REVIEW OF FIXTURE DESIGN FOR VARIOUS PIPE DIAMETERS

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ABSTRACT: Fixture are very important device for mass production in industries. As they eliminate the individual making, positioning and frequent checking, thus fixtures tend to reduce the operation time during which productivity and efficiency will increase. Almost every industry uses different types of fixtures based on their types of products. In our paper we have proposed an idea to design a metallic fixture for pipe industry. Pipes are not always straight they are present in different shapes depending on their application and space where it is fit. These pipes may eventually get corrode with respect to time or fluid flowing through it and such a pipe is needed to be remanufactured. To manufacture the pipes again we need to hold the pipe against the fixture. Hence the fixtures are developed. In manufacturing of wooden fixture, there was requirement of wood and skilled carpenters but the quality of wooden fixture is not feasible as they can deform under heavy load. This lead to manufacturing of fixtures again and again. In our paper we have proposed an idea to design a metallic fixture which consist of metallic frame with various PCDs on it. a flexible system which helps us to change its angles and a special arrangement which helps us to rotate it so that various operations can be performed.

KEYWORDS - Inclined plate- for various PCD, base plate- for support, flexible feature of fixture- to change the angle

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1. INTRODUCTION:

A fixture is a work-holding or support device used in the manufacturing industry. Fixtures are used to securely locate (position in a specific location or orientation) and support the work, ensuring that all parts produced using the fixture will maintain conformity and interchangeability. Using a fixture improves the economy of production by allowing smooth operation and quick transition from part to part, reducing the requirement for skilled labour by simplifying how work pieces are mounted, and increasing conformity across a production run. Fixtures must always be designed with economics in mind; the purpose of these devices is to reduce costs, and so they must be designed in such a way that the cost reduction outweighs the cost of implementing the fixture. It is usually better, from an economic standpoint, for a fixture to result in a small cost reduction for a process in constant use, than for a large cost reduction for a process used only occasionally. Most fixtures have a solid component, affixed to the floor or to the body of the machine and considered immovable relative to the motion of the machining bit, and one or more movable components known as clamps. These clamps (which may be operated by many different mechanical means) allow work pieces to be easily placed in the machine or removed, and yet stay secure during operation. Many are also adjustable, allowing for work pieces of different sizes to be used for different operations. Fixtures must be designed such that the pressure or motion of the machining operation (usually known as the feed) is directed primarily against the solid component of the fixture. This reduces the likelihood that the fixture will fail, interrupting the operation and potentially causing damage to infrastructure, components, or operators. It is a cumbersome process that needs to be undertaking for each pipe. The existing method of templating involves fixturing the pipe on plywood templates with each pipe flange having the peculiar size and pitch circle diameter. The main disadvantage of plywood is the unacceptable tolerance achieved especially in the case of big and heavy pipes due to fragile wood work which is liable to deform easily. . Expensive plywood, frequent replacement, requirement of experienced carpenter, time waste are the measure disadvantages. To overcome the above mention problems this metallic fixture is developed. It consist of metallic frame with various PCDs design on it, a flexible system which helps us to change its angles and a special arrangement which helps us to rotate it so that various operations can be performed.

2. LITERATURE SURVEY:

Steven P Kish (1955) [1] claims; The present invention relates to a method of making tools suitable for use in the fabrication of sheet metal articles it also relates to a method of making tools and fixtures. In the manufacture of sheet metal parts such, for example, as in the automotive industry, the aircraft industry and household hard goods industry, it is well known that a large number of special tools are required such as dies for use in forming sheet-metal parts, assembly fixtures for use in holding fabricated parts properly related with respect to each other while they are connected together in a suitable manner to provide an assembly or subassembly of parts. In the past, master models of the finally designated part have been constructed from a suitable hard wood which has been carefully dried, such as mahogany. From these master models a large number of tools of the above type must then be made using the master models as a pattern. In an effort to reduce the cost of the handmade models, it has been suggested to employ a roughly shaped hard wood core surrounded by a plastic surface having the configuration of the article or a portion thereof. This method is subject to the disadvantage that the resultant model duplicate or template remains subject to the dimensional instability of the hard wood core. It is therefore one of the objects of this invention to provide a method for making tools and fixtures suitable for use in the fabrication of sheet metal articles which is both simple and economical. A further object of the invention is to provide a method for making tools and fixtures which have exceptional dimensional stability and resistance to deterioration from the elements. A still further object of the invention is to provide a method for the production of tools and fixtures which are light in weight, resistant to abrasion and rugged in use. In addition, other fixtures are required for the purpose of aiding in the making of production dies such as checking features for use in the manufacture of parts, spotting racks for use in checking die surfaces during the manufacture thereof, model duplicates, etc

William Stetz (1990) [2] also described, an apparatus for aligning and supporting confronting pipe or tube sections to be welded together. An elongated supporting table is provided with a pair of inwardly grooved tracks and various pipe secondary support members are

also provided to mate with the tracks and to hold several pipe or tube arrangements utilizing conventional T-fittings, 45° and 90° elbow fittings, nozzle fittings, etc. The apparatus permits minimal setup time, proper alignment, stability during welding and the use of conventional orbital pipe welding heads and a smooth angular welding surface free from interference by prior art longitudinally disposed clamping external members.

M. Vural, H.F. Muzafferglu, U.C. Tapici (2007) [3] As product design, to optimize a product, process design is also considerable. The product obtained after process must be at target in terms of value of geometry, size, tolerance etc. to be acceptable. For this reason, a product which is not affected by uncontrolled parameters must be planned on, in process design. When these expectations mentioned to achieve standard production and continuous challenge are considered, the importance of automation in manufacturing processes come into existence. However, when product variety is considered deficiency of hard automation and necessity to flexible manufacturing systems are stand in the forefront. Although, human factor seems as the main reason of faults in manufacturing, many present automation systems cause to face troubles in response to unpredicted modifications. Despite the decrease of human factor, full automation is still discussed as a difficult topic. In welding to achieve the target values and obtain repeatability, fixtures are used as in some other manufacturing methods. The main idea of designing a flexible manufacturing cell, producing hollow sections, discussed in this paper is depend on welding process that cause high manufacturing cost in comparison with product quality because of low manufacturing volume. The problems experienced during gas metal arc welding process of mentioned sections, used in automotive industry, are the basis of this study. Various defects were detected on manually welded parts at previously designed welding fixture and an improvement study was done to remove them. In preliminary work, low weld quality, geometrical tolerance faults and aesthetic defects were detected after manual welding. This study speeds up welding process of the part and also for aesthetic and strength properties stable quality level is achieved. By stable quality level problems would occur in next processes are eliminated. For this purpose, a welding fixture is designed and welding parameters, affecting distortions and residual stresses, such as welding speed and reverse distortion are taken into consideration. An industrial robot that can give response to modifications in manufacturing and feasible for process was chosen and integrated to test setup with suitable welding equipments.

3. PROBLEM DEFINATION:

In manufacturing wood fixture there was requirement of plywood and the qualified carpenter. Further quality work was not feasible as the fixture made up of plywood were proven to deform due to load of heavy and large pipe. This lead to rework. Therefore it was essential to have a suitable fixture for timely and quality work, reducing time for remanufacturing of pipe.The repair and renewal of pipe is done for all type of pipe like steam, cooling water etc. The pipe diameter varies according to its use and the material used for pipe can be mild steel, stainless steel, copper etc. Even the pressure in the pipe varies depending upon the fluid passing through it. The fixture is very crucial in the entire process. If the template of the pipe is not proper the pipe may clear the pressure test on shop floor but may fail in practical use. If the pipe is put in the system by forcing it into the place then the flange start leaking from the neck. Hence a metallic fixture is been made to overcome the problems mentioned above.

4. SCOPE OF WORK AND OBJECTIVE:

The scope and objectives of these stages are mentioned below.

Scope of work:

1. The monotony of the job will be removed and all the worker will feel zeal and enthusiasm.
2. Helps to perform the operation without any disturbance and with stability.

Objectives:

Reduces the work - As the manufacturing of wooden fixture is reduced, many operations are eliminated.

Enhanced quality of pipes - By providing the pipe proper support and strenght, working becomes easier and helps to enhance its quality

Significant savings in term of manpower - No need of skilled worker and carpenter.

Saving in time - Mounting and unmounting of pipe and flange from fixture becomes easy, the pipe doesnt dislocate due to failure in fixture, hence time doesn't get wasted in relocating the pipe and the metallic fixture can last for very long time as compared to wooden fixture, thus reduces the manufacturing time.

Templating can be undertaken even by a non-skilled worker.

5. METHODOLOGY:

The scientific way of approaching the goals of this title is to study the existing different types of fixture for pipes and their material and behaviour towards the loading. Then the change in diameter and material change concept is to be applied. Various steel materials are to be compared on the basis of mechanical properties and their cost. Basically material strength and its factor of safety are the main selection criteria for materials. A comparative study will be done using ANSYS to study the properties of metal. The metal with desired properties will be selected and a design for fixture will be made. The design of fixture will be a creative and innovative solution of designing a "flexible metallic fixture". The fixture consists of inclined plate which houses the changeable universal metallic template catering for pipes of various diameters. The material of the fixture is mild steel to give it the enough strength to take load of heavy pipes. The flexible feature of the fixture help it to give different angle according to the requirement of the pipe angle. This is achieved by adjusting the side slot and fixing the screw in the required slot depending upon the angle. The height of the fixture can be adjusted by positioning the plate in three different slots provided at varying heights. The distance between the two fixtures which are present at the end of the pipe holding the flange of the pipe can be adjusted. The base plate of the fixture is fixed on the ground/table where the processes perform with the help of bolt. The flange of the pipe is fixed to the fixture according to the required angle and the pipe is fitted between the two fixtures. This brings stability and helps to perform the further process of cutting and later on welding.

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