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The project of automatic feeder of sheet for press

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Abstract. Currently in the industry on a large scale is used of sheet feeders. Unfortunately, the producers more attention focused on the design of the trays with the use of metal circles. In the production of which it is impossible to use of metal circles it is necessary to provide a solution that meets the requirements of the production. Typically, these solutions are unusual and designed exactly the characteristics of the production. The aim of the project was to design of automated feedes belts for painted sheet steel to workspace eccentric press. The main design criteria: The maximum compact design of feeder; The possibility of adjusting the amount of feeder; Easy to change the operating parameters; Maximum number of items selected (catalog, standard); Easy installation design; The simplicity of installing sheet pile in feeder; Positioning accuracy of sheet; The stable characteristics of static and displacement; Reliability. As part of the work was performed the following tasks:

- They developed the concept of sheet feeder,
- There have been developed to optimize design solutions,
- Presented visualization process and verification of strength,
- Construction specification of feeder
- Designed control system of feeder.

1. Introduction

Presses are the basic equipment of each press department. The type and size of installed presses reflects the nature of the production. A purpose of the work was designing the feeder of the metal sheet to the eccentric press. Analysis of the literature on the subject allowed to get acquainted with technological processes, in which solutions of this type are being used, [1, 3].

Thanks to that three conceptions focused their attention. From them after applying the spot optimization one was chosen. Most optimum was a conception using the screw mechanism for picking stacks of the metal sheet up and an arrangement of two servomotors joined to oneself by a flexible joint.

Work on it was began from designing the spatial system of the feeder in Solid Edge program. At individual stages of the work were designed and made an agreements of picking stacks of the metal sheet up to the working space of the eccentric press and arrangement announcing and getting the belt of the metal sheet back up to the stamp of the press. In choosing servomotors, servomechanisms and the driving engine it was used the software made available by producers with using their ready libraries of models CAD [2, 5]. Next was made a technical documentary and whole was crowned by makeing an animation in Solid Edge program and simulation and cyclogram pneumatic arrangement in Fluid Sim program.

2. Design process

In the course of the work carried out three concepts of construction solutions. Based on the point optimization performed, the solution most appropriate to the criteria was chosen, Fig. 1.

The main selection criteria are:

Maximum compactness of the feeder structure, Adjustable height of the feeder, Easy change of working parameters, Maximum number of items selected (cataloged, normalized), Simplicity of assembly of the structure, Simplicity of installing sheet metal prisms in the feeder, Accuracy of sheet metal, Stable displacement characteristics , Reliability of operation.

The concept has been modeled in program Solid Edge.

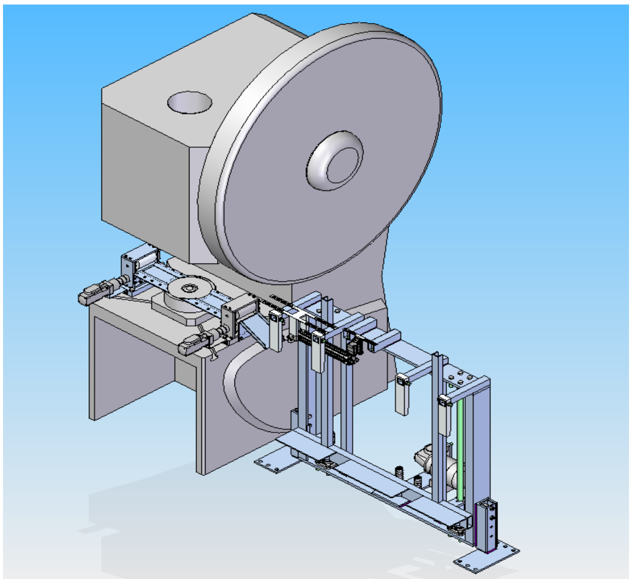

Figure 1. Feeder with complete equipment.

The design process has been divided into three stages.

In the first stage, the frame model was carried out together with the sheet metal lifting system Fig. 2. The lifting system carries out the lifting of the table using a screw mechanism. The screw drive is driven by the Nord motor.

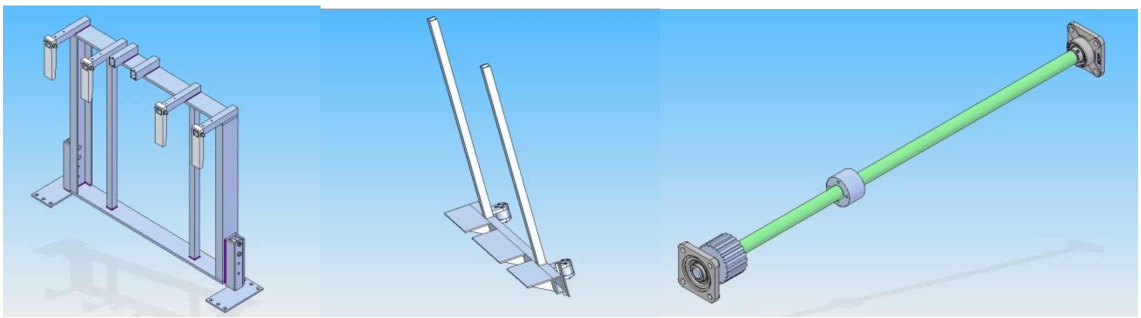

Figure 2. Lifting system and support frame.

In the second stage, a complete system for direct lifting was designed and the sheet belts were fed into the eccentric press working zone. In the construction of the system used CAD models. FESTO pneumatic components were mainly used. Elements can be selected modularly and thus adapted to the replacement parameters of the press.

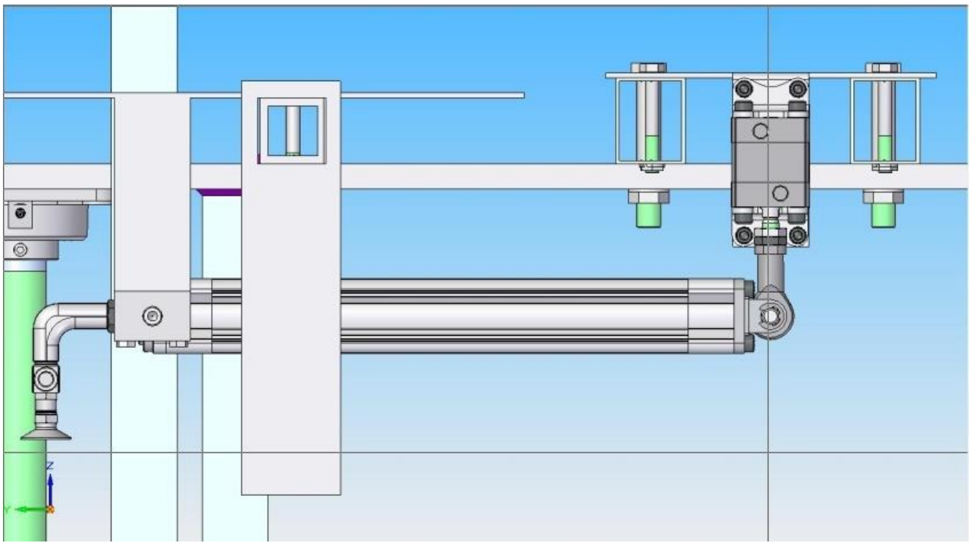

Figure 3. Feeding system of sheet metal belts.

The last stage of design was based on the design of the sheet feeder / receiver unit on the press table, Fig. 4. In order to ensure precise and trouble-free operation, two rollers are designed. The rollers are powered by a FESTO servo, [1, 2, 4, 5].

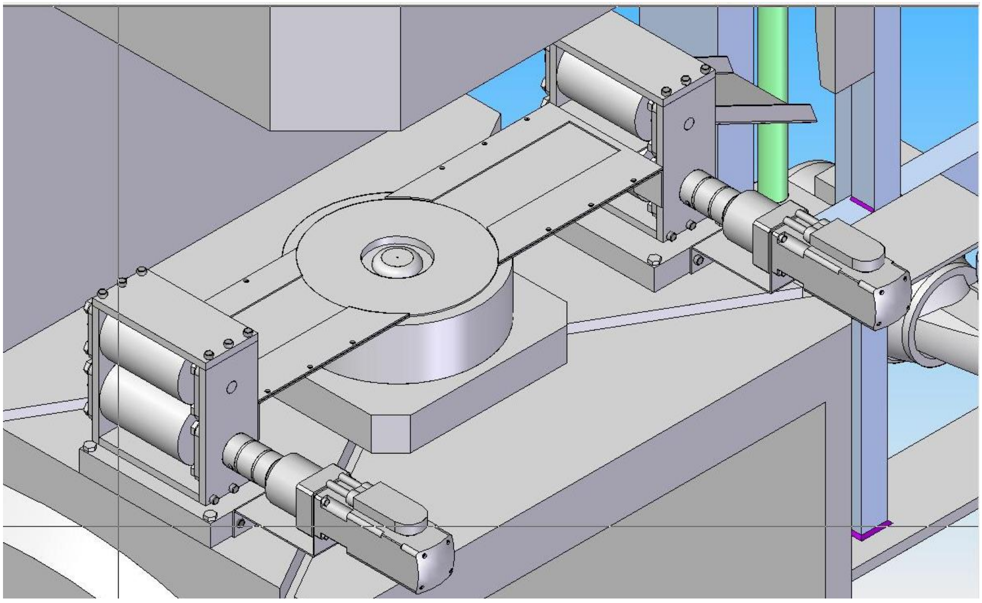

Figure 4. Roller system for sheet feeder.

3. Simulation of the operation of the pneumatic system

The basis of the project was to verify the system implementing the sheet metal feed directly to the feed roll system. Analysis of this process was carried out using FluidSim application. The application diagram is shown in Figure 5. The scheme includes all mechanical and control elements. The system consists of individual components:

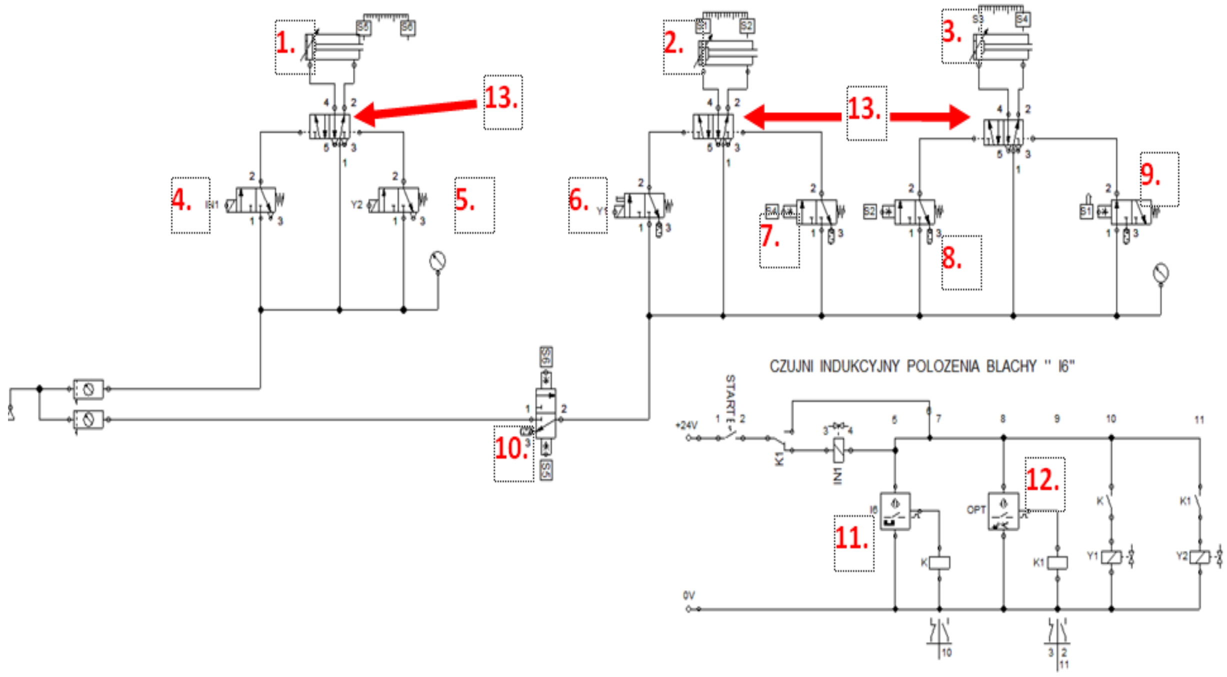

Figure 5. Selection of the type welded elements from the series of types.

1. Double acting actuator, simulating the sheet lifting system;
2. Double acting actuator: Festo ADN 32_10;
3. Double acting actuator DNC 32_250;
4. Distribution valve: Type 2/3 normally open electrically controlled; Electrically controlled by the solenoid valve IN1
5. Distribution valve: Type 2/3 normally open electrically controlled; Electrically controlled by the solenoid valve Y2;
6. Distribution valve: Type 2/3 normally open electrically controlled; Electrically controlled by the solenoid valve Y1;
7. Distribution valve: Type 2/3 normally open mechanical controlled byusing the S4 piston position sensor located on the Festo DNC 32_250;
8. Distribution valve: Type 2/3 normally open mechanical controlled by using the S2 piston position sensor located on the Festo ADN 32_10;
9. Distribution valve: Type 2/3 normally open mechanical controlled by using the S1 piston position sensor located on the Festo ADN 32_10;
10. Distribution valve: Type 2/3 normally open mechanical controlled by using S5 and S6 piston position sensors. This valve functions as a safety device for Festo actuators;
11. Inductive sensor I6, detecting sheet metal. This sensor activates the Y1 solenoid valve;
12. Optical sensor OPT, detecting the end of the sheet metal stack. This sensor activates the Y2 solenoid valve.
13. Five-way valve, two-way valve 5/2.

4. Animation of feeder operation

In order to better illustrate the operation of the layout, an animation of the position was performed.
The animation shows the operation of all the elements of the feeder, Fig. 8. It was made in Solid Works in the module Solid Works Motion. In the process of creating animation, a step-by-step method was used.

Using this method, precise timing of activation of individual motors was determined on the timeline.This was one of the first forms of verification of correct execution and control system, [4, 6]. The exact work characteristics are presented in the work cycle in Fig. 6. Shows the movement of individual actuators with their performance characteristics.

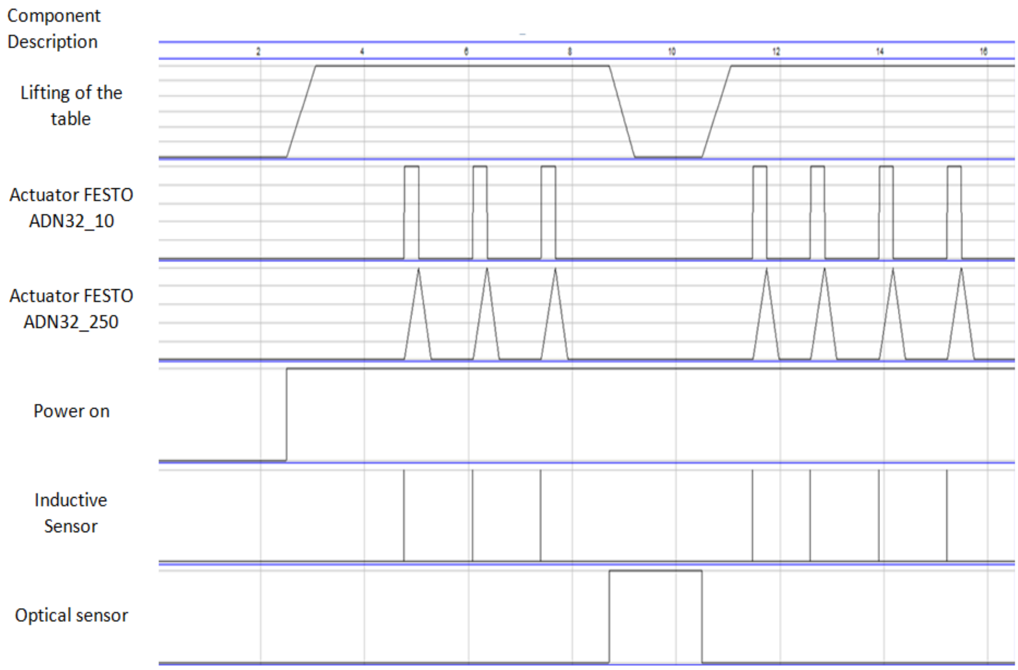

Figure 6. Cycle of the system work.

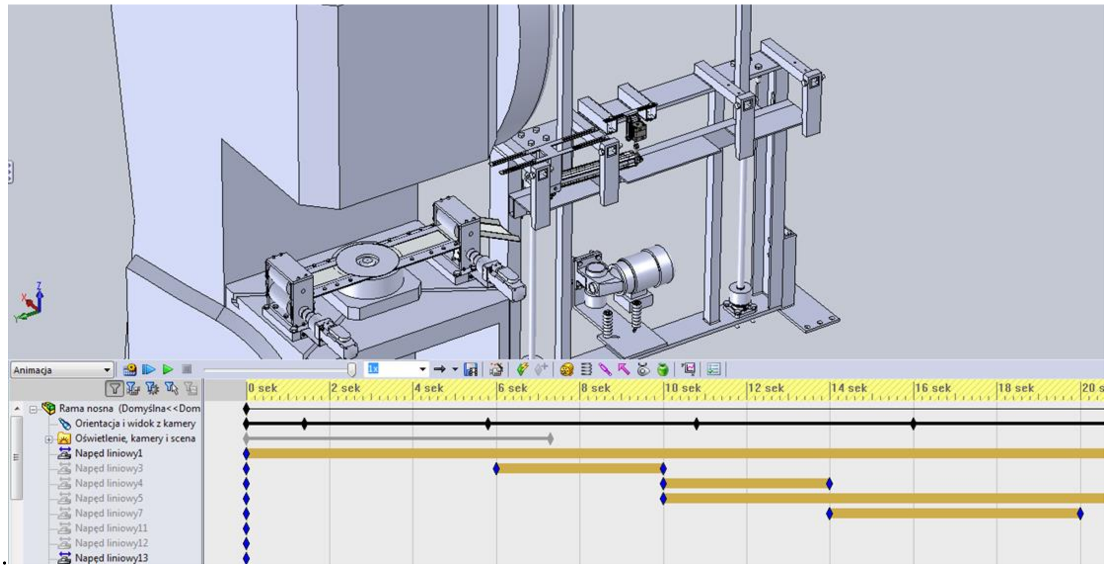

Figure 7. Animation panel operated for the feeder.

5. Conclusions

Currently in the industry on a large scale is used of sheet feeders. Unfortunately, the producers more attention focused on the design of the trays with the use of metal circles. In the production of which it

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is impossible to use of metal circles it is necessary to provide a solution that meets the requirements of the production.

At a time when automation occurs in every area of everyday life, the automation of old machines and their adaptation to automated technological lines are also logical. The following project is an example of the possibility of adopting old machines into automated processes. By investing in machine automation and designing appropriate tooling for it, attention should be paid to maximizing the use of selectable components, catalogs. Also keep in mind that production characteristics can often change, so consider this in the design process, leaving you with the ability to adjust individual components or easily rebuild individual components. Based on the fabrication, simulation, and animation team made using Solid Edge, Solid Works and Fluidsim, you can draw the following conclusions:

- The use of CAD software greatly reduces and streamlines the design process,
- Simulation of the operation of the actuators using the Fluidsim program, allows selection of the optimal solenoid valve system and placement of individual sensors.
- The use of pneumatic actuators allows for easy use of compressed air from the plant located in the manufacturing plant.

6. References

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