Design and Fabrication of Semi-Automated Sewage Cleaner

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Abstract- *Nowadays automation plays a vital role to assure the less human effort and advanced human safety. The proposed concept of our project is to replace the semi-automated one instead of manual work in drainage system with low cost easily available products. Drainage pipes are using for disposal of liquid and semi-solid materials at the end of drainage system but sewage canals are constructed at beginning level. Unfortunately, sometimes there may be loss of human life while cleaning the blockage in the sewage canals. To overcome this problem, we had implemented the design "semi-automated sewage cleaner".*

We designed our project to use this in efficient way to control the disposal of wastages and with regular filtration of wastages. Typically, 100 to 500 litres of waste water generated for each person connected to the system every day. So, sewage has to clean every day. Sewage drains can be cleaned continuously with the help of model by using the drive system to solid waste and threw it into waste buckets. This system is also worked at harsh condition climates and helping nature project waste from the excessive pollution.

Keywords- Pinion and gear, Shaft, Chain and Sprocket, conveyor Mechanism.

I. INTRODUCTION

The semi-automated sewage cleaning machine is used in that places where is water body which are to be removed. This machine is consisting of water wheel driven conveyer mechanism which collect & remove the wastage, garbage & plastic wastages from water bodies.

The biggest impact of cleaning the water can cause respiratory disease and it plays a challenging issue for the municipality officers. Water damage is classified as three types of contaminated water. They are clean water, grey water and black water. If not treated quickly, this water can then into black water or grey water, depending on length of time, temperature and contact with surrounding contaminants. A drainage ditch is a narrow channel that is dug at the side of a road or field to carry away the water.

Nowadays, even though automation plays a vital role in all industrial applications in the proper disposal of sewage from industries and sewage cleaning is still a challenging task. Drainage pipes are used for the disposal of sewage and unfortunately sometimes these may be loss of human life while cleaning the blockages in the drainage pipes.

The municipal workers are only responsible to ensure that the sewage is clean or not. Though they clean the ditches at the side of buildings, they can't clean in very wide sewage. The municipality workers need to get down into the sewage sludge to clean the wide sewage. It affects their health badly and also causes skin allergies. In the modern era there have been adequate sewage problems where sewage water needs to be segregated to clean as surrounding environment.

II. CONSTRUCTION

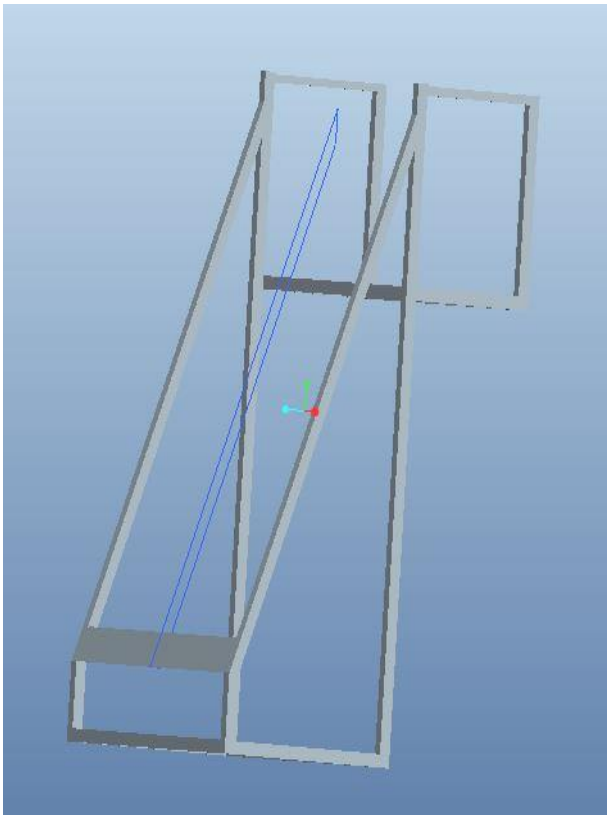

Fig. 1

III. WORKING PRINCIPLE

The basic principle of our project is conveyor mechanism. The device is place access a drain so that only water flows through the lower basement. Floating waste like bottles, plastic cans, covers etc… is lifted by lifters which are connected to the chain. The chain drives with the sprocket wheel which is driven by the motor. The energy is provided to the motor is electrical energy. When motor runs the chain stars to circulate making the lifter to lift up. It is based on the conveyor mechanism. The wastage materials are lifted by lifter teeth and stored in storage or collecting bin. Once the collecting tank is full, the waste materials have to remove from the bin.

IV. DIMENSIONS OF PARTS

A) Motor

Type	High Torque Motor
Input	DC Voltage
Speed	100 rpm
Voltage	(4 - 12 V)
Current	4 Amps
Power	48 W
Torque	3.8 Nm
Gear	Spur Gear
No. of Gears	6

B) Frame

Shape	L - Shape Bar
Area	2 (21*2)
Breadth	500 mm
Width	300+200 mm
Hight	1100 mm
Inclination Length	850 mm
Inclination Angle	70°
Material	Cast Iron

C) Chain

Type	Roller Chain
Material	Stainless Steel
Pitch	12.7 mm
Width	3.18 mm
Centre Distance	38 mm
No. of Teeth	158*2

D) Sprocket

Type	Ball bearing Idler Sprocket
Material	High Carbon & Chromium Steel Sprocket
No. of Sprocket	4
No. of Teeth	18
Width	3mm
Pitch	12.7 mm
Pitch Circle Diameter	228.6 mm

E) Shaft

Material	Mild Steel
Quantity	2
Outer Diameter	25 mm
Inner Diameter	20 mm
Length	500 mm

F) Bearings

Bearing Type	Ball Bearing
Material	Stainless Steel
Active Bearings	2
Passive Bearings	2
Outer Diameter	50 mm
Inner Diameter	25 mm
Breadth	15 mm

G) Collecting Bin

Material	G. I Sheet
Width	200 mm
Breadth	500 mm
Hight	250 mm

V. DESIGN CALCULATION

A) Motor

1) Power = V*I = 48 W

2)Torque = $\frac{P*60}{2*\pi*N}$ = **3.8 Nm**

B) Chain & Sprocket

1) Speed Ratio $i = \frac{n1}{n2} = \frac{100}{100} = 1$

z2 = 18 teeth = z2

2)selection of pitch a= [60-80] p

p=12.7

3)Selection of chain

Assume roller chain

p=12.7mm

Width=3.48=3.mm

Bearing area=2.01cm

Weight=3. 5 N

Min. breaking load= 10000N

4) Service factor $k_s = k_1 . k_2 . k_3 . k_4 . k_5 . k_6$

K_1=1.25[variable load with mild shocks]

K_2=1.25[fixed centre distance]

K_3=0.8[a_p =66 pitch]

K_4=1.25[sprocket angle more than 60º]

K_5=1.5[Continuous lubrication]

K_6=1.5[continuous running]

K_s=1.25*1.25*0.8*1.25*1.0*1.5

K_s=3.515

5) Chain velocity, $v = \frac{z1\, n1\, p}{60} = \frac{18*100*12.7}{60}$

V=0.381 m/s

6) Service Factor

n_1=7.8 for ks=1

Z_1=15-30

n_1=7.8*3.515 for ks=3.515

=27.417 z_1=15-30

N_1=100rpm

7) Breaking load $q = \frac{N\, n\, ks}{v} = \frac{60*18.275*2.343}{0.381}$

=6742.30N.<10000N

Design is safe.

9) Tangential Force $P_t = \frac{P}{v} = \frac{40}{0.381} = 104.99$ N

10) Centrifugal Force $P_c = mv^2 = 0.0508$ N

11) Tension due to sag $P_s = k.\ w.\ a = 6.042$ N

12) Factor of safety $n = \frac{a}{\sum b} = \frac{6744}{111.11} = 60.7$

13) Length of Chain= 1989 mm

14) Initial sag A = 0.5f = 871.2 mm

15) Dia of the Sprocket = $\frac{p}{\sin(\frac{180}{21})} = 73.13$ mm

VI. PHOTOGRAPHY

Fig. 1

VII. ADVANTAGES

- Reduction of Labour oriented method of cleaning, thus upgrading dignity of labour.
- It's applicable to reduce water pollution in rivers and ponds.
- Environment friendly system.
- Production cost is Low.
- It's operation and maintenance are easy.
- Light weight and easily portable.

VIII. DISADVANTAGE

- The System was partially immersed in the sewage, so it leads to the corrosion.
- Low amount of Vibration is occurred due to the movable parts.
- Floating materials are only collected by this collector.

IX. CONCLUSION

In the previous sewage disposal system, the sewage has to disposal manually and drainage has to clean manually by workers and this work is unhygienic to workers and time consuming. In the present scenario the sewage will be laid on the drainage only it will cause other problems such as environmental pollution, spreading of viral disease etc.

The system "Semi Automated Sewage Cleaner" has been successfully designed and implemented to overcome

previous problems. And also this system is helping to keep area clean and maintenance free.

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