

Design and Construction of a modified Coastal Garbage Collecting Machine

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ABSTRACT: The garbage is the important pollutant of environment specially underground sweet water and seas. Collecting and repelling garages in industrial, rural and urban districts has an important role in healthiness of streams and marsh waters. This days the coastal garbage produced by the tourism, has transformed a big problem in the coastal cities of Mazandaran Province, up to now the common method of garbage collecting was handy which requested for more workers, increasing expenses & time-consuming., therefore a machine was designed and constructed for performing the work mechanized. The machine is self-rotated & collect the garbage by the head inserted in frontier of the machine and transfer to the protractor band at the end part of the system. Following filling the tank, the garbage are transferable to the garbage bag with opening the exit valve.

Keywords: machine designing, garbage collecting, environment, sand coast.

INTRODUCTION

The garbage usually called dirty gold, has considered as a great problem in the human society. Increasing the garbage in urban great regions and some ecosystems including the coasts of seas and streams increased the environmental dangers. Mazandaran province produce daily 2800 tons garbage, most of them are the coastal garbage. The garbage has been collected by the travelers and tourism. Not only, transfer and repelling the garbage at Mazandaran are performed by municipality income but also, resulted providing some social problems including people complaints regarding the method of healthy transfer and penetration of the latex. Based on the report of Hamshahri newspaper, in forest and coastal region of Mazandaran province, 1000000 tons of garbage produce yearly most of them are repelled in the green forests out of them 620000 tons related to urban garbage and the remained are shares of villages. Removing garages in forest and state north coats resulted penetration of latex to the underground water which the great amount of the underground waters are considered as drinking water. Also, freedom of the garbage in the regions will be resulted in death of the some animals such as caribou & deer for nutrition of the materials and environmental negative affection. Collecting the garbage especially coastal garbage in the last years has been decreased and we observed the accumulation of the garbage o the coast and below and upper part of the sands. Collecting the materials with a common method instead of handy collecting excepted time consuming will be resulted in increasable expenses. More than, in the common method usually the quality of the garbage collecting will be considered for, some parts of the materials will be buried under sand and may not be observable by the human.

Therefore, in accordance with the mentioned items, in this study we decide to design and construct a self-rotation machine for coastal garbage. Garbage collecting machine is able to store a considerable volume of coastal garbage meanwhile solving the garbage handy collecting problem. The machine is able to collect garbage even in 15 cm. dept. Meanwhile whereas the machine is self-rotation is able to collect many garbage of coast in the time unit.

MATERIALS AND METHODS

First the status of Caspian Sea coast has been studied for efficiency of the set and for beginning the operation, the primary study in Mazandaran Caspian Sea at Sari City will be performed. Then the primary design of the set and then construction of set has been begun. The constructed machine has 240 cm. length and 150 cm. width and 210 Kg weight. The set includes the under-mentioned parts which will be described separately.

1-Head (frontier cape) 2- Conveyor band 3-motivator motor 4-power transfer system
5-Collecting tank 6- Control system 7- Control levers

Head:

The frontier cape or the set head which collect the garbage. The head includes a cylinder with 70 cm, length and 16 cm, width. The cylinder has been designed netted and meanwhile the least weight making the installation of the other pieces possible. On the cylinder 60 elastic thimble has been twisted with a special method. Every unit of the thimble, has been designed double which has been resulted in decreasing the joints and the better installation on the cylinders. The length of the thimbles is 18 cm. and its tip has been bend 7.00 cm. & under 120 angle. The work resulted better joint of the thimble & materials & better transfer of the materials to the protractor unit. The cylinder has been rotated on the hour side and it is regulated up to the interested depth. The cylinder has been joint the frontier part of the set within two crank & the cylinder axis have been inserted inside two bearings.

Conveyor band:

The protractor band has an effective role for transferring materials from cape to tank. The protractor band has been constructed a tarpaulin cloth under width 70 cm. The collected materials by the head have been pulled on Conveyor band and the protractor transfer the materials to the end part of the set called tank. The Conveyor band with slop 30 regarding horizontal side has been installed. The band has been installed on two rollers made Teflon with thickness of 7 cm. and length 75 cm. The cylinders have moved inside two bearings.

Motivator motor:

Considered as heart of the set and all motive parts of the set have received its port from the engine. The engine applied in the set is a single-cylinder motor with volume of 150 cc and petrol fluid. The motor is four clapper & two valves. The spark system included magnet and battery in the set. Running the engine is possible in two methods which the battery has not been charged. The most power of the engine is 9.3 {HP} in every round is equals to 8500 RPM. The maximum engine entropy is 8.1 {N.M} in every cycle is equals to 7400 RPM. The cooling system in the engine is appeared as two parts including cooling system and a fan.

Power transfer system:

In power transfer system one four-hour gear box which is connected to engine which prepared various speed during work and on the road. In exit part of the gear box one wheel chain with 15 cogs which transfer the power of the chain to the other motive parts. The first receiver of the engine power is a great wheel chain which has been installed on the behind motive wheels. The motive chains including 47 cogs which decreased the exit speed of the cogs box three times and increased the entropy on the motive wheels due to the better function of the set in coast. The mentioned chain wheel will be inserted in the part near the end of motive axis of the behind wheels and inserted on left side. Also, on opposite side, the other chain wheel included 24 cogs. This chain wheel with other chain has transferred the power to the Conveyor band & head. During function, moving head and Conveyor band motive opposite each other is requested. Using a small cogs box which has been installed on frontier and left side we can change the rotation side of the head and Conveyor band as inside the small gear box one chain wheel, two fully two simple gear wheel and two axis. The chain wheels on the internal axis and fully on the exterior axis have been inserted fixed, but, one of the simple gear wheel included 34 cogs have been installed on the axis and is transferable on the axis. Chain wheel included 24 cogs in the behind axis transfer the power to the chain wheel of interior axis including 24 cogs and rotated the axis and simple cog wheel on the axis. By moving the simple gear wheel inserted on the external axis, the transferring power from entrance axis gear wheel is receivable, therefore, the external axis has rotated contrast to set advancing side. On the end part of the exit axis of the small one, one fully has been installed with a strap with cross surface V form which transfer the power to the fully of the Conveyor band. All fully thickness is equals to 0.08 Cm.

Collecting tank:

Is place of accumulation of the collected garbage on the behind of the set with dimension of 90*90*70. For purring the sand pulled in the tank probability, the floor of the tan has been constructed netted. On the behind of the tank, one window has been installed as a drawer, by dragging it, the tank will be evacuated.

Control System:

As the set is self-rotated we need a control system. The various parts of the control includes: control riddle, connected rod, four-plugs, and transfer arms on the head f inferior wheels. The control system in the set is mechanical.

Control levers:

Includes gas lever, huge, control lever, head length & relief and head involvement. Gas lever on the upper side of the set and right side of the operator and connected to the window of carburetor. Huge lever on the set as motorcycle huge is handy which is connected to the engine huge by special huge. On left side of the seat one lever for the free of the gear has been installed. Regarding the swallowing of the garbage in the sand and hardness & losing the sand texture, applying the fingers of the set head is requested, therefore, we can draw up the amount of the fingers penetration in the sand. Also, when the set is moving on the road, the head shall be come up completely to preventing breaking the fingers. The work method of the lever is as follows: on the upper part of the head, one arm has been installed in the length of the head which is joint to a spool trough a towing wire. The spool which is inserted in frontier part of the operator leg, includes one gear wheel with oblique gear and one hellish gear wheel. The end of hellish has been joint trough four-plugs to a control lever on the frontier of the operator. As said previously, when the set is moving on the road, the head shall be positioned upper and prevented the rotation. Not only the head shall be stopped, but also, the Conveyor band shall be stopped. One control handle has been inserted in the small gear box which with a lever out of the gear box, we can exit a simple gear jointed the small gear box trough wheel as thousand-thistle connection. Pursuant to the function, the movement of head shall be stopped. Also, Conveyor band which is connected to the exit axis of the small gear box trough belt and fully shall be stopped.

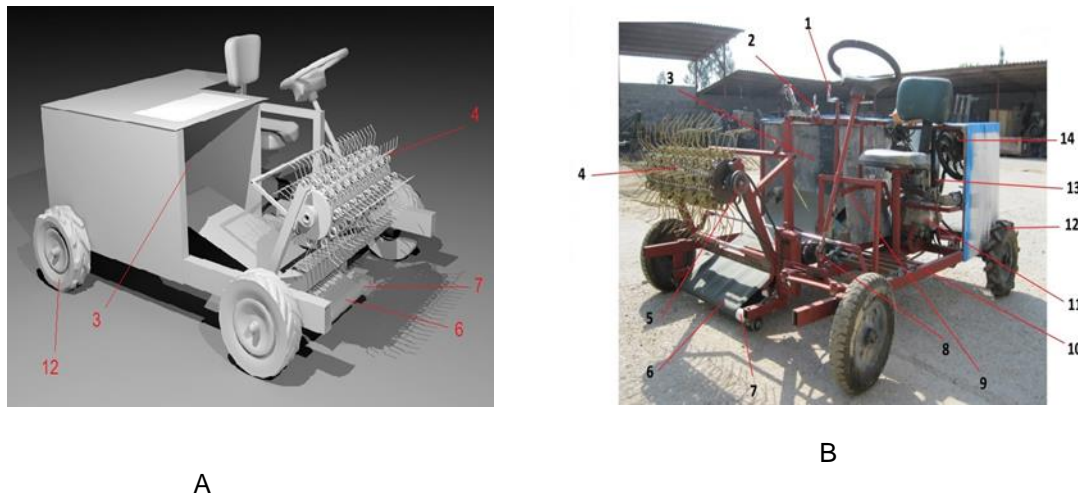


Figure 1. Designing of machines in solid works

- (A) constructed machines schematic (B)pick up head position leveler 2) Gas lever 3) hopper 4) pick up head 5) pulley 6) conveyor 7) conveyor roller 8) stirrer wheel 9) clutch lever 10) framework 11) engine 12) tires 13) gear change lever 14) cooling fan

Evaluation of the set:

Following construction of the set, it has been operated in lab. Environment to assign the function of the various units. For testing the set has been taken to the coast to evaluate its function on the sand. The parameters measured in laboratory are as follows:

A: set movement speed without applying head: whereas a least speed is requested in the set, during work, the set will use one gear and meanwhile transport, it shall use two gears. To determine speed, distance of 15 meters in length

were considered. Car could travel this distance in time of 58/13 seconds. It was also assumed constant engine speed (2800 rpm). So machine forward speed can be calculated from equation:

$$v = \frac{x}{t} \rightarrow \frac{15}{13.8} = 1.083 \text{ m/s} \cong 3.9 \text{ km/h}$$

B: set movement speed with applying head: the engine exit chain wheel bearing 15 cogs is 161.88 rounds every minute with speed 161.88 round every minute. The chain wheel of the motive axis included 47 gears has less speed than the chain wheel of the engine exit. (51.72 rpm). The power of the engine exceeded the head by chain and strap. In accordance with the chain wheel round and also, the gear wheels the speed of the head rotation has been computed 36.52 rpm.

C: The speed of Conveyor band: the diameter of fully existed in small gear box is equals to the diameter of the roller-head bearing protractor, therefore, the rotation of them are the same (36.52 rpm). Whereas the diameter of the roller including protractor is 0.7 cm. and the length of the Conveyor band is 1.00 meter, therefore, the speed of the Conveyor band is equals to 14 cm/s.

The parameters have been measured in real conditions included:

A: the speed of the set during work on the coast: for existing the soft sand on the coast, the rubbers of the set are spinning, therefore, the speed of the set movement on the coast is less than its speed on the asphalt. As the same as lab measurements, Following measuring the in the time unit, was recognized that the set speed is 3.2 K/H.

B: wheels sliding during work: sliding or slipping means the delay on the advancement speed to advancement speed during transportation on the road. Whereas the advancement speed on the road and coast is 3.9 & 3.2 respectively, therefore, the percent of sliding has been estimated %18.

$$s = \frac{a-b}{a} \times 100$$

$$s = \frac{3.9-3.2}{3.9} \times 100 \cong 18$$

C: time of filling tank: the parameters which are effective in filling tank such as the amount of the garbage on coast, volume and type of garbage and mass of garbage will assign the time of filling garbage. It has an area of 60 square meters of the beach selected and divided into three parts. In every area of waste collection and waste not collected in a portion to all waste in that area on were measured.

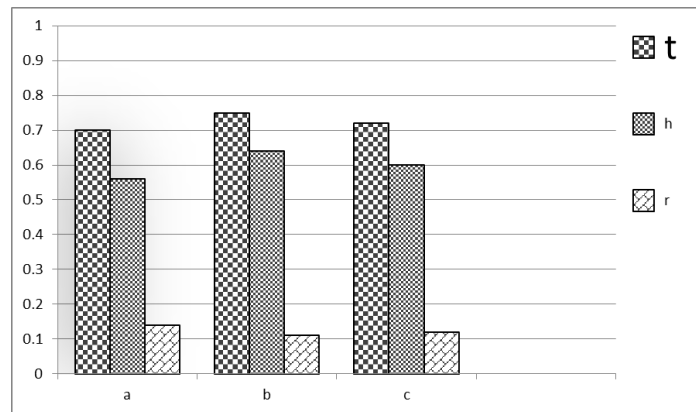


Figure 2. compares the collected waste and total waste

As can be seen in the figure 2, the total amount of waste (t) in a block is equal to 0.7 cubic meters. of this amount, 0.56 cubic meters collected by machine (h) and the 0.14 cubic meters remain on the ground (r). Values of (t), (h) and (r) block b, respectively, 0.75, 0.64 and 0.11 cubic meters respectively, and c is the value of the order to block 0.72, 0.6 and 0.12 cubic meters to respectively. If the average waste collected from each block to average total waste into blocks, the output device can be calculated.

$$\eta = \frac{A(h1, h2, h3)}{A(t1, t2, t3)} \times 100 \rightarrow \frac{0.6}{0.723} \times 100 = 83$$

Conclusion and Discussion:

The garbage is the polluter of the environment. Collecting and burial the garbage will result in many expenses and obstacles for municipality. Meanwhile making the coast ugly, the garbage will be transferred to the sea by water, wind and it will threat the life of aqueous. Regarding the production of the garbage more and more, the traditional methods shall not be used for collecting the volume of the garbage. Following designing the set, the time, worker power and the related expenses will be decreased increasable. Pursuant to test on the road and coat it founded that the coast garbage collecting set has an effective role in environment industry. The set will be substituted in the traditional methods of collecting the garbage with hands and therefore, increased the quality and quantity of the garbage collection.

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