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PHYSICAL MODELLING OF VARIABLE CONTACT PRESSURE AND VARIABLE DRAWBEAD HEIGHT INFLUENCE ON DEEP DRAWING OF THIN SHEETS

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Abstract: *For this experimental research, electro-hydraulic computerised device for sheet metal stripes sliding was made. Its main property is realisation of contact pressure and drawbead height as functions dependent on time, i.e. stripe travel. In addition, it is also possible to measure drawing force, pressure, drawbead displacement etc.*
The paper presents the preliminary results of the investigation of decreasing drawbead height influence in combination with increasing-decreasing contact pressure function. The stripes are made of low-carbon steel sheet metal of 0,8 mm thickness. Contact conditions are influenced additionally in two ways - by mineral oil lubrication and dry surfaces application. Drawbead geometry, with rounding radii of 2 and 5 mm, is also varied.
The results indicate that simultaneous influence of variable drawbead height, variable contact pressure, drawbead geometry and proper friction conditions can influence substantially the plastic flow process.

Keywords: *deep drawing, variable drawbead height, variable contact pressure.*

1. INTRODUCTION

Due to the significance and complexity of the process of thin sheet metals deep drawing, the tendency to accomplish the control of forming process is the latest trend. In order to succeed in that, it is necessary to select, out of a large number of influential factors, the ones which ca be varied throughout the forming process, thus correcting it until it is completed successfully. There are only two such factors: contact pressure and drawbead height [1].

Process control through active complex (closed-loop) systems requires constant dynamic feedback between the given function of the objective, controlled and controlling variables. The functions of the objective and controlled variable can be different: wrinkle height, thinning in critical zone, flange motion, flange thickness change, friction force, forming force, stress in work piece wall etc. The given objective functions are defined either by computer simulations or by previous experiments. Pressure on flange and drawbead height present the controlling effects. High velocity of reacting to controlled values change and robust controlling hardware and software apparatus are required, which all implies significant investments [2, 3].

There is also the alternative – a much simpler approach – used in this paper. However, first it is necessary to define optimal functions of pressure and drawbead height according to proper criterion (drawing depth, piece quality etc.). This often requires comprehensive experiments [4, 5] in order to identify the character of specified factors influence. With such information, it is possible to form the controlling apparatus for practical application whose main objective is to realise previously defined optimal functions of pressure and drawbead height. Such equipment requires considerably smaller investments regarding hardware and software and is far more accessible to a wide range of users.

Application of constant height drawbeads is still most often applied and well known [6, 7]. The same goes for application of constant blank holding force on flange. The main reasons for this are smaller