

The Development of Melt Gear Forming Equipment

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Abstract. Fuses are widely used in electronic products, and the bending of the silver wire in fuses requires special equipment processing. This design is a kind of equipment developed for the bending of the silver wire in fuses. After debugging, the equipment can better bend the silver sheet to meet the requirements of the fuses for bending the silver sheet.

Keywords: Fusant; Gear; Touch Screen; Fuse.

1. Introduction

1.1 System Control Requirements

The design requires mitsubishi PLC as the control core [1]. The reducer is driven by the driver, and the reducer drives the coaxial motion of the two gears, and the silver sheet is bent through the motion gap of the two gears. The equipment is required to realize the function of counting the number of bending workpiece after processing, adjusting the speed of gear movement, adjusting the number of gear movement, adjusting the position of gear, adjusting the distance between rolling wheels and emergency stop on the touch screen.

1.2 Hardware

1. hardware

The system hardware is composed of Mitsubishi FX3S programming controller [2], stepper motor, driver, reducer, gear and Taiwan Vellon TK6051IP touch screen, as shown in Figure 1.

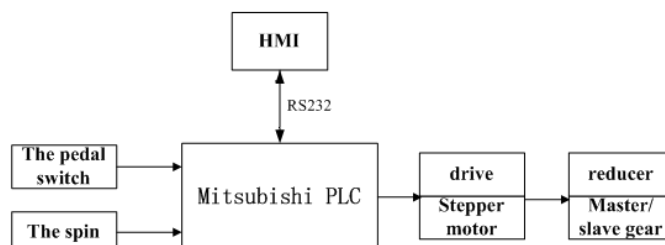


Figure 1. Mechanical structure drawing of gear

The size of the gear is designed according to the size of the workpiece. The size diagram of the mechanical structure of the designed gear [3] is shown in Figure 2.

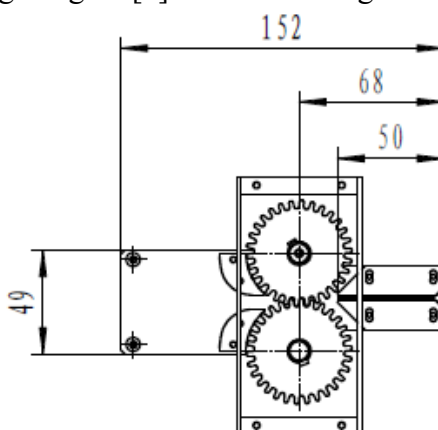


Figure 2. Mechanical structure drawing of gear

2. Technical parameters

The power supply voltage of the equipment is 220V, the total power is 350W, the conveying motor is the stepping motor, and the size of the body is 400x320x210(length × width × height, unit: mm). Part of the shell of the frame is bent by 2mm steel plate, the table is made of 12mm steel plate, and the equipment is gray plastic spraying. According to the requirements of equipment parameters, the device reference appearance designed with Solidworks software is shown in Figure 3.

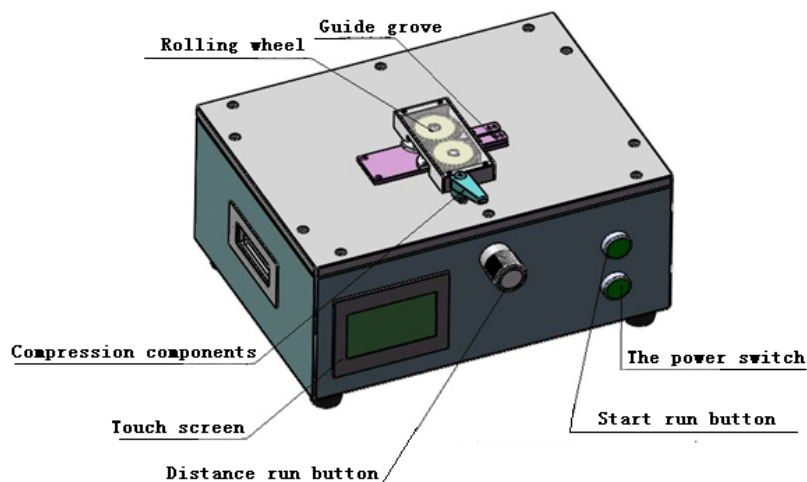


Figure 3. Equipment appearance figure

1.3 Software Part

Table 1. System instruction list

Step	instruction		Step	instruction	
0	LDI	M10	78	MPS	
1	DMUL	D200	79	AND	M8029
		K300	80	OUT	M4
		D204	81	MPP	
14	DMUL	D210	82	MOV	D8140
		K30000			D300
		D214	87	LDP	M0
27	MPS		89	MOV	K0
28	ANDP	Y003			D100
30	DADD	D220	94	LD	M1
		K1	95	OUT	Y001
		D220	96	LDP	M0
43	MRD		98	ORP	X002
44	ANDP	M20	100	OR	Y003
46	MOV	K0	101	ANI	M4
		D220	102	ANI	M5
			103	ANI	X000
51	MPP		104	OUT	Y003
52	ANDP	Y003	105	LD	X001
54	MOV	K0	106	ANI	X000
		D8140	107	PWM	K5
59	MOV	K0			K10
		D300			Y000
64	LD	Y003			
65	DPLSY	D204	114	END	
		D214			
		Y000			

1. Ladder diagram design

PLC sends instructions through DPLSY pulse and sends pulse and direction signals to the driver. By setting multiple registers, PLC controller drives the stepper motor to move, and the stepper motor realizes coaxial motion through the reducer to the gear [4]. The specific program instructions of the system are shown in Table 1.

2. Touch screen design

The touch screen interface includes counting function, speed adjustment and turn number adjustment, as shown in Figure 4.

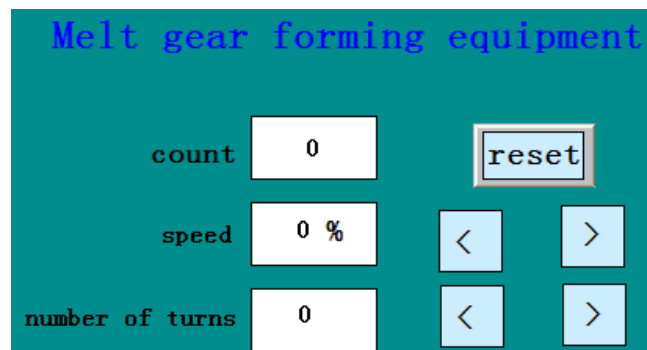


Figure 4. Device Parameter Setting

(1) Counting function: every time the equipment processes the silver sheet, the counting value will be automatically accumulated and displayed on the screen, up to 9999 times. Press the reset button to reset and start counting.

(2) Speed adjustment: Adjust the speed percentage, which is 1 second/circle when the speed is 100%. You can press the value box to pop up the value input keyboard for modification, or press the Decrease and Increase buttons on the right of the screen for modification. Click the button once to modify 1, and hold down the button continuously to automatically jump.

(3) Number of turns adjustment: Set the number of turns of the gear. Because it needs to return to the original starting position, only integer turns can be set, and the maximum number can be set to 10. Press the value box to pop up the value input keyboard for modification, or press the reduce and increase buttons on the right to modify, and the number changes by 1 by clicking the button once.

1.4 System Debugging

After design and processing, the actual control diagram of the system is shown in Figure 5.



Figure 5. Physical system drawing

After the device is powered on, turn on the power warping switch on the rear panel, and the warping switch indicator lights up. After the system is powered on, the touch screen on the front panel starts to self-check and enter the system. After the self-check, the system runs normally, and the touch

screen displays the operation interface as shown in Figure 4. The manual feeding mode will be used to process the silver sheet into the guide groove, through the gap between the two gear movement of the silver sheet extrusion bending. The touch screen can display the current machining number, set and adjust the speed and gear number. The silver sheet after bending is shown in Figure 6.



Figure 6. Silver sheet bending diagram

After running for a period of time, gear position should be adjusted, roller wheel spacing should be adjusted, etc.

(1) Gear position micro adjustment: press and hold the green button on the front panel, the gear will rotate slowly, release the button to stop when it reaches the desired position, and the system will take this as the starting position and return to this position after operation.

(2) Roller wheel spacing adjustment: when adjusting the master and slave roller spacing, first loosen the pressing components on the worktable, adjust the distance adjustment knob on the front panel, lock the pressing components on the table when the position is appropriate.

(3) Emergency stop function: If a fault occurs during system operation, the system will stop after pressing the emergency stop button on the front panel, and there will be a prompt on the touch screen. After fault recovery, rotate the reset emergency stop button.

1.5 Conclusion

1. Identify problems and solutions

(1) If the system fails to supply power after the power is turned on, check whether the fuse in the power warping switch is damaged.

(2) Appropriate protective measures should be taken for the parts that may cause operation injury. Organic transparent glass cover should be added to the gears.

2. The late maintenance

Check gear wear regularly and replace it immediately once it is worn. Check the running condition of the linear guide regularly. If the surface of the guide is not covered by oil film, please add lubricating oil immediately. If the surface of the guide is polluted by dust and metal dust, please clean it with kerosene before adding lubricating oil.

References

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