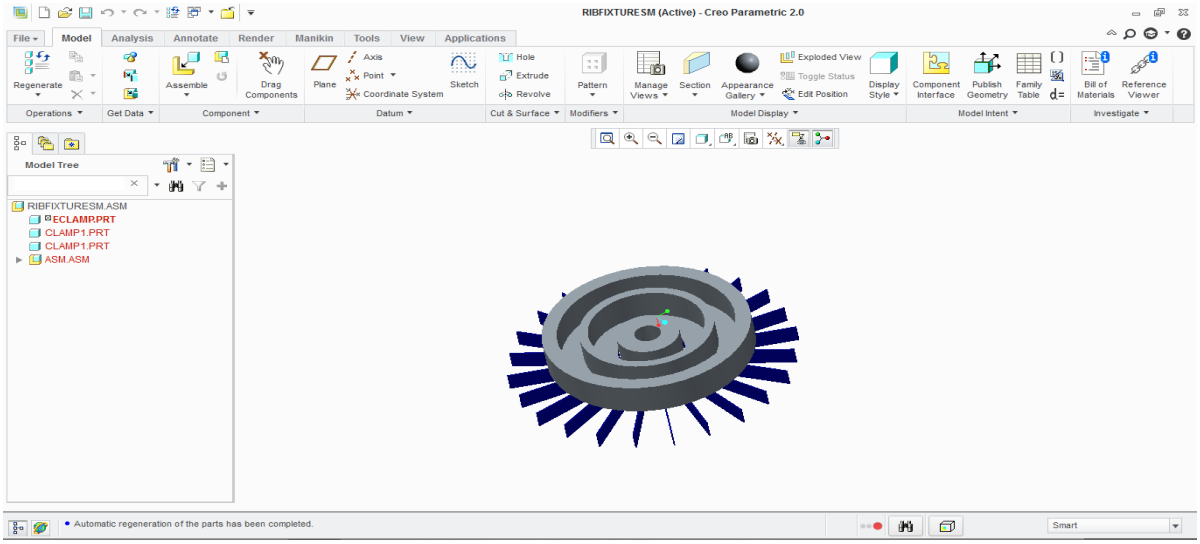
V. CONTROL METHODS FOR THE CARBIDE INSERTS DAMAGE DURING INTERRUPTED CUTTING

- Optimal insert selection
- Insert geometry
- Simple and innovative grades
- Physical vapor deposition

VI. DESIGN IMAGES



6.1 Design of TLT impeller



VII. BENEFITS

- Time for levelling the rib is reduced in this machining process when compared to previous methods.
- Human fatigue is reduced.
- Surface finish in ribs is improved.
- The number of worker involved is less in improved method of rib levelling machining process.
- Safe working condition ensured.
- Delivery time is advanced.

7.1 Financial benefits – Comparison

Process	Time(Existing)	Time(Proposed)
Disc plate marking	2 hrs.	2 hrs.
Load disc WIH fit-up	1 hr.	1 hr.
Welding	4 hrs.	4 hrs.
Ultrasonic testing (Including cleaning and grinding)	4 hrs.	4 hrs.
Load ring & Support ring fit-up	2 hrs.	2 hrs.
Welding	8 hrs.	8 hrs.
Ribs fit-up	8 hrs.	8 hrs.
Stiffener weld	12 hrs.	12 hrs.
Rib Level Machining (including loading and unloading time)	4 hrs.	4 hrs.
Cover plate 1 fit up	1 hr.	1 hr.
Weld	2 hrs.	2 hrs
TOTAL	64 hrs.	48 hrs

Table 2. Comparison of machine hour rate

VIII. ESTIMATED BENEFIT

Man hour rate	-	Rs.295/hr.
Machine hour rate	-	Rs.180/hr.
No of impeller fabricated in a year	-	208 nos.
Man hour save per impeller	-	16 hrs.
Man hour save per year	-	3328 hrs.
Man hour cost save per year	-	Rs.9,81,760
Additional machine hour required	-	832 hrs.
Machine hour cost	-	Rs.1,49,760
Total benefit	-	Rs.8,32,000
(Man hour saved - Machine hour added)		

IX. CONCLUSION

When comparing with the existing method of rib leveling, the proposed method reduces time for leveling the rib and surface finish is improved. By applying this method economic cost of producing the product is marginally reduced. Human fatigue is reduced and the number of worker involved is less.

This project work has provided us an excellent opportunity and experience, to use our knowledge in Air Pre-Heater (APH), Electrostatic Precipitators (ESPs) and Types of Fan used in boilers. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

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