A New Approach for Improving the Quality and Quantity Production of Embedded Type Fin Tubes in Cooling Tower Industries

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ABSTRACT: Finning machines that are widely being used in cooling tower industries for fin tube production have shown problems in the production process that has come up recently. These fin tubes are in turn, used in condensers and heat exchangers as a vital cooling unit in power plants. In a study in a cooling tower industry, major problems such as fin breakage and slip occurring between tube and drive tires were encountered. This was mainly due to grease and dirt in the tube surface which is practically unavoidable, and bent tubes. Here a novel approach to eliminate the problem is perceived, with the utilisation of the fin chips as an abrasive to clean the surface of the tube. This can be done using either compressed air or centrifugal turbines. The method will help both ways to encounter tube slip problems and, utilisation of the waste chip materials as well.

KEYWORDS: Finning Machine, Fin tube, Abrasive Cleaning, Fin breakage, Cooling Tower Industry.

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1. INTRODUCTION

In cooling tower industries the finning machines used to manufacture fin tubes are mainly the New McElroy type finning machines or Precitec Finning machine. These are a type of miniature rolling mills synchronized along with rotation (at about 3000 rpm) and the advancement of the tube. In New McElroy, the tube advancement is automatic, whereas in Precitec, two drive heads are operated by two shafts and often fail in operation due to the proper synchronization of the chucks. Due to this, also additional man power is required as at least two operators are required in the process.

The major problem as was found during operation in a cooling tower industry was fin breakage due to:

- Slip occurring between the tube and tire drives due to greasy surface;
- Bent tubes;
- Improper synchronisation
  Different shape and size of the fins are being used in the industry according to the needs of the design of the heat exchanger and changes in the heat transfer characteristics are affected accordingly. Thus, the shape and size of the fin is responsible in a great way for determining the efficiency of the heat exchanger,[1,2,3]

So to eliminate fin breakage, after inspection and detailed study the following observations were made:

- The tube be made rough;
- The drive tire cannot be made rough as lubrication is necessary due to continuous rolling and friction, resulting in heat;
- Sand Blasting Process cannot be used due to major disadvantages and pollution as well;
- Shot Blasting Process can be used but increases cost increasing another unit ;
- Cleaning the tubes by thinner or other process to remove the dirt/oil or grease from the tube surface.

2. INSTRUMENTATION SYSTEM AND METHOD

A) Proposed System

In the fin tube production process, the two drive heads alternatively grips the tube and advances it. There is a fin strip feed mechanism consisting of coils, spindle rolls, universal strip guides via which the fin is fed to the tube. The fin strip comes from the bobbin via the guides and is rotated at required angle. In the main finning mechanism, the pan and pressure wheel, grooving tool and back filler helps to form helical coils that are embedded in the tube. There is a separate cooling system which mainly uses emulsion based coolant and also aids in lubrication of the system during the finning process. The coolant is then recycled and used.

Whenever there is a lack of proper synchronisation or slip occurring, as is found often during the process, fin breakage occurs as can be seen in figure 1.

Initially the fin strip materials and chips are wasted, and in some cases recycled. The proposed

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system is described in figure 2 shown below. In this proposed system, the fin chips (material of the fin strip and chips is mostly aluminium) are collected. These aluminium chips are then carried away to a separate chamber and further made into smaller pieces by grinding, which falls into the hopper. Fine particles of abrasive are then carried to abrasive blast chamber where the chips are mixed with compressed gas using a compressor and the mixture is then sprayed onto the tube surface before entering the drive head before the finning process to take place. Due to this, an abrasive cleaning process takes place, clearing off the dirt and grease responsible for tube slip. Blast cleaning technology is found more efficient in cleaning the surface.[4,5,6]

The block diagram model shown below in figure 3 describes the principal systems (blocks/units) and indicates the order in which the process will take place.

Figure 1 Typical example of Fin breakage

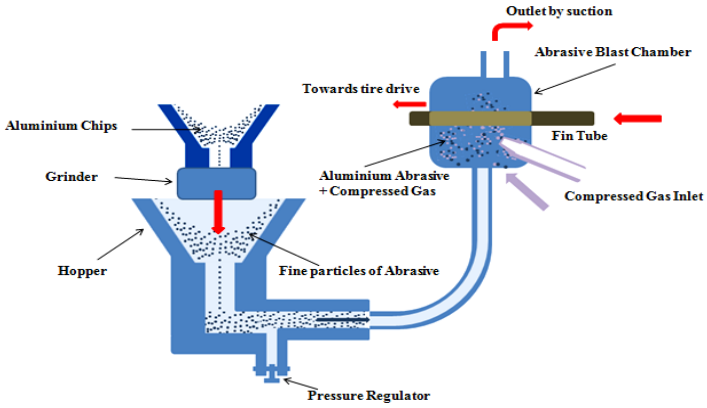

Fig 2. Schematic Diagram of the proposed system

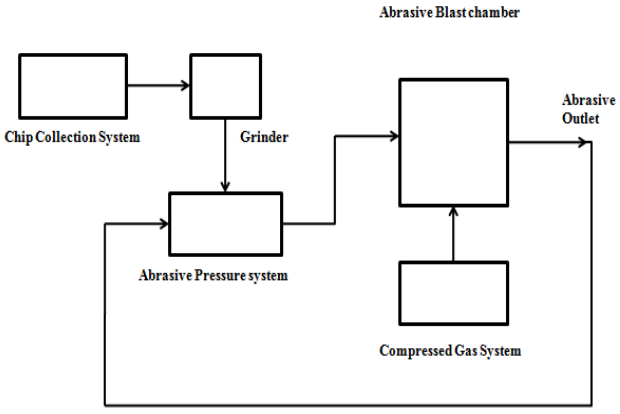

Fig 3. Block Diagram showing the main systems and the order of the process

Fin Specifications

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Fin Material	**Aluminum 1060-F 1050-; 6063-0**
Max Fin Height	6-8''
Operating RPM	2400
Max tube RPM	3000

Machine Requirements

Tube length	15.2 Meters.
Voltage	460V±5%
Frequency	48Hz to 62Hz
Horsepower	150 HP AC Motor

3. RESULTS AND DISCUSSION

The fin breakage problem and slip occurring between the tube and drive tires can be eliminated using steps such that roughness is increased and hence slip is removed.

This process uses the effect of abrasive impact where metal abrasive is sprayed at a high pressure thereby removing the dirt, grease and other contaminants from the surface. Thus quality of the surface is improved and no slip occurs between the drive gears and tube.

The advantages of this system are:-

- Enhanced productivity;
- No need for additional Operator for tube maintenance;
- Reuse of the chips produced, reducing waste;
- Low investment process as opposed to sand blasting and shot blasting;
- Environment friendly and no pollution is caused like sand blasting processes;
- No health hazard for the workers and operator;
- Waste generation is reduced subsequently.

4. CONCLUSIONS

In this study we have tried to device a system to eliminate the fin breakage problems and tube slip. Greater amount of efficiency is obtained in fin production, and also finer quality of fin tubes is produced. This also increases the production rate drastically as smooth production rate is desired in industry. This is also a complete environment friendly process and also reduces the amount of chips wasted, thereby initiating a smart waste management and Green Manufacturing in the industry. The eco friendly method also reduces the amount of pollution and health hazards for workers as was found in sand blasting process.

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