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THE COMMAND AND OPERATION OF A ROBOT VACUUM GRIPPER IN WOOD INDUSTRY

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Abstract: *The paper presents the command and operating possibilities for two variants of the studied gripping systems which are used for the panels' manipulation or that of the furniture pieces. An experimental manipulator, built especially for the furniture industry domain, was equipped with these gripping systems. The operating diagram and the command programmes were presented for two variants of the studied gripping systems.*
Keywords: *command and operation, vacuum gripper,computer, robot.*

1. INTRODUCTION

The purpose of the command and operation for the gripping system of an industrial manipulator or robot [1] is its doing of some technological operations as:

- bracing the execution elements of the gripping system with the panel, furniture piece or body to be manipulated
- the bracing maintenance during the technological process of manipulation
- the gripper separation of the panel, furniture piece or body done at destination

All these operations are carried out due to the commands received from a process computer after ruling some specific programmes for each type of gripper. The paper presents the motion - time diagrams, the operation schemes as well as the programmes in assembly language for two variants of vacuum grippers.

2. THE COMMAND AND OPERATING SYSTEM OF THE VACUUM GRIPPER

The vacuum gripper functions (fig.1) using both the compressed air from the compressor whose features have been presented above (for the pneumatic motors), and the negative pressure obtained with the help of a pump vacuum. The negative pressure in the cup ranged from -0.03 to -0.05Mpa. One 190mm diameter cup was used for experiments [2].

The pneumatic diagram in the case of a pump vacuum usage is presented in figure 2. The cup rises and descends due to the 1.0 double-action liniar pneumatic motor. The regulation of its motion speed is obtained by means of chokes with 1.2 and 1.3 direction valves. The operation of the 1.2 pneumatic motor and of the 2.0 cup for the panel release at the end of gripping is determined by the feeding of the 1.1 and 2.1 distributor coils [3].

The command which creates the negative pressure in the cup is given by the detector of its valve (when the detector touches the surface of the panel, the valve opens connecting the cup chamber with the pump vacuum. The motion-time diagram for the vacuum gripper (the pump vacuum variant) is shown in figure 3.

A sequence of programme (fig. 4) has been created for the vertical displacement of the gripper and the cup's ventilation, being presented as it follows (for the case of the panel gripping). Two bits of the output interface of the process computer port have been used for command (one for the gripper's descending and one for the cup's ventilation) [4].

The vacuum gripper, the ejector cup variant (with Venturi effect), uses the compressed air obtained from the compressor for creating both the vertical displacement (the 1.0 linear pneumatic motor) and the basin in the cup.

The pneumatic diagram of operating the vacuum gripper, in this variant, is presented in figure 5. Also here, the vertical motion speed can be regulated by means of chokes with 1.2 and 1.3 direction valves.

Figure 1. The cup gripper of the experimental manipulator.

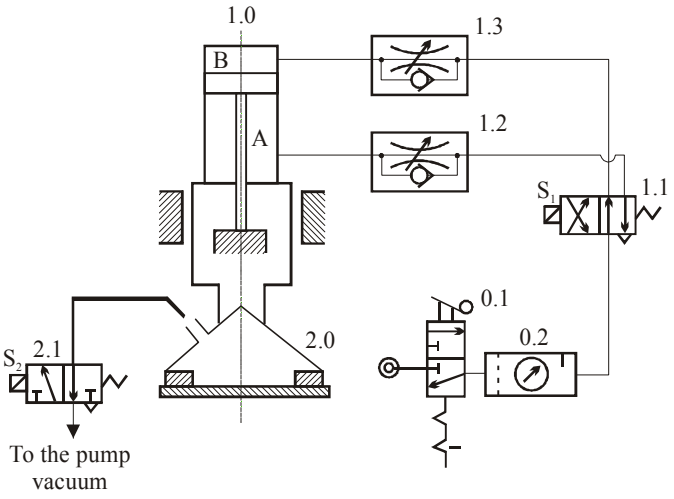

Figure 2. The pneumatic diagram of operating the vacuum gripper (using the pump vacuum).

Elements		State		Time diagram Tact 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Pos.	Name	Fonct.motion	Position	
0.1	Retained control distributor	Air feeding gripper	Acţ. 1 Inact. 0	
1.1	Electric control distributor	Pneumatic motor control 1.0	Coil 1 Spring 0	
1.0	Double-action pneumatic motor	Up-down displacement gripper	Up 1 Down 0	
2.1	Electric control distributor	Control of valve atmosph. air input	Coil 1 Spring 0	
2.0	Valve cup	Gripping panel	Grip. 1 Release 0	
	Cup valve	Vacuum circuit closing-opening	Open 1 Close 0	

Figure 3. The motion-time diagram for the gripper of the experimental manipulator (the vacuum gripping variant which uses the pump vacuum)

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                        ; *** Gripping panel ***
08A0    3A FC01         PREL: LD A,(VAL41)      ;GRIPPER DESCENDING
08A3    CB E7           SET 4,A
08A5    D3 41           OUT (041H),A
08A7    32 FC01         LD (VAL41),A
08AA    CD 08FE         CALL TEMP               ;PANEL GRIPPING
08AD    CD 08FE         CALL TEMP
08B0    3A FC01         LD A,(VAL41)            ;PANEL RISING
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08B3    CB A7       RES 4,A
08B5    D3 41       OUT (041H),A
08B7    32 FC01     LD (VAL41),A
08BA    CD 08FE     CALL TEMP
08BD    3E 01       LD A,01H            ;PANEL TAKEN OVER
08BF    32 FC0E     LD (PREH0),A
08C2    C9          RET
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Figura 4. A sequence of programme for operations vacuum gripper.

The operation of the 1.0 pneumatic motor and getting the basin in the cup are determined by feeding the 1.1 and 2.1 distributors' coils. The motion-time variant for the vacuum gripper (the Venturi effect variant) is shown in figure 6.

In order to obtain the gripper vertical displacement and the basin in the cup, a sequence of programme has been created. The 4 (the gripper's descending) and 5 (the cup's ventilation) bits of the output interface of the process computer port have been used for command [5].

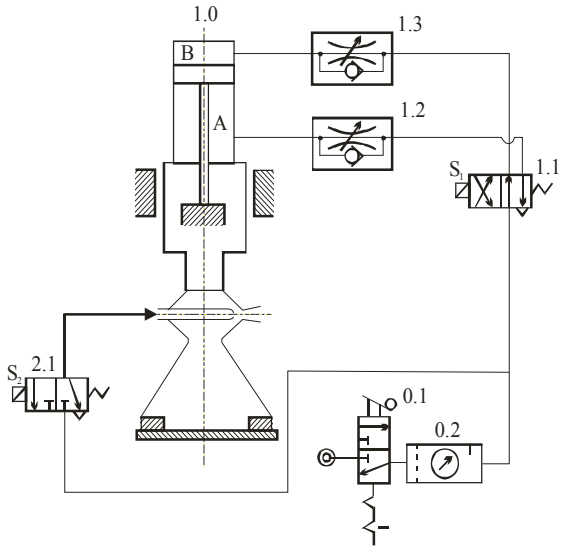

Figure 5. The pneumatic diagram of operating the vacuum gripper (by using the ejector cups).

Elements		State		Time diagram
				Tact
Pos.	Name	Fonct. motion	Position	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
0.1	Retained control distributor	Air feeding gripper	Acț. 1 Inact. 0	
1.1	Electric control distributor	Pneumatic motor control 1.0	Coil 1 Spring 0	
1.0	Double-action pneumatic motor	Up-down displacement gripper	Up 1 Down 0	
2.1	Electric control distributor	Gripper cup command	Coil 1 Spring 0	
2.0	Ejector cup	Gripping panel	Grip. 1 Release 0	

Figura 6. The motion-time diagram for the gripper of the experimental manipulator (the vacuum gripping variant by using the ejector cups).

3. CONCLUSION

- Two variants of vacuum grippers have been experimented.
- The single-action cup gripping has permitted the easy taking over of panels, of some masive wood pieces and even furniture bodies from panels for low surface roughness.
- The pump vacuum or compressed air - for ejector cups (based on the Venturi principle), have been used to create the basin in the cups.
- The operating diagrams and command programmes have been presented for the studied grippers.

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