A NEW METHOD FOR COLLECTING THE GARBAGE NON – USING ENERGY

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ABSTRACT

This paper presents the design and evaluation of a non-using energy mechanism for collecting the garbage. The collector of rubbish is implemented by using the mechanical motion includes the gearbox, conveyor belt and brush, to alleviate the need of fuel as well as energy. The basic operation principles of the machine describe as follow: with a 384 N thrust force, the sanitation worker can move the garbage cart which makes the brooms work and take the rubbish to the conveyor belt then put it into the waste tank. The system can collect 100% of amounts of the garbage for leaves, papers, etc. and 60% for the small stones and small leaves. The system would not only help to reduce the cost but also be environmental friendliness. The effectiveness of the approach is verified through the experimental results based on the real system action.

KEYWORDS: Green technology, collecting the garbage, non- using energy

1. INTRODUCTION

Nowadays, the fossil fuels are gradually exhausted. The study of energy saving technologies and conservation are increasingly developed. Peter McKendry produced energy from biomass [1]. Tomio Mimura et al. presented research and development on energy saving technology for flue gas carbon dioxide recovery and steam system in power plant [2]. These studies have made energy conservation technologies and energy efficiency.

Most garbage carts and waste collecting robots use electricity or fossil fuels for operation [3]. These machines achieve higher performance several times compared with collection by human but they still have some disadvantages: they cannot work well in some locations and not environment friendly. From the actual needs, this paper presents a solution of collecting the garbage without using energy.

2. SYSTEM DESIGN

The systems are designed based on the idea of not using fossil energy, renewable energy that works perfectly with the mechanical motion.

The figure 1, 2 and 3 shows how to design this system. When workers push the garbage cart, wheels spin. One wheel is connected to the gearbox and transmits the motion to brush (6) and side brushes (4) through the transfer tube roller chain. Brushes (4) rotating sweeper position and armor eel in the middle of the cart, sweep, (6) up sweeper bucket conveyor through singing (5). Conveyor motion of the wheel get active (2) through the chain transfer roller tube and put garbage in the trunk (7). Trunk (7) is designed to leave, when full garbage the worker just open the key holder, pull out trash and other trash instead to continue their work.

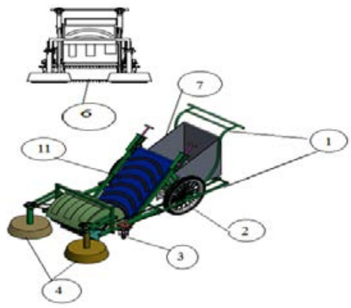

Figure 1. *Schematic of the non – using energy collecting garbage system.*

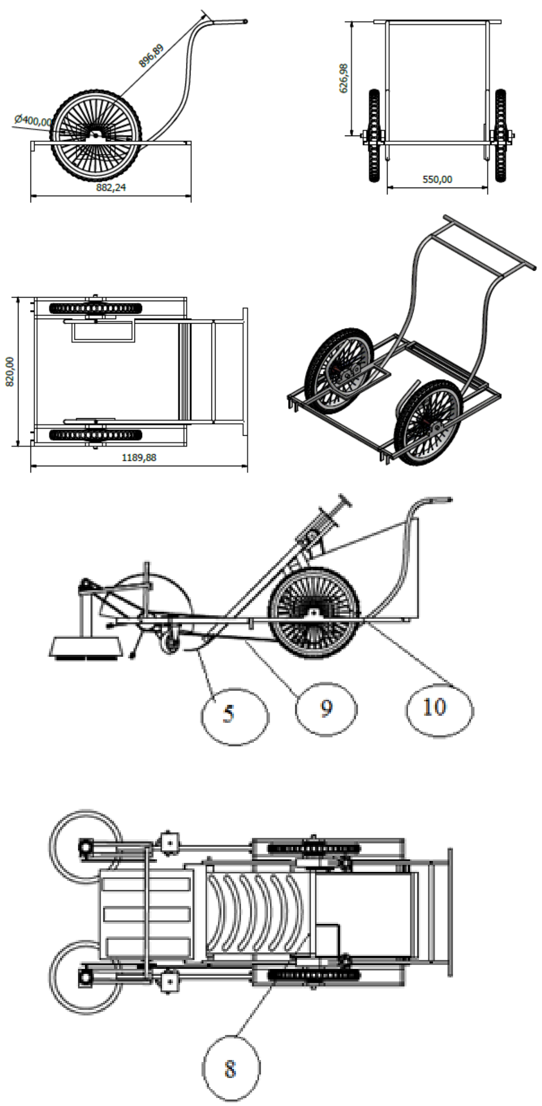

Figure 2. *Chassis of system*

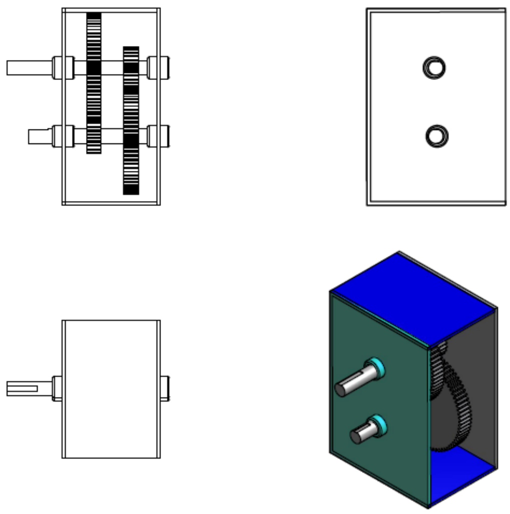

Figure 3. *Gearbox of system*

3. MODEL OF SYSTEM

3.1 Transmission ratio

When the dustman moves the garbage cart, the speed of recognition reaches 5 km/h. The rotational speed of the brushes is relatively low so the system needs to be accelerated for the broom. In this paper, after calculating from the Eq. (1), this system chooses the transmission ratio of 1:15. Fig. 4 describes how to design the gear box in order to fulfill the selected transmission ratio.

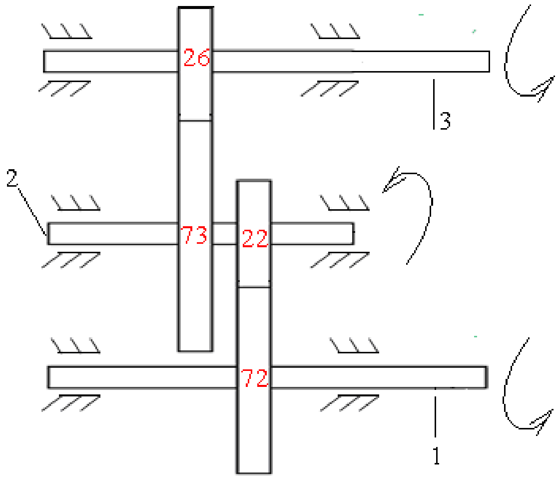

Figure 4. *The gear box diagram*

1. initiative axis; 2. intermediate shaft; 3. output shaft.

$$i = \frac{n_2}{n_1} = \frac{z_1}{z_2} \qquad (1)$$

where i is transmission ratio; n_1 is the rotation speed of the passive shaft; n_2 is rotation speed of the active shaft; z_1 is the number of teeth of the initiative gear; z_2 is the number of teeth of the passive gear.

Transmission ratio of gear box can be calculated by Eq. (2)

$$i = i_1 \times i_2 \times i_3 \qquad (2)$$

3.2 Thrust force

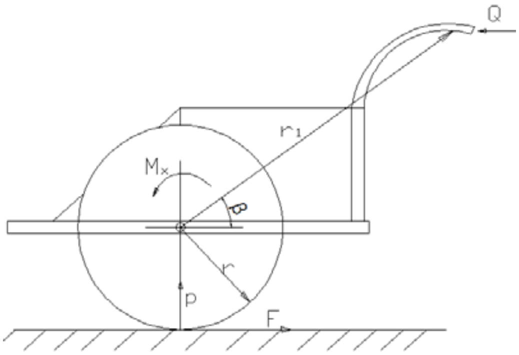

Figure 5. *Thrust force diagram*

To move the system, the thrust force Q of the worker must overcome the friction force (pφ) induced by the road onto the wheels. To calculate Q, the torque (M_x) in the x direction should be calculated first via Eq. (3) and Eq. (4).

$$M_x = r \times F \quad (3)$$

$$M_c = M_x \times i \times \eta = r \times F \times i \times \eta \quad (4)$$

where M_x is torque of the initiative, F is the friction force between the road and wheels, r is radius of active wheel, M_c is torque needed to move the cart, η is performance of transmission systems, η = (0.5 - 0.7)

In order to ensure for a non-slip movement condition for the cart wheels, a sticking coefficient φ between two surfaces should exist. The regular value of the sticking coefficient is φ=0.3–0.8. Secondly we calculate the clamping force of the wheel with the road initiative by the Eq. (5).

$$P_\varphi = \varphi \times P \quad (5)$$

where P is the weight of system, P_φ is the wheel traction with the road.
For non-slip wheels on the road must meet conditions according to the Eq. (6).

$$F \le P_\varphi \quad (6)$$

Finally from the force diagram in Fig. 5 we establish the formula to calculate for the thrust force Q:

$$M_c = Q \times r_1 \times \cos\beta \quad (7)$$

$$Q = \frac{r \times P_\varphi \times i \times \eta}{r_1 \times \cos\beta} \quad (8)$$

4. RESULTS AND DISCUSSIONS

Table 1. *The results of Q depend on P*

r (m)	r_1 (m)	i	P (kg)	P_φ	Q (kN)
0.2	0.896	11	40	20	0.385
0.2	0.896	11	45	22.5	0.434
0.2	0.896	11	50	25	0,482

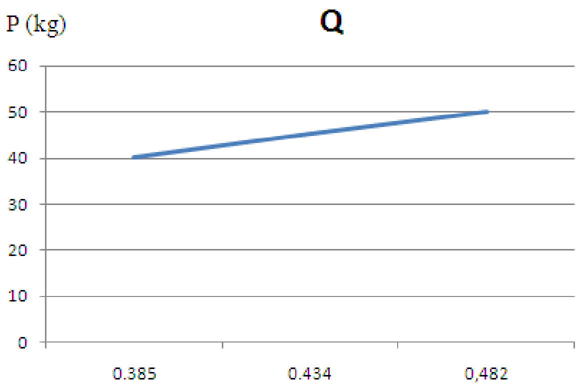

Figure 6. *The relation of Q and P*

Table 1 is the result of Q depend on P. When the weight of system increases, the thrust Q will increase slightly. From Table 1 and Fig. 6, we can conclude that the garbage collecting capacity of the is 10 kg.

Table 2. *The results of Q depend on i*

r (m)	r_1 (m)	i	P (kg)	P_φ	Q (kN)
0.2	0.896	11	40	20	0.385
0.2	0.896	14	40	20	0.456
0.2	0.896	17	40	20	0.596
0.2	0.896	20	40	20	0.701

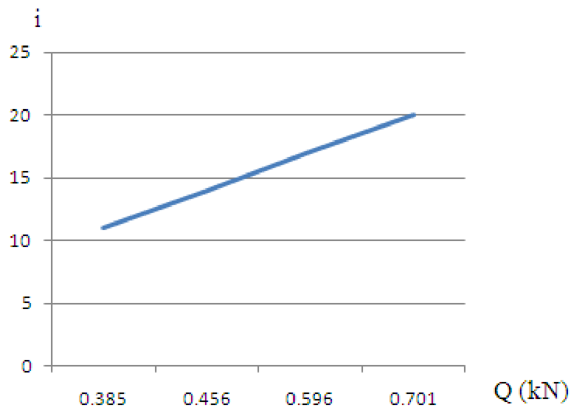

Figure 7. *The relation of Q and i*

When the gear ratio i increases, the operation of the system is more stable. However the thrust Q will also increase accordingly. From the Table 2 and Fig. 7 one can conclude that the garbage man will not work effectively for the gear ratio between 17 and 20. From the above analysis, a preferred gear ratio is 11.

5. CONCLUSION

The presented system will operate stably when the gear ratio is 11 and the weight of the system is 40 kg. With unload cart, the worker need a thrust of 384 N. When the cart is fully loaded, the weight of cart is 50 kg, the system needs a thrust of 482 N.

The experimental results show that this unpowered garbage cart can collect 100% of amounts of the garbage for leaves, papers, etc. and 60% for the small stones and small leaves. The system would not only help to reduce the cost but also be environmental friendliness. The effectiveness of the device is verified through the experimental results on real conditions.

6. REFERENCES

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[3] www.dustbot.org

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