

SEWER CLEANING MACHINE

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Abstract : Current methods of cleaning sewer manholes are mainly human centred , though it is illegal under ‘‘Prohibition of Employment as Manual Scavengers and their Rehabilitation Act 2013’ . Available mechanized methods are either too complex and costly or can’t be used in all environments. Thus they are currently playing a minimal role in solving the problem of manual scavenging. Therefore it makes it necessary to find a mechanized solution which can be used in all terrains and still work efficiently to tackle the issue. Various advancements have been made in the field of gripping as well as open drain systems. But they have still not been used in a synergistic way All of the above situations have led to choked sewer lines in most of urban and semi urban areas which further strains the working of the manual labour. This report discusses the method of cleaning sewer manholes by applying mechanized solutions to keep human intervention only up to the part of operating the machine which can be used in all possible terrains where manholes are present.

IndexTerms - sewer, manual scavenging, gripping systems, manholes.

I. INTRODUCTION

Mumbai's skyline is rising by the day, but the growth has come on the beleaguered backs of sanitation workers. Manual scavenging, as their work is known, was ruled illegal in 2013, but private contractors hired by the municipal government continue to employ them.

According to ‘Prohibition of Employment as Manual Scavengers and their Rehabilitation Act 2013’ manual scavenging has been totally prohibited but private contractors hired by the municipal government continue to employ them. Hundreds reportedly die from the work each year. Although sewage clean-up has become mechanized in some areas, government figures suggest that 770,000 people either work as sewage cleaners or are supported by them.

Background

The process of sewer or manhole cleaning is still done by manual labour due to following reasons-

Cheap labour consisting of poor people belonging to lower strata of social hierarchy is easily available and most of them are illiterate, not knowing their basic rights stated in article 1 of United Nations.

People working in this inhuman profession are subjected to various toxic gases in the sewer chambers which reduce their life expectancy to an alarming level. Few mechanized solutions have been found but none of them have been able to have a significant impact on the issue.

Importance

The Tata Institute of Social Sciences, an educational and research organization, found that 80% of the workers die before age 60 because of work-related health problems. In Mumbai, an average of 20 sewer workers die each month from accidents, suffocation or exposure to toxic gases, the study found.

All available mechanized solutions for this purpose are too costly for the enterprises to manufacture and sell. Existing machines and robots are too bulky to carry in narrow lanes and are slower in operation taking into consideration the scale of cleaning.



Fig. no. 1 A sanitation worker without any safety equipment.^[1]

II. OBJECTIVES & SCOPE

The principle behind this project is to restore basic human rights as stated in article 1 of United Nations and stop violation of 'Prohibition of Employment as Manual Scavengers and their Rehabilitation Act 2013'. To design and manufacture a system which can be accommodated in any working terrain and do the work as efficiently as possible. Our solution aims to produce such a system which would require only 1 person who will be responsible for only transporting and using the machine. In a normal case, to clean one manhole, minimum 3 people are involved i.e all 3 are subjected to inhuman conditions. It can be used in any terrain that can't be reached with current machines. Thus, it will try to bridge the gap between most economic and most efficient methods available.

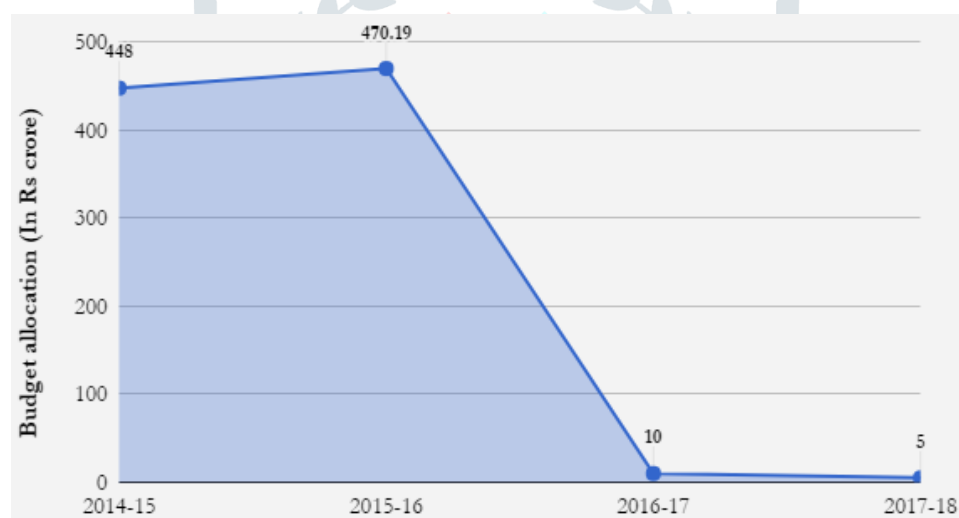


Fig. no. 3 Data showing drastic reduction in budget

III. LITERATURE SURVEY

The Tata Institute of Social Sciences^[2], an educational and research organization, found that 80% of the workers die before age 60 because of work-related health problems. In Mumbai, an average of 20 sewer workers die each month from accidents, suffocation or exposure to toxic gases, the study found. Many engineers have tried solving the problem of manual scavenging by either designing the system to remove silt / waste from flowing drain lines or by designing various grippers / spades to lift weights ranging from minimum to 10 kilograms.

Mragank Sharma^[3] has designed his project in order to use it in an efficient way to control the disposal of waste along with regular filtration of drains, removal of solid waste in order to avoid blockage in drains to promote continuous flow of drainage water which ultimately reduces the threat to human life. The process starts collecting the sewage wastes by using the arm and it throws back the waste into the bin fixed in the machine at the bottom. But it was only possible to use this in open drain lines. Taking this a step forward, M. Mohamed Idhris^[4] has created a remote controlled sewage cleaning machine which keeps human intervention to a minimum. Two power window motors are connected to the wheel and it is driven with the help of the remote control set-up. The RF transmitter transmits the signal as the switches are operated by human. The antenna helps in transmitting the signals over a long distance and the RF receiver receives the signal transmitted by the transmitter.

Related work

GENROBOTICS innovations pvt. Ltd .[5] implemented the human controlled robot ‘Bandicoot’ for facing this challenge. A Semiautomatic robotic system for manhole and sewer line cleaning aimed at the complete elimination of manual scavenging for cleaning the manhole and positioning the pressurized jet in an accurate manner in water jet cleaning. A robot which they have patented.

This replaces manual work by its use of artificial intelligence and top notch mechatronics implementation. It consists of a spider portion which constitutes 4 robotic arms which act like grippers to collect waste. The vertical motion is brought into action by spiral wire mechanism which allows the spider to move vertically with accuracy. To assist the cleaning process, lights, cameras and other auxiliary sensors have been used.

Maniar group of companies pvt ltd.[6] are a leading enterprise in the road , nallah , sewer cleaning process. They have a design similar to a JCB but the power required for hydraulic operation is taken from Tractor’s P.T.O through propeller joint. Similarly for the Machines mounted on Jeep or Truck Chassis, the required power is taken from Vehicle’s engine through P.T.O.

The function is fully hydraulic, operated through lever controlled valve provided near the operator’s seat. The telescopic side box section can be extended hydraulically for better reach and visibility of the ditch / nalah. The beam has a 90° (degree) angle and is attached with ditch bucket of approximately 50 liters for collection of silt / mud / sediment and is directly emptied in to the trailer body attached with the chassis / vehicle as the case may be. This reduces / eliminates the process of re-handling of the collected silt. The collected silt can be dumped / emptied hydraulically at the dumping site.

IV. TERMINOLGY USED

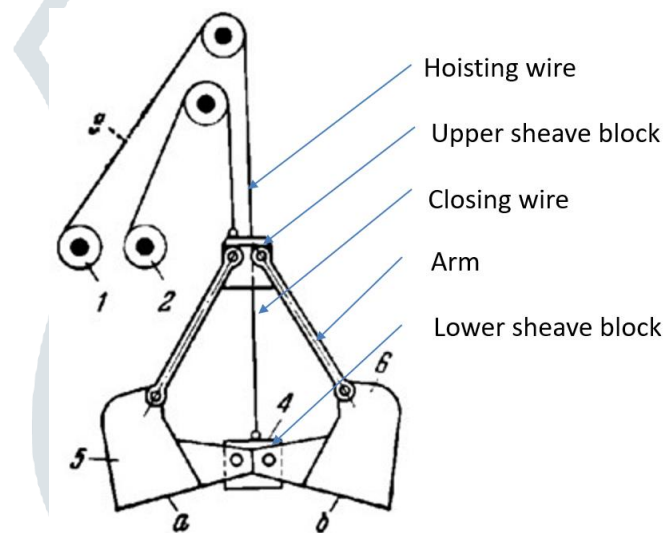


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V. IMPLEMENTATION

Fixed parameters are-

- Outer diameter of manhole – 500 mm
- Size when bucket open – 350 * 350mm
- Maximum operating depth – 10 feet

Clamshell bucket elements –

- Hoisting wire
- Closing wire
- Lower and upper sheave block and Arms for support

Mechanical winch elements –

- Handle
- Drum

- Worm gear
- Gear
- Support wheel
-

Drive elements –

- Dc motor
- Steel wire
- Control panel

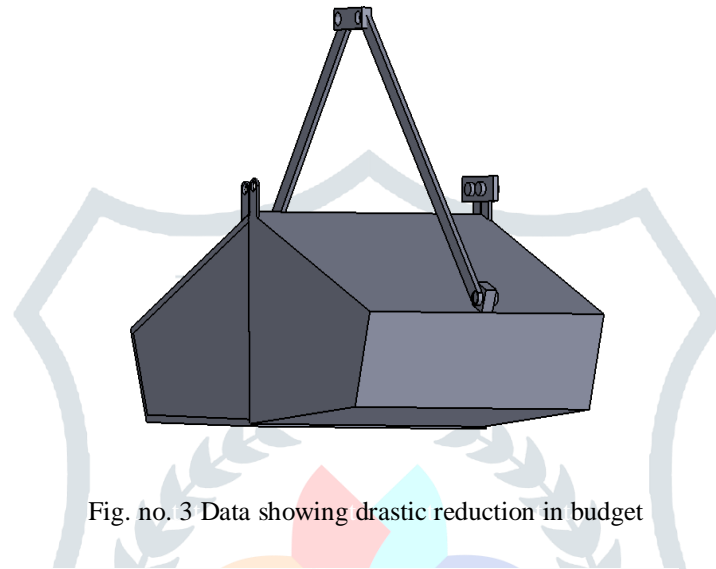


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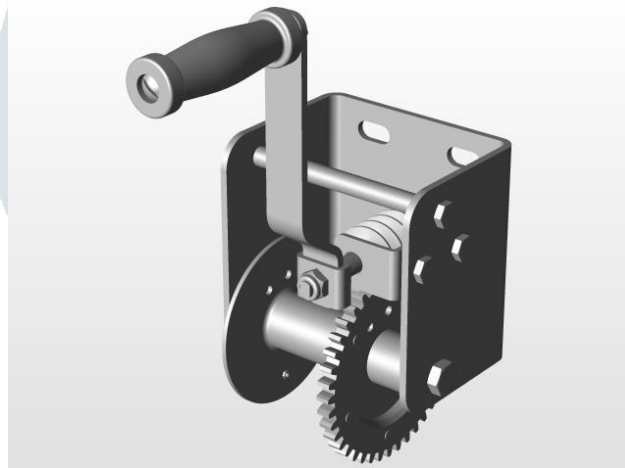


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SR. NO.	COMPONENT	MATERIAL
1	Gear assembly	AISI 1020 Steel
2	Handle	AISI 1340
3	Drum and gear shaft	Stainless steel
4	Wire	Steel
5	Clamshell bucket	Sheet metal
6	Frame	Stainless steel

Table no. 1 material selected

VI. RESULTS AND DISCUSSION

Through this project we aim to fulfil the following points –

- Restoration of basic human rights according to Article 1 of United Nations charter and implementation of ‘Prohibition of Employment as Manual Scavengers and their Rehabilitation Act 2013’
- Human intervention will be only up to transporting the machine and controlling the motions.
- Process of cleaning will be economical and fast as minimum 3 people are required to clean one manhole and time required ranges from an half an hour to one.
- Increase health life of sanitation workers. This is because people are subjected to unhygienic conditions and exposed to toxic gases which, according to a study results in death of these people below the age of 50 years
- Reduce cases of flooding due to choked drain lines as this will effectively clean the lines with greater reliability.

VII. REFERENCES

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