Design and Manufacturing of Twist Removing and Straighting Mechanism for Pipe

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Abstract— The other straightening machines which are bulky and sometimes it is not easy to move that machine from one line to another line. But this torque head i.e. twist removing machine is less bulky compared to conventional machining, which we can move to one line to another line. Also we have less effort to move that machine In conventional machining system for particular diameter of pipe a separate machine is used for straightening of pipes but in this torque head machine variable diameter of pipe can be straight by using different diameter of rollers.

Keywords: Twist Removing, Straighting Mechanism, Pipe

I. INTRODUCTION

Straightening machine has been built with various methods of driving the rolls. Some machine has a separate drive motor for each roll. Regardless of the way the rolls are driven it is important that all rolls revolve at the same speed within about 1 to 2 rpm at maximum machine speed. A certain black art and mystery surrounds tube and pipe rotary straightening machine. Like all machinery, the various components and system joint together to form the working straightener, however the heart of a tube straightener is the set of work rolls, specially contoured to enable the machine to straighten a range of different tube diameters. Straightening machine is the finishing machine for the high frequency welded tube mill line, which is used to straighten the steel tubes, estimate the stress and bend the steel tube after forming and welding. A pipe straightener which utilizes parabolic upper and lower rollers combined with hydraulic cylinders to apply pressure between alternate parabolic rollers so as the pipe is moved between the rollers the bends and twists are removed. By adjusting the top and bottom rollers from a right angle with respect to the pipe up to approximately 45 DEG with the upper rollers being adjusted in opposite angular relation to the lower rollers, pipe may be readily straightened. At least some of the upper rollers and some of the lower rollers are power driven, preferably with hydraulic motors, the conduits of which hydraulic motors are connected in series so that all the rollers will be driven at a uniform speed, with certain rollers being idler rollers. Straight pipe exhaust is a high performance exhaust system which offers very minimum back pressure and can hence improve the top end performance of a racing engine. Apart from the headers they would be fairly straight with perforated pipes lined with dampening materials which convert sound energy to thermal energy.

II. PROBLEM STATEMENT

The pipe for silencer of two wheeler is manufacture by cold rolling process, due to respective process of manufacturing the pipe gets twisted and ovule in cross section. Such twisted pipe is not suitable for the silencer of two wheeler bike. The reasons of rejection are listed below:

A. Physical Problem:

1) Induced residual stresses, which further causes premature failure.
2) Non uniformity in dimensions.
3) Poor structural integrity.

B. Technical Problem:

1) Flow restriction.
2) Poor emission performance.
3) Poor acoustic performance.

C. Financial Problem:

1) Further processing may cause rejection from customer.

III. OBJECTIVE

A. To Reduce the Number of Rollers-

In conventional machine two to three sets of rollers are used but in this torque head we have used two numbers of rollers which are in vertically mounted. And we have facility to change the rollers according to the diameter of manufacturing of pipe.

B. To Make the Straightening Process Portable-

The other straightening machines which are bulky and sometimes it is not easy to move that machine from one line to another line. But this torque head i.e. twist removing machine is less bulky compared to conventional machining, which we can move to one line to another line. Also we have less effort to move that machine.

C. To Reduce Ovality for Uniform Dimension-

The ovality increases the non-uniformity in diameter. Due to the ovality the diameter changes at different sections. So to get uniform dimensions we required to removing twist

D. To Remove the Twist of Pipe of Varying Diameter-

In conventional machining system for particular diameter of pipe a separate machine is used for straightening of pipes but in this torque head machine variable diameter of pipe can be straight by using different diameter of rollers.

IV. MANUFACTURING OF TORQUE HEAD

Process of Manufacturing of Pipe Cold working of a metal is carried out below its recrystallization temperature. Although normal room temperatures are ordinarily used for cold working of various types of steel, temperatures up to the recrystallization range are sometimes used. In cold working, recovery processes are not effective. Silencer pipes are manufactured by the cold rolling process. Stainless steel sheets and strips are commonly finished by rolling. Foil is

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made of the softer metals in this way. Cold rolling metals impart smooth, bright surface finish and in good physical and mechanical properties to cold rolled parts. If the objective is only to give a clean, smooth finishing metal, only a superficial amount of rolling will be needed. On the other hand, where it is desirable that the tensile strength and stiffness be increased substantially, the section thickness is significantly reduced, and then higher roll pressures and deeper kneading are necessary. Cold rolling also improves machinability in the cold rolled part by conferring the property of brittleness, a condition, which is conducive to smooth tool, finishes with broken chips. The preliminary step to the coldrolling operation, the sheets of pre hot-rolled steel are immersed in an acid solution to remove the washed in water and then dried. The cleaned steel is passed through set of rolls of cold rolling process thereby producing a slight reduction in each the required thickness is obtained. The arrangement of rolls in a rolling mill, also called rolling stand, varies depending on the application. The various possible configurations of rolls are similar to hot rolling. The names of the rolling stand arrangements are generally given by the number of rolls employed. These stands are more expensive compared to the nonreversible type because of the reversible drive needed. Internal stresses are set up in cold rolled parts which remain in the metal unless they are removed by proper heat-treatment. This process needs more power for accomplishing the operation in comparison to hot rolling

V. WORKING OF MACHINE

A. Step 1: Pre-processing

Using a CAD program that either comes with the FEA software or provided by another software vendor, the structure is model. The final FEA model consists of several elements that collectively represent the entire structure. The elements not only represent segments of the structure, they also simulate its mechanical behaviour and properties. Regions where geometry is complex (curves, notches, holes, etc.) require increased number of elements to accurately represent the shape; whereas, the regions with simple geometry can be represented by coarser mesh (or fewer elements). The selection of proper elements requires prior experience with FEA, knowledge of structure's behaviour, available elements in the software and their characteristics, etc. The elements are joined at the nodes, or common points. In the pre-processor phase, along with the geometry of the structure, the constraints, loads and mechanical properties of the structure are defined. Thus, in preprocessing, the entire structure is completely defined by the geometric model. The structure represented by nodes and elements is called "mesh".

B. Step 2: Processing

In this step, the geometry, constraints, mechanical properties and loads are applied to generate matrix equations for each element, which are then assembled to generate a global matrix equation of the structure. The form of the individual equations, as well as the structural equation is always,

$$\{F\} = [K]\{u\}$$

Where,
{F} = External force matrix.
[K] = Global stiffness matrix
{u} = Displacement matrix

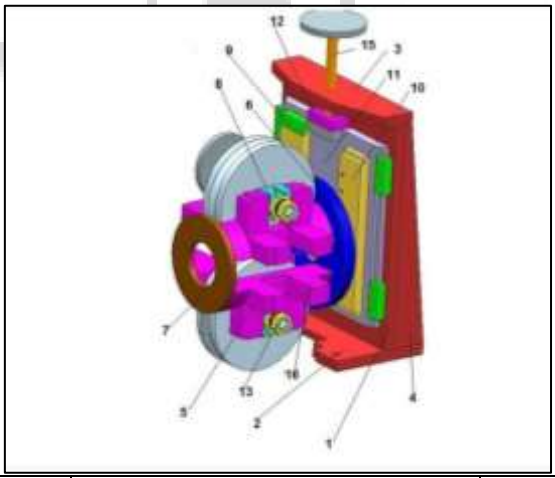
The equation is then solved for deflections. Using the deflection values, strain, stress, and reactions are calculated. All the results are stored and can be used to create graphic plots and charts in the post analysis.

C. Step 3: Post processing

This is the last step in a finite element analysis. Results obtained in step 2 are usually in the form of raw data and difficult to interpret. In post analysis, a CAD program is utilized to manipulate the data for generating deflected shape of the structure, creating stress plots, animation, etc. A graphical representation of the results is very useful in understanding behavior of the structure.

VI. DESIGN OF COMPONENT

Design of Gear
Gear material: En8 =0.0319
Beam strength of worm gear tooth =220N/mm^2
Levis form factor =1.827
Efficiency of worm gear pair =0.7544
Diamension of worm and worm gear
$Z_W/Z_P/q/m$ =1/60/10/4
Forces acting on worm gear pair
$F_{WR}=F_{GR}$=88.76 N
Design of Worm Shaft-
Shaft Material:En8 =53 mm
Square Block
W =64 mm
H =87.2 mm
T =36.2 mm
L =270 mm



Part N0.	Part Name	Quantity
1	Base Plate	1
2	Side Plate1 (Bottom Plate)	1
3	Side Plate2 (Top Support plate)	1
4	Gusset (Rib)	2
5	Square Blocks	4
6	Worm Wheel	1
7	Top Plate	1
8	Spacer Blocks	4
9	Locking Plate	8
10	Adjusting Plate 1 (Vertical Plate)	1

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11	Adjusting Plate 2 (Horizontal Plate)	1
12	Rod Support	4
13	Hex Nut	2
14	Bolts	2
15	Adjusting Shaft And Hand Wheel	2
16	Bush	1

CONCLUSION

With the help of newly developed Torque head machine, it is concluded that the:

- The Torque head machine is able to reduce the ovality and removes the twist of pipe.
- We can adjust the centre of pipe on a single torque head by giving the sliding plates adjustment which were not present in previous mechanism.
- This newly developed Torque Head machine has helped to cure the ovality of the pipe more accurately by using adjusting roller pair.
- By using adjustable roller pair, different size and shapes of pipes like circular, rectangular, square can be straighten on the same machine.
- Thus the machine has reduced the time of production, hence it is more efficient.
- The machine requires less floor space.
- Thus, it is thus concluded that the newly developed Torque Head machine is capable of reliably reducing the torque and ovality using more expensive machines, but at a fraction of the cost.
- On the basis of results, we can conclude that depending upon thickness and radius of pipe the ovality of pipe decreases by 2-3% within the tolerance limit.

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