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COMPUTER CONTROLLED EXPERIMENTAL DEVICE FOR INVESTIGATIONS OF TRIBOLOGICAL INFLUENCES IN sheet FORMING

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ABSTRACT

Sheet metal forming, particularly deep drawing method is influenced by several factors. Blank holding force and drawbead displacement ar 2 of them that may be controlled throughout the forming method. For this purpose, AN electro-hydraulic computerised sheet-metal strip slippy device has been created. the fundamental characteristic of this device is realization of variable contact pressure and drawbead height as functions of your time or stripe displacement. There ar each, pressure and drawbead, 10 linear and nonlinear functions. extra options contains the power to live drawing force, contact pressure, drawbead displacement etc. The device summary and initial results of steel sheet stripe slippy over rounded drawbead ar given within the paper.

1. INTRODUCTION

Technology of deep drawing of skinny sheet metals is incredibly vital in trendy trade. owing to the event of recent materials of a lot of complicated formability and raising of the technological necessities to the upper level, the necessity for realisation of complete management of forming method will increase. so as to achieve that, out of an outsized range of prestigious factors, it's necessary to spot, those which might be modified and controlled throughout the forming method. There ar solely 2 such factors: contact pressure on projection and drawbead height [1]. the method management through active, intelligent complicated systems needs constant dynamic feedback between the given goal perform, controlled and dominant variables [2]. The goal functions and controlled variable are often different: wrinkle height, dilution within the important zone, projection motion, projection thickness modification, friction force, forming force, tension stress in work piece wall, etc. The given objective functions ar outlined either by laptop simulations or by previous experiments. Pressure on projection and also the drawbead height gift the dominant effects. High reacting speed to controlled values modification and sturdy dominant hardware and computer code equipment ar needed, that all implies important investments [2 - 4]. there's conjointly an alternate – approach|a far} easier approach – during a way employed in this paper. However, initial it's necessary to outline optimum functions of pressure and drawbead height per correct criteria (drawing depth, piece quality, forming force, tension stress etc.). This usually needs comprehensive experiments [3, 4] so as to spot the character of specific factors influence. With such data, it's doable to create the dominant equipment for employment whose main goal is to understand antecedently outlined optimum functions of pressure and drawbead height.

requires significantly smaller investments concerning hardware and computer code and is way a lot of accessible to a good vary of users. the appliance of constant height drawbeads continues to be most frequently applied and standard [5, 6]. a similar goes for application of constant blank holding force on projection. the most reasons for this ar smaller forming method prices. However, owing to the event of recent materials of a lot of complicated formability properties, in most cases it's impossible to accomplish the satisfactory results by classical strategies. There also are some new concepts, like the appliance of drawbeads during which the angle between drawbead axis and sheet plane is completely different from 90o [7]. there's conjointly the enlarged interest in several numerical simulations and virtual application of drawbeads in processes of complicated work items forming [8]. the appliance of blank holding force while not draw beads is that the subject of separate analysis supported a similar said principles [9, 10]. during this paper, the stress is on the presentation of properties of equipment for investigation of the character of the association between the drawing force and combination of assorted influences, put in at the college ofEngineering in Kragujevac. The properties embody friction conditions (dry, application of lubricant), drawbead pure mathematics (two misestimation radii), variable

functions of pressure, variable functions of drawbead height and corresponding constant values of each pressure and drawbead height.

The drawing force is obtained from laboratory press ERICHSEN 142/12 in vary 0-20 kN, moreover as a stress signal for measurement the force of correct sensing element. Hydro-cylinders for drawbead motion and pressure realization ar fed by mixture ERICHSEN of nominal pressure one hundred bars and flow one.5 l/s. The oil from the mixture runs through the series of governable proportional hydro valves to each cylinders. measurement and pressure dominant branch consists of a pressure sensing element which provides the present real price signal and management unit (micro-controller) that receives the given desired price from the computer code and sends signal to the D/A device. The received analogous signal is transmitted to the management card of the correct hydro-valve connected to the pressure cylinder. In dominant branch, owing to drawbead motion, the present real drawbead position is scan by rotation encoder. when process, the signals ar sent to the management unit (microcontroller), and so to the cardboard for management of hydro-valve for drawbead cylinder. One signal is expounded to the direction modification, and also the different one to the worth of drawbead motion perform. For measurement and reading truth drawbead position, supporting branch with inductive sensing element and correct electronic equipment is created.

2. ANTECEDENTLY OUTLINED AND EXTREMELY COMPLETE PERFORM OF PRESSURE AND DRAWBEAD HEIGHT

For the wants of planned comprehensive experiment, half-dozen variable dependencies of each pressure and drawbead motions on time, as given functions, were outlined. In Figs. 4, 5 and 6, those functions ar marked with numbers one to six. Dependencies five and half-dozen ar linear, and 1, 2, three and four non-linear, parabolic. Functions were outlined supported empiric values of lowest and top pressure (0-20 MPa), drawbead height (0-8 mm) and method length. the method length was restricted by the restricted stripe displacement of sixty millimetre and adopted slippy speed of twenty mm/min. This caused top method length of three min (180 s). the aim of practical dependencies outlined in such some way is that the inclusion of a good vary of doable actions: decreasing, increasing, combined decreasing-increasing and increasingdecreasing, linear and non-linear. watching and analyzing of the response of drawing force modification on action of such dependencies in conjunction with friction conditions and drawbead pure mathematics is that the most vital a part of this device operation.

The material is low carbon sheet DC04. Pressure relate to perform P4 (Fig. 6), and drawbead misestimation is five millimetre. Friction determined by lubrication with the acceptable oil. Dependences in Fig. 8a ar increasing, wherever at parabolic dependence R2 has a lot of intensive increase within the half of the stripe displacement. This distinction contains the cause for drawing force reaction that shows higher intensity decrease for milder method conditions at linear dependence of drawbead height R6.

Based on preliminary results, obtained by investigation the steel sheet DC04, concerning the character of the drawing force response, it's doable to form the subsequent conclusions:

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