The design of the canteens tableware cleaning machine

Yuguang Jia [a], Min Qin [b] and Xuezhen Gong [c]

School of Shandong University of Science and Technology University, Qingdao 266590, China;

[a]2492524008@QQ.com, [b]596770287@QQ.com, [c]gxuezhen@126.com

Abstract

The cleaning machine of the canteen tableware mainly consists of the power transmission part of the cleaning machine, the cleaning and soaking device, the transmission washing device and the reception device of the tableware. The power transmission part of the cleaning machine is provided by the motor, which makes the belt drive, chain drive and decelerator run, and the transmission device is an essential part of the whole cleaning device.The cleaning and soaking device is mainly composed of the washing - up pool and the conveyor belt, which mainly soak the tableware to remove the large particles on the tableware, and then continue to transport through the conveyor belt, which plays a connecting role for the next step of cleaning。The transmission and scrubbing device is mainly composed of brush support, brush, conveyor belt, sprocket, shaft, belt, bearing, drum, fan, air pipe and lower bracket.The work is to make the tableware be transported on the conveyor belt. Through the washing device on the upper part of the conveyor belt, the tableware is washed, the stains on the tableware are brushed off, and the water on the tableware is blown dry by the blow of the fan.The tableware receiving device mainly lies in not making the tableware fall to the ground, so that it is convenient for finishing later.The way and process of the cleaning machine work: first, the tableware is soaked through the Tableware pool to remove the large particles on the tableware.then transported through the conveyor belt, and the large particles that remain on the tableware are washed by water during the transportation process.Then through the conveyor belt cleaning device to multi-stage cleaning of tableware, brush away the stain on tableware, through the fan blowing then blow dry the water on the tableware, at last, through collecting device to put away their tableware .It not only solves the sanitary problem of tableware in the catering industry, but also avoids the tedious artificial labor, at the same time, it improves the cleaning efficiency and becomes the right assistant of the catering industry.

Keywords

Cleaning machine; soak; Conveyor belt; Rinse; Multistage washing; Fan; Receiving device.

1. Introduction

Cleaning is a basic activity necessary for People's Daily life. This habit is too common, so this universal habit is getting less and less attention and ignores the meaning of cleaning. In recent years, the rapid development of economy has been witnessed by all people, but people's living standards have been improved, and the health problems in the catering industry have been taken seriously. The rapid development of the economy and the continuous improvement of the society have led to the continuous expansion of the cleaning industry. Therefore, the cleaning company has become the inevitable product of this era. All kinds of cleaning machines have appeared in succession, breaking into the market, serving the catering industry, good business opportunities. Especially in recent years, due to many other industries for internal adjustment, make a lot of employees are laid off, the rise and development of cleaning industry, put many people to realize the re-employment, to join the work of cleaning industry. Economic development led to the development of the catering industry, walking in the street snacks, hotels, restaurants, but a lot of tableware can not meet the standard of health in the store, so eating out when the health problem of tableware has become the focus of attention. Because people like to go to clean places to eat, to clean the tableware hygiene standards are improved, so

there are more and more cleaning company, working on cleaning industry is too much. It is understood that up to now, various cleaning companies across the country have reached more than 2,200, and the number of workers in the cleaning industry has reached more than 400,000. This is also enough to show that the cleaning industry is slowly replacing the crude manual cleaning mode, which is developing towards specialization, humanization and scale. Then the tableware can be sterilized by professional cleaning, will be welcomed by people, will become the mainstream.

After investigation and research, the hygienic standard of tableware in catering industry needs to be improved. Nowadays, there are a lot of catering enterprises, there are many problems for the health of tableware, they still use the original cleaning method, consciousness is too backward, using only simple washing, some food industry not disinfected, would be put into use. This provides the conditions for the breeding of bacteria and the potential harm to people's physical health, which can easily lead to the spread of some infectious diseases. Nowadays, we all realize the importance of health. It is the capital that we enjoy life, which will inevitably become the focus of social attention. The health department of the country attaches great importance to the health problem, advocates the hygienic standard, makes the conscience catering enterprise, and causes the public opinion. Change concept when people go out to eat, they realize that small and medium-sized catering industry for the cleaning of tableware can't compare with professional cleaning utensils company, so people go out to eat now prefer using professionally handled tableware, because they are the professional cleaning and disinfection, by contrast, are much more clean. As a result, these tableware supply enterprise built up his own brand, also have the market, and the government advocated and encouraged, contributing to an example and health care, inspire the confidence of investors. It is also enough to show that the catering industry today is not only the strength of the brand, it is particularly important to ensure the hygienic standard of tableware, so that it can develop better. Clean tableware bring business to the catering industry, which is after the investment returns, consider, this is tripartite benefit investment, tableware cleaning machine manufacturers have business opportunities, the tableware of catering industry synthetic tableware cleaning industry, ensure the tableware hygiene standards, can also buy their own cleaning equipment for the processing, can play a propaganda, a good reputation, the food industry with customers, diners can use clean tableware. Tableware cleaner catering industry bring convenient at the same time, also bring the comfort and peace of mind, the purpose of our study of the cleaning machine is to let it become the food industry's right-hand man at the same time, let a person use clean tableware. It guarantees both the market and health.

The design of tableware washing machine should improve its energy saving, simple operation, single safety, reliability, defilement ability, humanization and so on.

The cleaning machine is designed to meet the following requirements:

(1) Saving electricity, easy operation, durable, high efficiency, small volume, high safety factor, long life, etc.

(2) Safe and stable operation, simple and convenient maintenance, compact structure and strong reliability.

(3) Remove dirt from spoons, chopsticks, bowls, plates, dishes, etc.

(4) It can receive the cleaned dishes and facilitate manual sorting.

Canteen cleaning machine design based on the tableware, chopsticks, spoons, plates, bowls, dishes and utensils using the principle of high pressure cleaning machine work, motor drive pump through the water to complete a absorption, discharge process, will be a certain amount of water to the high pressure pipeline, make it have enough energy to reach the high pressure nozzle. And high pressure of nozzle hole diameter is much smaller than the diameter of the high-pressure pipe, through the nozzle hole to accelerate the aggregation of water jet, jet of high pressure cleaner jet blow on the cleaning of tableware is called Jet Operations. When the impact of the high-pressure water jet is greater than that of the dirt on the surface of the tableware, the high pressure water jet will wash away the dirt, which is the purpose of cleaning the tableware. Based on this method, it is helpful for the design of the cleaning machine.

At present most of the cleaning machine used in tableware is timing control system, this kind of control mode can't according to the number of when cleaning utensils and tableware pollution situation to choose the washing time, and the amount of water washing. There are disadvantages of wasting water resources, consuming energy and cleaning time too long. And most of cleaner product the function of a single, cannot adapt to the demand of the market, do not conform to the requirements of the human, cannot meet the requirements of tableware industry for cleaning machine, have been knocked out, also means that the lack of market, lack of competitiveness, is also difficult to establish oneself in food industry, so the research and design a strong adaptability, can be adopted by the market of washing machine is the key to solve the problem of the product. Improve the performance of tableware cleaning machine, be about to choose reasonable power supply, analysis of the shaft well, chain wheel, the force of the connecting rod and the transmission mechanism is determined, and the design of classifiers, draw assembly drawings were analyzed to solve the problem.

2. The structure and working principle of tableware cleaning machine.

2.1 The structure of the cleaning machine.

The structure of the cleaning machine is shown in figure 2-1.

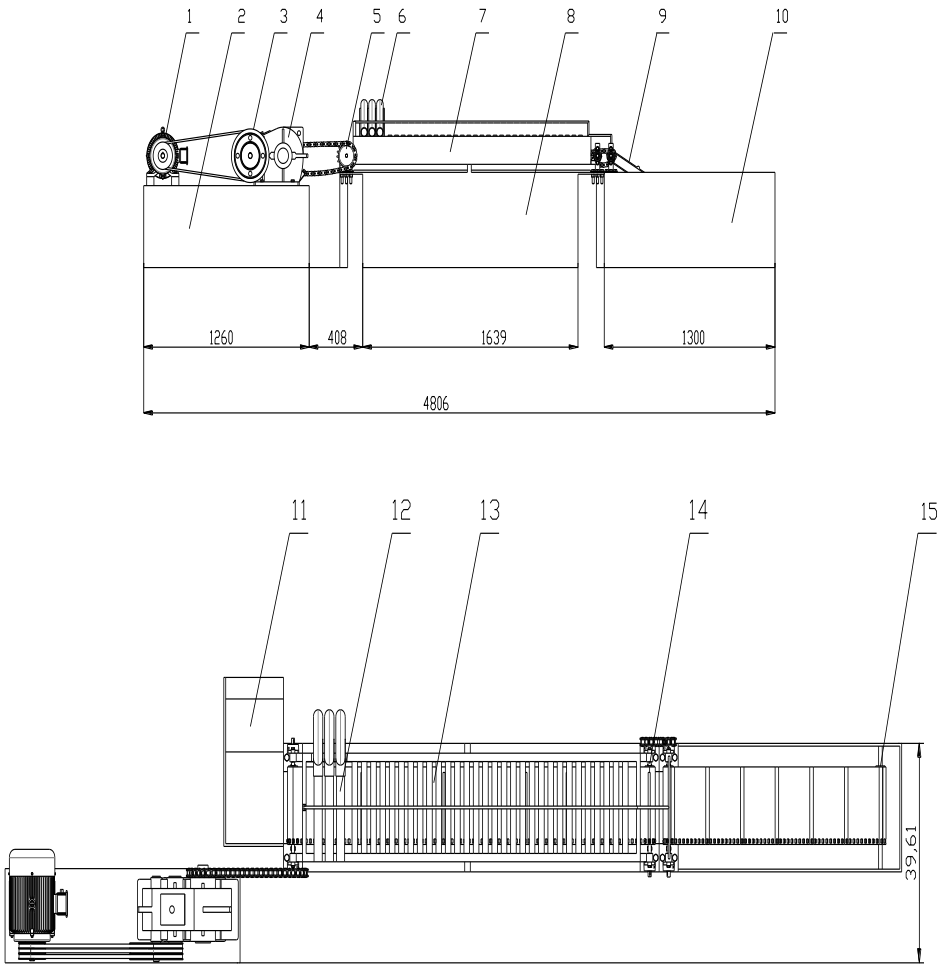

Figure 2-1 structure diagram of cleaning machine.

motor 2. Motor support 3. the pulley 4. Reducer 5. sprocket 6. fan 7. Tableware washing device. 8. support 9. Conveyor belt. 10. Tableware pool 11. Tableware receiver. 12. duct 13. brush 14.shaft 15. roller

2.2 Cleaning method and working process of cleaning machine.

The advantages of cleaning method and the working process: the cleaning machine mainly adopts single tableware cleaning, the cleaning method can not only improve the efficiency of the tableware cleaning and cleanliness, and convenience the manual sorting. First of all, Soak the tableware in the sink and remove the large particles on the tableware. The conveyor belt 1 is transported up to the top, and rinsed to the large particles that still remain on the tableware during transportation, Transport through a conveyor belt 1 to a conveyor belt 2,tableware on the conveyor belt 2 continue to transport, through the upper part of the conveyor belt 2 wash device to multistage tableware wash, brush away the stain on tableware, through the fan blowing then blow dry the water on the tableware, finally by receiving device to put away their tableware, and then to manual sorting.

The transmission part of the cleaning machine is shown in figure 2-2.

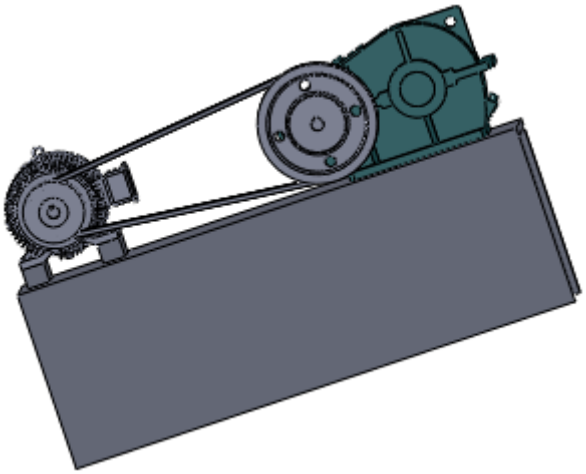

Figure 2-2 transmission structure diagram.

All the kinetic energy of the whole washing machine depends on the electric motor, which makes the belt drive, chain drive and reducer operate. The transmission device is an indispensable part of the whole cleaning device.

3. Power source selection

3.1 Selection of motor

Because the tableware washing machine needs the torque is not very large, so the power of the determination motor is 0.75kW. As the rotating speed of the cleaning machine is 60r/min, it can be seen from table 3-1: the model of the motor is Y90S-6, and the speed of the motor can be determined as 910r/min.

Table 3-1 Y series (IP44) motor technical data.

Motor type	Rated power/kW	Full speed/（r/min）	Locked-rotor torque	The maximum torque	quality/kg
Y90S-6	0.75	910	2.0	2.0	23
Y90L-6	1.1	910	2.0	2.0	25
Y112M-6	2.2	940	2.0	2.0	45
Y132S-6	3	960	2.0	2.0	63
Y132M1-6	4	960	2.0	2.0	73
Y132M2-6	5.5	960	2.0	2.0	84
Y160M-6	7.5	970	2.0	2.0	119
Y160L-6	11	970	2.0	2.0	147
Y180L-6	15	970	1.8	2.0	195

3.2 Determination of transmission ratios at all levels.

According to the speed requirement of the washing machine, the following calculation is made:

$$i=\frac{n_{\text{motor}}}{n_{\text{roller}}}=i_{12}i_{23}i_{34}=\frac{910}{60}=15.16 \tag{3-1}$$

The transmission ratio of transmission at all levels is determined: belt transmission $i_{12}=2.52$; Direct gear drive (deceleration device) $i_{23}=2.5$; Chain drive $i_{34}=2.4$.

3.3 Calculate of motion parameters and dynamic parameters

The shaft of the connection driven belt wheel is axis 1, and the shaft of the straight tooth drive is axis 2, and the shaft of the driven sprocket is 3,The speed of the driven pulley is n_4, Because the small conical teeth and the driven belt wheel are on the same axis, the speed of the straight teeth is n_3; The speed of the active chain wheel is n_2.

$$\text{Axis 1}\quad n_{Axis1}=n_2=\frac{n_1}{i_{12}}=\frac{910}{2.52}r/\min=361.11r/\min \tag{3-2}$$

$$\text{Axis 2}\quad n_{Axis2}=n_3=\frac{n_2}{i_{23}}=\frac{361.11}{2.5}r/\min=144.44r/\min \tag{3-3}$$

$$\text{Axis 3}\quad n_{Axis3}=n_4=\frac{n_3}{i_{34}}=\frac{144.44}{2.4}r/\min=60.18r/\min \tag{3-4}$$

Input power of each shaft. The drive efficiency of each axis is η_1=0.96, η_2=0.95, η_3=0.95

$$\text{Axis 1}\quad P_1=P_c\eta_1=0.75\times0.96=0.72kW \tag{3-5}$$

$$\text{Axis 2}\quad P_2=P_1\eta_2=0.72\times0.95=0.684\,kW \tag{3-6}$$

$$\text{Axis 3}\quad P_3=P_2\eta_3=0.684\times0.95=0.6498\,kW \tag{3-7}$$

Torque of each axis:

$$\text{Torque of motor}\quad T_d=9100\frac{P_c}{n}=9100\times\frac{0.75}{910}N\cdot m=7.5N\cdot m \tag{3-8}$$

$$\text{Axis 1}\quad T_1=T_di_{12}\eta_1=7.5\times2.52\times0.96N\cdot m=18.144N\cdot m \tag{3-9}$$

$$\text{Axis 2}\quad T_2=T_1i_{23}\eta_2=18.144\times2.5\times0.95N\cdot m=43.092N\cdot m \tag{3-10}$$

$$\text{Axis 3}\quad T_3=T_2i_{34}\eta_3=43.092\times2.4\times0.95N\cdot m=98.25N\cdot m \tag{3-11}$$

4. Design and calculation with Belt drive

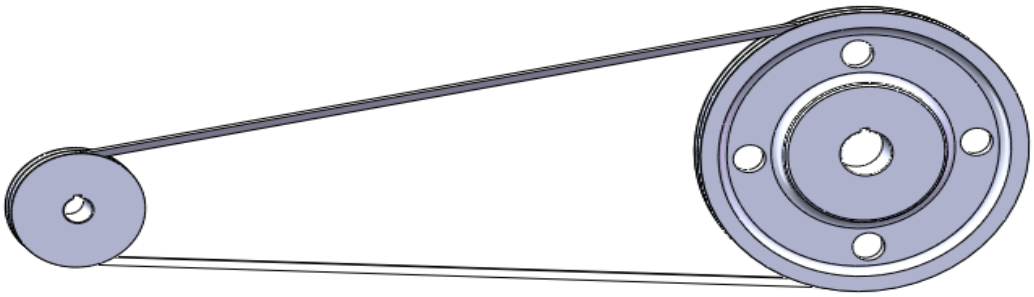

Figure 4-1 pulley transmission

4.1 Design power

The working condition coefficient $K_A=1.2$ is obtained from table 13-8 in the Fundamentals of mechanical design (hereafter used in the table).Therefore,

$$P_c = K_A P = 1.2 \times 0.75kW = 0.9kW \tag{4-1}$$

4.2 Choose belt type

According to $P_c = 0.9kW, n_1 = 910r/\min$, the type A belt drive is selected according to figure 13-5.

4.3 Determine the base diameter of large and small band wheels.

From table 13-9, it should be no less than 75, and now take $d_1 = 125mm$,it can be obtained

$$d_2 = \frac{n_1}{n_2} d_1(1-\varepsilon) = \frac{910}{361.11} \times 125 \times (1-0.02)mm = 308.7mm \tag{4-2}$$

From table 13-9, $d_2 = 315mm$

4.4 Calculating the tape speed

$$v = \frac{\pi d_1 n_1}{60 \times 1000} = \frac{\pi \times 125 \times 910}{60 \times 1000} m/s = 5.96m/s \tag{4-3}$$

The speed is between 5~25m/s and suitable

4.5 The base length L_d and center distance a of the V band

Preliminary selection of center distance

$$a_0 = 1.5(d_1 + d_2) = 1.5 \times (125 + 315)mm = 660mm \tag{4-4}$$

$$L_0 = 2a_0 + \frac{\pi}{2}(d_1 + d_2) + \frac{(d_2 - d_1)^2}{4a_0} = [2 \times 660 + \frac{\pi}{2} \times (125 + 315) + \frac{(315-125)^2}{4 \times 660}]mm = 2024.824mm \tag{4-5}$$

Check table 13-2. Take $L_d = 2240mm$

Actual center distance

$$a \approx a_0 + \frac{L_d - L_0}{2} = (660 + \frac{2240 - 2024.824}{2})mm = 767.588mm \tag{4-6}$$

4.6 Check the small wheel angle

$$\alpha_1 = 180^\circ - \frac{d_2 - d_1}{a} \times 57.3^\circ = 180^\circ - \frac{315-125}{767.588} \times 57.3^\circ = 165.8^\circ > 120^\circ \tag{4-7}$$

appropriate

4.7 The number of V bands

Check table 13-3 by $d_1 = 125mm, n_1 = 910r/\min$, obtained $P_0 = 1.37kW$

The transmission ratio $i_{12} = 2.52$ is Checked in table 13-5,obtained $\Delta P_0 = 0.11kW$

Check table 13-7 by $\alpha_1 = 165.8^\circ$,obtain $K_\alpha = 0.96$.Check table 13-2 ,obtained $K_L = 1.06$.

Thus can be obtained

$$z = \frac{P_c}{(P_0 + \Delta P_0)K_\alpha K_L} = \frac{2.64}{(1.37 + 0.11) \times 0.96 \times 1.06} = 1.752 \approx 2 \tag{4-8}$$

The band number is 2.

4.8 Pressure on the wheel shaft

Check table 13-1 obtained $q = 0.1kg/m$.

Therefore, the initial pulling force of the single V band is

$$F_0 = \frac{500P_c}{zv}(\frac{2.5}{K_\alpha} - 1) + qv^2 = \frac{500 \times 2.64}{2 \times 6.15} \times (\frac{2.5}{0.1} - 1) + 0.1 \times 6.15^2 = 2579.39N \tag{4-9}$$

Pressure on the axis

$$F_Q = 2zF_0 \sin\frac{\alpha_1}{2} = 2\times 2\times 2579.39\times \sin\frac{165.8^\circ}{2} = 10238.44N \quad (4\text{-}10)$$

4.9 Structural design of pulley

Selection of HT150 for pulley materials, Because $d_2 = 315mm < 350mm$, we use the ventral structure. Check table 13-10:

$$h_{a\min} = 2.75, h_{f\min} = 8.7, e = 15, f_{\min} = 9$$

Thus can be obtained

$$d_a = d_2 + 2h_{a\min} = 315 + 2\times 2.75 = 320.5mm \quad (4\text{-}11)$$

$$d_f = d_2 - 2h_{f\min} = 315 - 2\times 8.7 = 297.6mm \quad (4\text{-}12)$$

$$B = 2f = 2\times 9 = 18mm \quad (4\text{-}13)$$

$$\varphi = 38^\circ$$

5. Design of sprocket

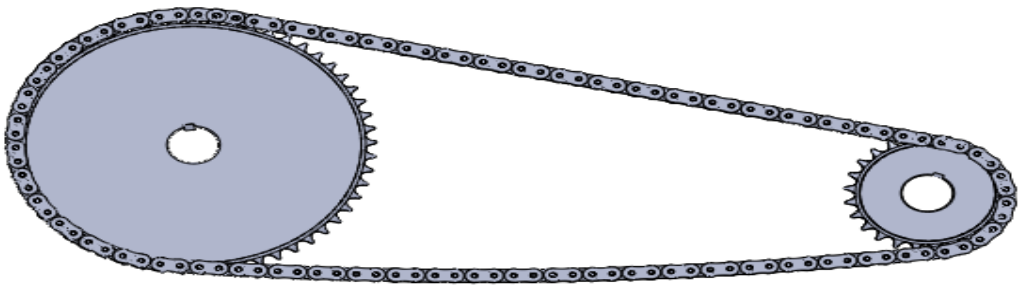

Diagram 5-1 chain drive schematic diagram

5.1 Sprocket tooth number

By axis 3 power $P_3 = 0.6498kW$,speed $n_{Axis3} = 60.18r/\min$,transmission ratio $i_{34} = 2.4$,Check Table 13-12,obtained: $z_1 = 17$

Number of large chain teeth $z_2 = iz_1 = 2.4\times 17 = 40.8$ (5-1)

$z_2 = 41$, the actual transmission ratio is $i = \frac{41}{17} = 2.41$

The error is far less than $\pm 5\%$, so it is allowed.

5.2 Chain node number

Initial center distance $a_0 = 40p$, obtained:

$$L_p = 2\frac{a_0}{p} + \frac{z_1+z_2}{2} + \frac{p}{a_0}\left(\frac{z_2-z_1}{2\pi}\right)^2 = 2\times\frac{40p}{p} + \frac{17+41}{2} + \frac{p}{40p}\left(\frac{41-17}{2\pi}\right)^2 \approx 110 \quad (5\text{-}2)$$

The chain section number $L_p = 110$

5.3 Computing power

Table 13-13: $K_A = 1.4$, Therefore,

$$P_c = K_A P = 1.4\times 0.75kW = 1.05kW \quad (5\text{-}3)$$

5.4 The chain pitch

It is estimated that the chain drive works on the left side of the vertex of the curve shown in figure 13-33.Table 13-13,obtained

$$K_z = (\frac{z_1}{19})^{1.08} = (\frac{17}{19})^{1.08} = 0.89 \tag{5-4}$$

Single row chain, $K_m = 1.0$,Therefore,

$$P_0 = \frac{P_c}{K_z K_m} = \frac{1.05}{0.89 \times 1.0} kW = 1.18kW \tag{5-5}$$

From figure 13-33, when $n_{Axis3} = 60.18r/\min$, the power of the 12A chain can be transferred to $3kW(>2.40kW)$ .Therefore, 12A chain is adopted. pitch $p = 19.05mm$

5.5 Calculation chain speed

$$v = \frac{z_1 p n_1}{60 \times 1000} = \frac{17 \times 0.75 \times 144.44}{60 \times 1000} m/s = 0.03m/s \tag{5-6}$$

5.6 Pressure on the axis

$F_Q = (1.2 \sim 1.3)F$,Let $F_Q = 1.3F$, therefore

$$F = 1000 \times \frac{P_c}{v} = 1000 \times \frac{1.05}{0.03} N = 35000N \tag{5-7}$$

$$F_Q = 1.3F = 1.3 \times 35000N = 45500N \tag{5-8}$$

6. Design of axis 3

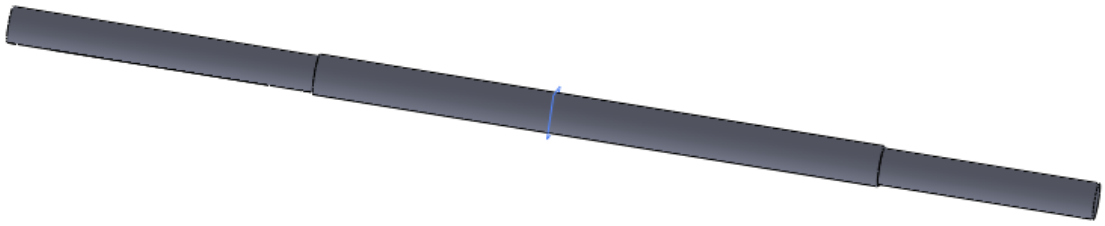

Figure 6-1 The positive view of axis 3

6.1 Selection of materials

Table 7-1 The common material and its main mechanical properties of the shaft

Material brand	heat treatment	Blank diameter/mm	Hardness HBW	tensile strength σ_b	Yield point σ_a	Bending fatigue limit σ_{-1}	Torsional fatigue limit τ_{-1}	Allowable static stress $[\sigma_{+1}]$	Allowable fatigue stress. $[\sigma_{-1}]$	note
				MPa						
45	Normalizing	25	≤241	610	360	260	150	244	173~200	Most widely used
	Normalizing tempering	≤100	170~217	600	300	240	140	240	160~184	
		>100~300	162~217 156~217	580	290	235	135	238	156~180	

		>300~500		560	280	225	130	224	150~173	
		>500~750		540	270	215	125	216	143~165	
	modulation	≤ 200	217~255	650	360	270	155	260	180~207	
20Cr	Carburizati0n	15	Surface 56~62 HRC	850	550	375	215	340	208~250	
	Quench	30		650	400	280	260	260	155~186	
	tempering	≤ 60		650	400	280	260	260	155~186	

Because there are sprockets on the shaft and the torque is large, the material of shaft 3 selected from table 7-1 is No. 45 steel, and the HBS is 217 to 255MPa, Take 210 MPa.

6.2 Positioning of components on shaft

(1) Make the assembly plan: Sprocket 1, sprocket 2, roller connects with conveyor belt.

(2) According to the requirement of axial positioning, the diameter and length of each segment on the shaft are determined.

Table 7-2 The A value of several axial materials

Shaft material	Q235, 20	35	45	1Cr18Ni9Ti
$[\tau]/N\cdot mm^{-2}$	12~20	20~30	30~40	15~25
A	160~135	135~118	118~107	148~125

Now the minimum diameter of the shaft is calculated. After consulting the relevant literature, we can know the formula for calculating the minimum diameter of the shaft. The lowest diameter of the axis :

$$d \geq A\times\sqrt[3]{\frac{p}{n}} \tag{6-1}$$

In the formula： d ——Minimum diameter of active drum（mm）

A——Look up a table to know

p ——Transmission power（kW）

n ——Shaft speed（r/min）

It can be seen from table 7-1: $[\tau]=155MPa$, From the front calculation, we can see: $P_3=0.6498kW$, $n_{Axis3}=n_4=60.18r/\min$, To bring the data into the form (7-1):

$$d \geq A\times\sqrt[3]{\frac{P_3}{n_4}}=A\times\sqrt[3]{\frac{0.6498}{60.18}}\approx 17mm \tag{6-2}$$

Minimum axis diameter, $d_{\text{Bearing}}=17mm$, Next is the sprocket: $d_{\text{链轮}}=17mm$,And then a section of the roller, $d_{\text{Roller}}=17mm$,Bottom bearing selection NU203E。

Table 7-3 general parameters of bearing.

Specification list	internal diameter/d	external diameter/D	width/B
NU 202 E	15	35	11
NU 203 E	17	40	12
NU 204 E	20	47	14
NU 205 E	25	52	15

NU 206 E	30	62	16
NU 207 E	35	72	17
NU 208 E	40	80	18
NU 209 E	45	85	19
NU 210 E	50	90	20
NU 211 E	55	100	21

It is known from the above table that the parameters of the bearing : $d=17mm$, $D=40mm$, $B=12mm$

Continuation table 7-3

Specification list	internal diameter/d	external diameter/D	width/B
NU 215 E	75	130	25
NU 216 E	80	140	26
NE 217 E	85	150	28
NU 218 E	90	160	30
NU 219 E	95	170	32

The length and diameter of axis at 2 on the left end of the shaft: $l_1=141mm$, $d_1=17mm$

There are drums in the middle of the shaft. The length and diameter of the axis at 2: $l_2=260mm$, $d_2=19mm$

The length and diameter of axis at 3 on the left end of the shaft: $l_3=99mm$, $d_3=17mm$

So the total length of the axis: $l=500mm$

7. Conclusion about cleaning machine.

The main part of the whole washing machine is composed of the power transmission part, the cleaning and soaking device, the transmission washing device and the receiving device of the tableware.

7.1 The power transmission part of the cleaning machine.

The transmission of the washing machine is mainly provided by the motor, which can make the whole washing machine run by belt drive, reducer and chain drive. The transmission device will be an integral part of the whole cleaning device.

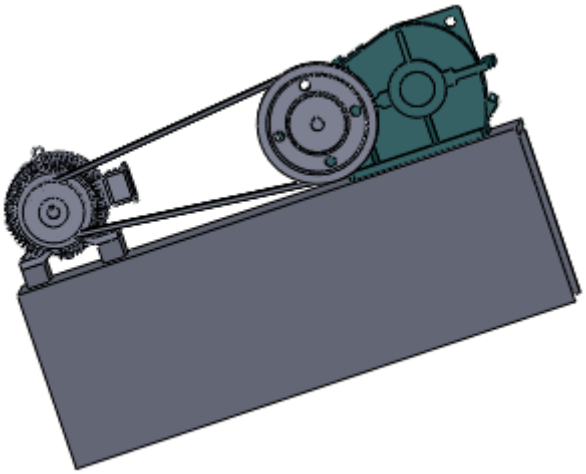

Figure 7-1 power transmission part of the cleaning machine.

7.2 Cleaning and soaking plant

It is mainly composed of Tableware pool and conveyor belts. The main effect is to remove the large particulate matter from the tableware by soaking the tableware, and then continue to transport the

tableware by the conveyor belt. The working mode is to transfer the soaked tableware from the conveyor belt 1 to the conveyor belt 2, which will connect the next step of cleaning.

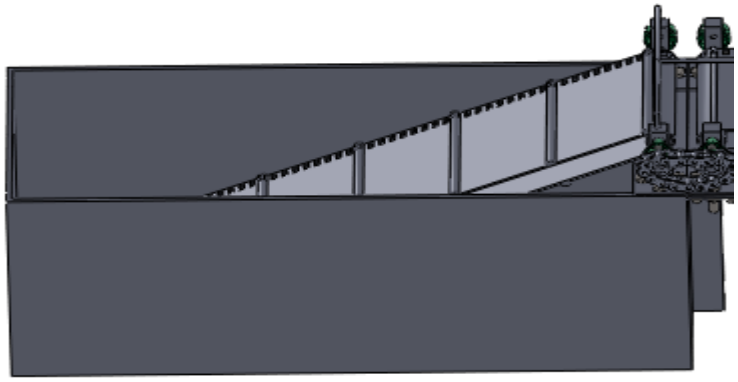

Figure 7-2 cleaning and soaking device.

7.3 Transfer and washing device.

It is composed of washers, brushes, conveyor belts, shafts, bearings, sprocket, roller, fan, air duct and lower bracket. The working mode is to carry the tableware through the conveyor belt. When the washing device is on the upper part of the conveyor belt, the tableware will be cleaned at a multi-stage, removing the remaining stains from the tableware. Finally, the blower is responsible for blowing the remaining water on the tableware.

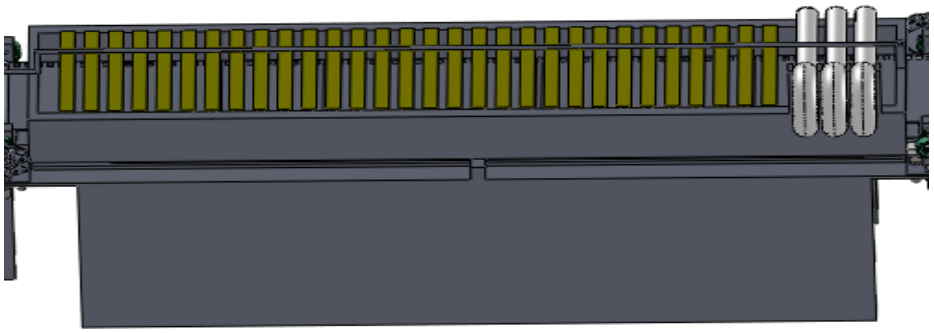

Figure7-3 Transfer and washing device.

7.4 Tableware receives device

The main function is convenient to arrange tableware, it is the end of the cleaning work of washing machine, make tableware not easy to fall to the ground, convenient artificial to do tableware to arrange.

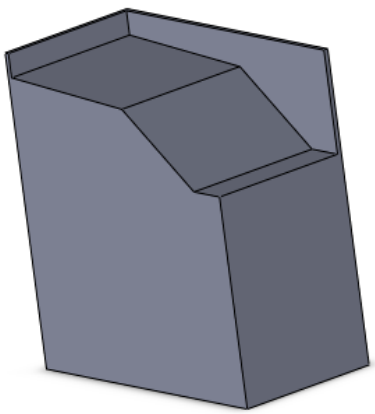

Figure 7-2 tableware receives device

7.5 The overall structure and the connection between the devices.

Overall structure: the power transmission part, cleaning and soaking device, transmission washing device, and tableware receiving device are connected to each other. Connections between devices: the motor and the reducer are connected by a belt drive; The reducer is connected to the washing device by a chain drive; The cleaning and soaking device is connected by a transmission ratio of 1:1 to the washing device; With these links, the entire tableware cleaning machine has a complete cleaning route to function properly.

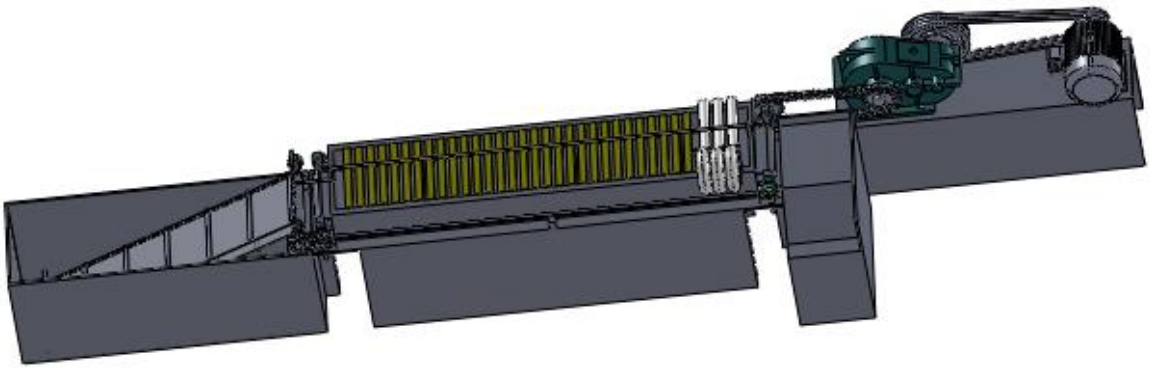

Figure 7-5 overall structure.

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