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Design and manufacturing Sewage cleaning machine

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Abstract

In this project the proposed concept is to replace the manual work for drainage cleaning by mechanical system. We know that water has a great importance in human being life, the water flow in drain having full of wastes like polythene, bottles etc. The drains get blocked due to these wastes in water. Now a day's even through mechanical machine plays a vital role in different applications in the proper disposal of sewages from industries and residential are still challenging task. Drainage is using for the disposal of waste water and unfortunately sometimes there may be loss of human life while cleaning the blockage in the drainages. The government also spends too much money to clean the drainages. To overcome this problem and to save the human life we implement design "Drainage cleaning system". We designed our project to use this system efficient way to control the disposal of wastages. The system has a dc motor that starts running as soon as the set-up is switched ON. DC motors are connected to the spur gear drive and it is run the wiper blade shaft. A wiper blades are used for clean wall surface of the sewage. This system has limited human intervention in the process of cleaning and it turn reduces spreading of diseases to man who clean the drainage. Keyword: Drainage system, clean water, Sewage.

1. INTRODUCTION

As today's era is moving towards being digitalized and automated with a great speed, the youth want everything very easily and smart. Not only the youth but the people of all generation are finding it very easy to be smart effort and more and more being healthy and are getting attracted or joined towards latest technology of being "smart work". Anywhere you go, you get this technology available. So we thought of using this technology and adding more to it for our final year project. Nobody likes to suffer and wait for our long waiting hours just to get good surrounding or so. To avoid this and to save time of our management of waste we are creating a application called "Sewage or Drainage Cleaning System".

Sewage or Drainage Cleaning System proposed to overcome the real time problems. With the continued expansion of industries, the problem of sewage water must be urgently resolved

due to the increasing sewage problems from industries of the surrounding environment. The waste and gases produced from the industries are very harmful to human beings and to the environment. Second Important thing is waste management system by which worker can maintain all his health and work good through application maintain that reporting worker don't need to wait and get in to drainage. One more very useful and important advantage of our system is that the worker to replace the manual work in drainage cleaning by fully automatic drain cleaner. And can access them very easily. It also overcome all sorts of drainage problems and promotes blockage free drains promoting the continuous flow of the water. In the modern era there have been adequate sewage problems where sewage water needs to be segregated to clean our surrounding environment.

The proper disposal of common wastes is still a challenge faced nowadays, even though automation also plays a vital role in the industrial and commercial applications. Usually what we see in a country like India is that common wastes like plastic bottles, polythene, covers, sanitary pads, etc and others are left in the streets and in the open drains. These waste particles obviously cause blockage of the drainage system during monsoon season when there is a flow of water through the roads and drainage systems. Also, where the closed drainage system open near a river causes the pollution of river. This blockage of drainage system can cause accumulation of waste water in these drains. Several waters borne diseases such as cholera, worm disease, typhoid, malaria etc will occur due to the contamination of these stagnant water. This can cause many health issues and may even lead to deaths, other than the local common issues caused by the blockage of drainage. In India, there is no existing automated mechanism by which this blockage of drainage can be removed. Currently these blocked drains are cleared with the help of manual workers were the workers have to get into the drains and manually remove the wastes. In such situations the rate of diseases spread among these workers are high and this affects their life's and reduces their immunity.

As a solution to theses social relevant problems and as a solution to the health issues caused thereby, we propose an automated mechanism, "Sewage or Drainage Cleaning mechanism". Our proposed system is used to clean suspended wastes from water like polythene, bottles etc. present in drains eliminating the human labour involved in doing. this can be used to overcome the problem of filtration of the wastes from water and it save the time and cost that spend on cleaning the drainage holes.

1.1 Problem Definition:

In today's era automation plays a very important role in all engineering applications for the proper disposal of sewage from industries and household is still a challenging task. Drain pipes are used for the adequate disposal of waste and unfortunately sometimes there may be a threat to human life during the cleaning of blockage in the drain pipes or it can cause serious health issues because of the pertaining problems like malaria, dengue, etc. In order to overcome this problem as well as to save human life we implement a design "Sewage or Drainage Cleaning System". We designed our project in order to use it in an efficient way to control the disposal of waste along with regular filtration of drains, cleaning 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. So, we are making a sewage or drainage cleaning machine.

1.2 Objective:

The problem of water logging due to plastic, thermocole and waste materials leads to pest growth and it favour diseases like malaria, typhoid etc. This is unsafe for human life and hence the idea of this project emerged. The objective of the proposed project is to design and fabricate a machine for drainage hole cleaning in order to prevent humans from getting affected by various diseases from the infectious microbes present in the sewage while cleaning manually. This proposed system is to minimize or overcome the problem faced while using man operated machine and to minimize the increased dumping rate of waste.

1.3 Scope:

As the project has been based on the baseline to make integration of the benefits for human health, societal concerns and national cleanliness policy of drainage holes. therefore, it covers many sections of proportionate benefits to the whole sphere of our present life.

1.4 Organization of Dissertation:

Designing and testing of the model of Sewage or Drainage Cleaning System will perform at for working or drainage cleaning. After finalization and design of working model the

fabrication process is to be done in the private workshop. Required reference books and data books will be taken from internet & college library.

1.5 Methodology:

Methodology used for whole processing of Sewage or Drainage cleaning Machine is given below; this methodology gives way about how work is to be carried out in systematic way**.**

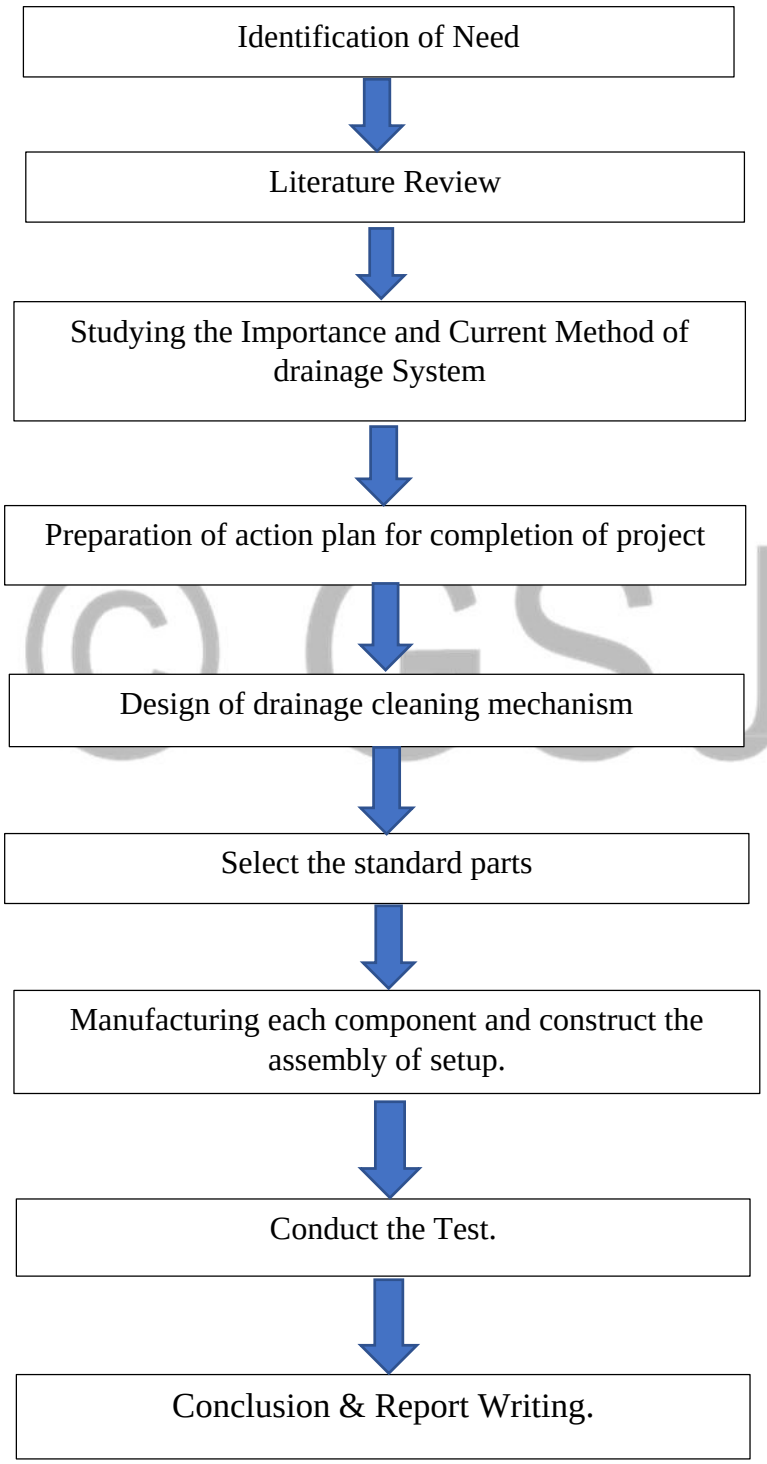

Fig.1.1. Methodology.

2. LITERATURE REVIEW

In the present chapter the contribution made by different researches and authors in the field of drainage / cleaning system were enlist in short. It includes the methods, mathematical modelling, software's. the literature is based on drainage cleaning system finally the summery of literature reviewed was added.

Ganesh U L, Vinod V Rampur, done the work on, Semi-Automatic Drain for Sewage Water Treatment of Floating Materials, according to his study, the proposed concept is to replace the manual work in drainage cleaning by mechanical drain cleaner. Now-a-days even though mechanical drainage plays a vital role in all industrial applications in the proper disposal of sewages from industries and commercials are still a challenging task. Drainage pipes are using for the disposal and unfortunately sometimes there may be loss of human life while cleaning the blockages in the drainage system. To overcome this problem and to save human life we implement a design "mechanical semi-automatic drainage water cleaner" and we designed our project to use this in efficient way to control the disposal of wastages and with regular filtration of wastages. The Drainage system cleaner is a machine which helps to protect the environment from different kinds of environmental hazards through the promotion waste management by the removal of garbage from the drainage system. These wastes when not removed end up settling in residential places where these wastes are burnt thereby causing climate change otherwise these wastes block the drainage systems thereby causing flooding. [1]

B.Babu, P.Raja, A.Anand Jayakumar , done the work on, Design And Development Automatic Sewage Cleaning Machine, according to his study, Traditional method for disposal sewage waste is carried over by manual scavengers where they get inside the maintenance whole pit. It has been estimated 1.24 million scavengers in the country are involved in the sanitation of our surroundings. In Manual scavengers mainly used for basic tools such as a bucket lined with a sack and a handle. The worker then carries the waste manually in bare hands and takes it to the disposal sites. Here scavengers are exposed to gases such as hydrogen disulfide, carbon (IV) oxide, ammonia, and methane. Prolonged exposure to hydrogen disulfide can lead to death by asphyxia. In individual may experience epileptiform convulsions and may fall unconscious and later die. The gas is also associated with visual acuity. To eradicate this condition, manual scavenging is replaced by machines. This machine removes solid waste and again to suck away the liquid sewage. The primary function of the sewage cleaning machine is to collect, transport as well as to dispose of the solid waste in the waste bucket by the help of claws. Solid waste in drainage includes empty bottles, polythene

bags, papers etc. The continuously cleaned in the drainage with the help of a model using this drive system to remove the solid waste and threw it into a waste bucket. [2]

Prashant D. Chaudhari, Gaurav S. Gajare, done the work on, Design and Fabrication of Semi-Automated Drainage Cleaning System, according to his study, The research paper focuses on replacing the manual method of cleaning the drainage system with the semi-automated mechanical drainage cleaner. The method followed nowadays is proving to be the health hazard for the worker undergoing the process of cleaning the drainage. Along with the drainage water some solid waste travels through the drainage line and at the junction points of drainage system these solid waste gets accumulated over time and thus causes the blockage of system. This urges the need of timely cleaning of drainage lines. So this system will help to resolve the problem and will thus help in ensuring the timely cleaning of the system by segregating the solid waste. From this project it is concluded that DCM is helpful for separating solid waste from the drainage water which will further avoid the blockage of drainage line and avoid flooding. Due to continuous rotation of the chain the lifter timely collects all the waste and thus avoids the blockage by separating solid waste from the liquid. Separation of these solid waste helps in treating the solid waste and thus converting it into degradable waste. Being light in weight this kind of system can be placed at the junction points of the drainage system that are frequently subjected to blockages. The system functions more effectively during the heavier rains which has more volume of garbage with high velocity running water through the drainage lines.[3]

S. Ramanathan, R. Sudharshan, Karthik B, A. Mohammed Suhail, S. Chiranjeev, done the work on, Sewage Cleaning Machine, according to his study, The earliest form of sewer cleaning was hand excavation whereby labourers loaded sediment into barrows which were moved down the sewer and then lifted out at manholes by bucket. The work is not only dirty, unpleasant and dangerous. The major problem in manual scavenging is the health issues faced by the workers and more over the cleaning is done by human beings because of earning. Nowadays even though automation plays a very important role in all industrial applications, the proper disposal of sewages from industries and commercials are still a challenging task. Drainage cleaning system is proposed to overcome the real time problems. In this project our aim is to replace the manual work in drainage cleaning by introducing a semi- automated system in an efficient way to control the disposal of wastages and with regular filtration of wastages. In our model, a pneumatic piston is connected in a wire rope which in turn is coupled with kinematic linkages. The linkage from the frame is to be submerged into the sewage. When the pneumatic piston is actuated, the grippers which are

provided at the bottom expand and collect the solid wastes from the sewage. Ultimately our motto is to fabricate a machine which is cost effective as well as efficient in working. Automation is a technology concerned with his application of mechanical, electronic and computer-based systems to operate and control production. Our aim is to fabricate and automate a machine at a lower cost which would benefit the manual scavengers. By implementing this concept of drainage cleaning method there will be reduce in the manual scavengers in our country which reduces the health hazards for humans thereby reducing the environmental pollution in our country.[4]

Ajay Sharma, Ankur Singh, Mahipal Singh, done the work on, Automatic Drainage Cleaning System, according to his study, in this project we proposed the concept of "Automatic Drainage Cleaning System", which replace the manual work of cleaning drainage by humans. Automatic Drainage Cleaning System (ADCS) proposed to overcome the real time problems. This system is used for automatic cleaning of drainage. This proposed system uses an automatic drain cleaning system that lets fluid flow through it but catches large solid waste like bottles, plastic and accumulates it. Labor cleaning drainage leads to a high risk of them catching infections or poisoning due to large amount of waste/chemical in them.so for reducing work of humans and analyzing several problems, we proposed our project ADCS. The problem of drainage blockage due to plastic waste and other solid waste can be eliminated by using of ADCS system. Cleaning of drains/gutters has always been a problem. Labors cleaning gutters & drain seems unethical and also leads to a high risk of them catching infections or poisoning due to large amounts of waste/chemicals in them. So here we provide a fully automated drain gutter cleaning mechanism to tackle these modern-day gutter jamming issues. Our system uses an automated gutter/drain cleaning system that lets fluids flow through it but catches large solid waste like bottles & plastic and accumulates it. So gutter cleaners need to just clean these gutter cleaning systems installed at points instead of cleaning entire gutter floors.[5]

S. Jayasree, Dr. Smt. G. Prasanthi, done the work on, Fabrication of Automatic Sewage Cleaning System, according to his study, Now a day’s automation gives the solution to all the problems and increases the chance of getting better accuracy in all industrial applications. But still it is not possible to get the better result in the issue of industrial drainage system and it is a challenging task to design the safe drainage system with optimum design. Drainage pipes are used for the disposal and unfortunately sometimes they may be loss of human life while cleaning the blockages in the drainage pipes. To avoid this risk and also reduce the time of cleaning the drainage automated sewage cleaning system is designed based on the problems

faced by the people. In this work automation approach will be used instead of normal cleaning method which will be designed to control the disposal of wastage in efficient manner. For control, the wastage regular filtration method may be used. IOT means internet of things. Here as and when the dustbin get filled up, a sms message is sent to the registered mobile number of the person. So cleaning of dustbin is done at the right time. Modern services are becoming polarized. With the emergence of more and more automatic terminal services, modern services are also gradually becoming unmanned. Thus this semi automated sewage cleaning system helps in cleaning the sewage automatically and helps in decreasing the spread of diseases due to direct human intervention into the sewage. Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Thus the project has been successfully fabricated and tested. [6]

Ganesh S. Patil, Rahul A. Pawar, Manish D. Borole, Shubham G. Ahire, Ajay L. Krishnani, Amit H. Karwande, done the work on, Review Paper on Drainage Water Cleaner Machine, according to his study, Water is the basic need for the existence of life on earth. In spite of 70% water on earth majority of water is not suitable for drinking purpose. There is a huge demand of clean water as it is used for a variety of purpose such as drinking, bathing, cleaning, cooking etc. Impurities present in water can cause serious health issues that can damage the life of human beings. Wastewater is characterized as the stream of utilized water from homes, organizations, ventures, business exercises and foundations which are subjected to the treatment plants by a precisely planned and built system of funnels. The measure of stream dealt with by a treatment plant shifts with the season of day and with the times of the year. The procedures looked into here incorporate both those that expel poison soils in wastewater and those that vanishes them. Utilizing a wastewater treatment innovation that expels, instead of decimates, a toxin will give a treatment remains. This sort of wastewater is characterized and characterized by its wellsprings of cause. Regularly 200 to 500 liters of wastewater are created for every individual associated with the framework consistently. At wastewater treatment plant, this stream is dealt with before it is permitted to be come back to the earth. There are no occasions for wastewater treatment, and most plants work 24 hours each day of the week. Wastewater treatment plants takes a shot at basic purpose of the water cycle, helping nature shields water from the intemperate contamination. Most treatment plants have essential treatment and auxiliary treatment. [7]

Vijay Rajendra Nikam, Kawale Rohit Kailas, Patil Hemkant Rajendra, Kumbhar Roshan Dattatray, Prof. Satish Damodar Shewale, done the work on, Automatic Drainage Cleaning

System, according to his study, Water is the basic need for the existence of lifeon earth. In spite of 70% water on earth majority of water is not suitable for drinking purpose. There is a huge demand of clean water as it is used for a variety of purpose such as drinking, bathing, cleaning, cooking etc.. The chief function of the automatic drainage system is to collect as well dispose the solid waste to the waste bucket with the help of forks. Solid waste in drainage water includes empty bottles, polythene bags, papers etc. Impurities in drainage water can lead to blockage of the drainage system. In order to avoid such situation these impurities are needed to be taken out time to time for the continuous flow of drainage water. Drain can be cleaned continuously by the help of model using the drive system to remove the solid waste and threw it on roller conveyor to flow with it towards damping ground . This project is designed with the objective to initiate the efficient working of system. This project automatically cleans the water in the drainage system each time any impurity appears, and forks which are driven by chain sprocket grasp the solid waste and threw it on roller conveyor to avoid blockage. It even reduces the cost of manual labour as well as reduces the threat to human life. [8]

M. Mohamed Idhris, M.Elamparthi, C. Manoj Kumar, Dr. N. Nithyavathy, Mr. K. Suganeswaran, Mr. S. Arunkumar, done the work on, Design and fabrication of remote controlled sewage cleaning machine, according to his study, The motive of the project is to automate the sewage cleaning process in drainage, to reduce the spreading of diseases to human. The black water cleaning process helps to prevent pest infestations by reducing the residues that can attract and support pests. It also improves the shelf life and sensory quality of food products. In the proposed system, the machine is operated with remote control to clean the sewage. Hence, this system avoids the impacts from the sewage waste and its harmful gases. This helps to prevent the mosquito generation from the wastage. The system has a wiper motor that starts running as soon as the set-up is switched on. Two power window motors are connected to the wheel and it is driven with the help of the remote control set-up. 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. An arm is used to lift the sewage and in turn a bucket is used to collect them. The set-up runs even in sewage area with water (limited to a particular amount) so that the wastages which floats on the water surface also gets collected. The garbage which affects the drainage is also picked up and removed. This system has limited human intervention in the process of cleaning and in turn reduces spreading of diseases to mankind. [9]

3. CONSTRUCTION

We are trying to build a Sewage or drainage cleaning system which will reduce manpower for removing waste from drainage holes. Basically, we will integrate the system with the cleaning & waste removal system. main component of system is given below,

3.1. D.C. Gear Motor:

A 12V DC wiper motor is adopted to meet the required torque and the varying loads. The motor is attached to a driving shaft, which gives motion to a wiper system. The DC Motor are used to move the shaft from starting to end position of the brushes and the brushes rotates continuously based on the input power which it receives from the DC Motor to clean the drainage holes. The two rotary brushes are used to clean the drainage holes in vertical wall positions. A shaft is used to hold the brushes in side positions. Gear motor is used to produce high torque with low speed for drainage wall cleaning. DC motor used has specifications as 12V, 5A which produces power of 50 watt and the shaft speed is 60 rpm.

Fig. 3.1 D.C. Gear Motor.

3.2. Gear drive:

A gear is a rotating machine part having cut teeth, or in the case of a cogwheel, inserted teeth (called cogs), which mesh with another toothed part to transmit torque. Geared devices can change the speed, torque, and direction of a power source. Gears almost always produce a change in torque, creating a mechanical advantage, through their gear ratio, and thus may be considered a simple machine. The teeth on the two meshing gears all have the same shape. Two or more meshing gears, working in a sequence, are called a gear train or a transmission. A gear can mesh with a other gear for producing rotation of central wiper.

Fig. 3.2. Gear Drive.

3.3. Shaft:

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power. Shafts are generally formed by hot rolling and finished to size by cold drawing or turning and grinding. Shaft is a common and important machine element. It is a rotating member, in general, has a circular cross-section and is used to transmit power. The shaft may be hollow or solid. The shaft is supported on bearings and it rotates a set of gears or pulleys for the purpose of power transmission.

Material for Shafts:

The ferrous, non-ferrous materials and nonmetals are used as shaft material depending on the application.

Fig. 3.3 Shaft.

3.4. Pedestal bearings:

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support and axial loads. It achieves this by using at least three races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling, they have a much lower than if two flat surfaces were sliding against each other. Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races.

This type of bearing consists of i) a cast iron pedestal, ii) gun metal, or brass bush split into two halves called “brasses”, and iii) a cast iron cap and two mild steel bolts. The detailed drawing of a pedestal bearing is shown in image below. The rotation of the bush inside the bearing housing is arrested by a snug at the bottom of the lower brass. The cap is tightened on the pedestal block by means of bolts and nuts. The detailed part drawings of another Plummer block with slightly different dimensions are also shown in image below.

Fig.3.4. Pedestal bearing.

3.5. Washer:

A washer is a thin plate (typically disk-shaped) with a hole (typically in the middle) that is normally used to distribute the load of a threaded fastener such as a screw or nut. Other uses are as a spacer, spring (wave washer), wear pad, preload indicating device, locking device, and to reduce vibration (rubber washer). Washers usually have an outer diameter (OD) about twice the width of their inner diameter (ID). Washers are usually metal or plastic. High quality bolted joints require hardened steel washers to prevent the loss of pre-load due to Brinelling after the torque is applied. Rubber or fiber gaskets used in taps (or faucets, or valves) to stop the flow of water are sometimes referred to colloquially as *washers*; but, while they may look similar, washers and gaskets are usually designed for different functions and made differently. Washers are also important for preventing galvanic corrosion, particularly by insulating steel screws from aluminum surfaces.

Fig.3.5. Washer.

3.6. Nut and Bolt:

As nuts and bolts are not perfectly rigid, but stretch slightly under load, the distribution of stress on the threads is not uniform. In fact, on a theoretically infinitely long bolt, the first thread takes a third of the load, the first three threads take three-quarters of the load, and the first six threads take essentially the whole load. Beyond the first six threads, the remaining threads are under essentially no load at all. Therefore, a nut or bolt with six threads acts very much like an infinitely long nut or bolt.

Fig.3.6. Nut and Bolt

3.7. Frame:

Mild steel angle or pipe is used for construction of frame supporting the main and auxiliary components. DC motor, gear drive, shaft & bearings which gives the rotation to the main cleaning mechanism will fixed on frame.

3.8. 12 Volt transformer:

Fig.3.7. 12 Volt transformer.

Voltage transformers (VT), also called potential transformers (PT), are a parallel-connected type of instrument transformer. They are designed to present a negligible load to the supply being measured and have an accurate voltage ratio and phase relationship to enable accurate secondary connected metering.

4. WORKING

The drainage cleaning mechanism is used to carry out any floating or sub-floating particles by immersing the equipment into the drainage system. Here the mechanism is placed into the drainage water in such a way that the drive portion is placed in the flow of the stream in drainage holes. From our surveys, it was found that the drainage system's actually does not have any standard dimensions; that is the width and the depth of the drains are varied according to the parallel road networks, e.g. the size of a drain in the urban areas will be much larger than the drains in the rural areas. The mechanism is basically designed to remove out the solid wastes of the running drains and hence cleaning the possibility of any blockage of the flowing waste water. Drainage cleaning mechanism is used to take out garbage's by simple immersing equipment into drainage.

We designed our project to use this system efficient way to control the disposal of wastages. The system has a dc motor that starts running as soon as the set-up is switched ON. DC motors are connected to the spur gear drive and it is run the stirrer blade to clean garbage form bottom of drainage. A wiper blades are used for clean wall surface of the sewage. This system has limited human intervention in the process of cleaning and it turn reduces spreading of diseases to man who clean the drainage. Thus, by combining a mechanical and an electrically integrated system we obtain a mechanism that is very much efficient and effective in cleaning the waste particles from the drainage system.

5. ANALYTICAL DESIGN

DESIGN CALCULATION

Design consists of application of scientific principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific function with maximum economy and efficiency. Hence a careful design approach has to be adopted. The total design work has been split up into two parts;

SYSTEM DESIGN

System design mainly concerns with various physical constrains, deciding basic working principle, space requirements, arrangements of various components etc. Following parameters are looked upon in system design. Selection of system based on physical constraints. The mechanical design has direct norms with the system design hence system is designed such that distinctions and dimensions thus obtained in mechanical design can be well fitted in to it. Arrangement of various components made simple to utilize every possible space. Ease of maintenance and servicing achieved by means of simplified layout that enables quick decision assembly of components Scope of future improvement.

MECHANICAL DESIGN

In mechanical design the components are listed down and stored on the basis of their procurement in two categories,

Design parts & Parts to be purchased.

For designed parts detailed design is done and dimensions there obtained are compared to next dimensions which are already available in market. This simplifies the assembly as well as the post production and maintenance work. The various tolerances on work are specified. The process charts are prepared and passed to manufacturing stage. The parts to be purchased directly are selected from various catalogues and are specified so as to have case of procurement In mechanical designed at the first stage selection of appropriate material for the part to be designed for specific application is done. This selection is based on standard catalogues or data books;

E.g.:- PSG Design Data Books, SKF Bearing Catalogue etc.

5.1. Agitator Stirrer Motor selection:

Density of slurry in drainage $\rho = 1200$ kg/m^3

Speed of the Agitator blade N = 60 rpm. = 1 rps. (Application Basis)

diameter of Agitator blade D = 300mm= 0.3m.

Power Number for Straight type blade Np = 2.96 [21]

Shaft Power Ps = Np. P. N^3. D^5

$= 2.96 \times 1200 \times 1^3 \times 0.3^5$

Ps = 8.63 Watt.

Motor Power $\mathbf{P = \frac{Ps}{0.85}}$ **= 10.1545 Watt.**

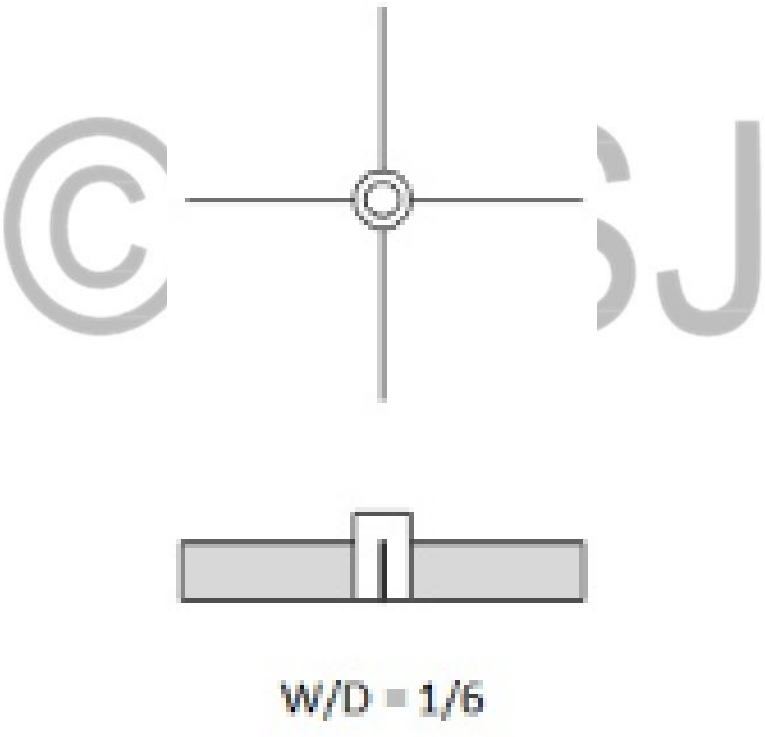

Fig.5.1. Straight Blade (S-4)

Thus selecting a motor of the following specifications

- **DC motor**
- **Power = 50 watt**

- **Speed= 60 rpm**

Motor Torque

$$P = \frac{2 \Pi N T}{60}$$

$$T = \frac{60 \times 50}{2 \Pi \times 60}$$

T = 7.96N-m

Power is transmitted from the motor shaft to the input shaft by means of an gear drive.

5.2. Shaft design:

To find diameter of shaft by ASME code

For commercial steel shaft, Actual shear stress $\tau_{act} = 55N/mm^2$

$T = \Pi/16 \times \tau_{act} \times d^3$

$$\Rightarrow \tau_{act} = \frac{16xT}{\Pi x d^3}$$

$$7.76^3 = \frac{16 \times 55}{\Pi \times d^3}$$

$d^3=737.089$

d=9.033mm **select d=20mm**

5.3. Bearing selection:

As shaft dia. – is 20mm so we have selection a pedestal bearing having shaft outer dia. – 20mm.In selection of ball bearing the main governing factor is the system design of the drive i.e.; the size of the ball bearing is of major importance; hence we shall first select an appropriate ball bearing. Taking into consideration convenience of mounting of ball bearing. As shaft diameter is 20mm to it &selected a pedestal ball bearing having shaft outer dia-20mm ball bearing to support the shaft of 20mm.

Total Axial load on bearings is = Weight of Wiper Blade + weight of shaft.

Axial load on each bearings Fa = 15 N.

Equivalent dynamic load

Pe = V.Fa.Ka

= 1 X 15 X 1.5

Pe = 22.5 N

bearing life is,

$$\mathbf{L^{10} = \frac{Lh10\ X\ 60\ X\ n}{10^6}}$$

L_{h10} from graph 4.6 PSG Design data book for 16000 rpm maximum speed of ball bearing is 315000 Hours.

$$\mathbf{L^{10} = \frac{31500\ X\ 60\ X\ 4300}{10^6}}$$

L^{10} = 8127 millions of revolutions.

$$L^{10} = \left(\frac{C}{Pe}\right)^{\left(\frac{10}{3}\right)}$$

$$C = (L10)^{\left(\frac{10}{3}\right)}\ X\ Pe$$

$$C = (8127)^{(0.3)}\ X\ 22.5$$

C = 335.09 kN.

PSG Design data book P.No. 4.13.

5.4. Lead screw design:

For screw material C40 yield stress $\boldsymbol{\sigma}_y$= 330 N/mm^2

Ultimate shear stresses = 0.5 $\boldsymbol{\sigma}_y$=165 N/mm^2

Tensional shear stress T = Π/16 x τ xd^3

$$\Rightarrow \boldsymbol{\tau} = \frac{\mathbf{16xT}}{\mathbf{\Pi x d^3}}$$

$$7.96 \times 10^3 = \frac{16 \times 165}{\Pi \times d^3}$$

dc =6.2626mm **select dc=7 mm.**

Nominal dia. d= 10mm.

Core dia. dc=7mm.

Pitch p = 3mm.

Operating load W= 150 N.

Coeff. Of friction μ = 0.11 (For steel lubricated screw)

Coeff. Of friction μc = 0.125 (For coller)

$\lambda = \tan^{-1} \frac{L}{\Pi \times dc} = \frac{Nt \times p}{\Pi \times dc}$ (N_t= 1)

$\lambda = \tan^{-1} \frac{1 \times 3}{\Pi \times 7}$

$\lambda = 7.7682^0$ **(For single start)**

$\boldsymbol{\mu_1} = \frac{\mu}{\cos\beta}$

$= \frac{0.11}{\cos 14.5}$

$\mu_1 = 0.1136$

Φ_1=$\tan^{-1}\mu_1$

=$\tan^{-1}$0.1136

$\Phi_1 = 6.4820^0$

Efficiency for screw

$\eta_s = \frac{\tan\lambda}{\tan(\Phi 1 + \lambda)}$

$= \frac{\tan 7.7682}{\tan(6.4820 + 7.7682)}$

η_s = 0.5371

η_s = 53.71%

5.5. Spur gear pair system:

No teeth on gear Zg = 36

No teeth on pinion Zp=14

Material of gear & pinion both are C40. DDB. P No.1.10.

Sut p =580 N/ mm^2

Sut g =580 N/ mm^2

Application factor ka = 2

Load distribution factor km= 1

Factor of safety Nf = 1.5

BHN = 217

Power P = 50Watt.

Np= 60rpm

Beam strength (δb)

6bp $=\frac{Sup}{3}=\frac{217}{3}$ = 72.33 N/mm^2

6bg= $\frac{Sug}{3}=\frac{217}{3}$ = 72.33 N/mm^2

Assuming 20^0 full depth involution system,

Yp=0.484 - $\frac{2.87}{Zp}$=0.484 - $\frac{2.87}{14}$ = 0.279

Yg=0.484 - $\frac{2.87}{Zg}$=0.484 - $\frac{2.87}{36}$ = 0.404

Now, δ_{bp} . Yp = 72.33 ×0.279= 20.180 N/mm^2

δ_{bg} . Yg = 72.33 ×0.404= 29. 221 N/mm^2

As δ_{bp} . Yp ≤δ_{bg} . Yg

Pinion is weaker then gear. Hence, it is necessary to design the pinion for bending.

Bending force (Fb)

Fb=6bp.b .m.Yp

=72.33 X 10m X m X 0.279

Fb =201.80 m^2 N

Wear strength (Q)

Q = $\frac{2Zg}{Zg+Zp}$ = $\frac{2X36}{36+14}$ =1.44

Load stress factor (K)

K=0.16[$\frac{BHN}{100}$]^2= 0.16[$\frac{217}{100}$]^2= 0.7534N/mm^2

Bucking eq^n for the weer strength (Fw)

Fw =$dp \times b \times Q \times K$

= 14m x 10m x 1.44 x 0.7534

Fw=151.885 m^2

Fw ≤Fb design should be on wear failure

Effective load

$V=\frac{\pi \times dp \times np}{60 \times 1000} = \frac{\pi \times 14m \times 60}{60 \times 1000}$ = 0.0439 m m/s

Tangential force (f_t)

$F_t = \frac{P}{V} = \frac{50}{0.0439\,m}$ N = $\frac{1136.82}{m}$ N

As per the gear pair is manufactured by generation, the velocity factor is given by,

Kv =$\frac{6}{6+v}$ =$\frac{6}{6+0.0439m}$

Feff=$\frac{Ka.Km.Ft}{Kv}$

Feff=effective load

Ka=application factor

Km=distribution factor

Kv=velocity factor

Feff= $\frac{2\times1}{\frac{6}{6+0.0439m}} \times \frac{1136.82}{m}$

Estimate the module-

Fw=Nf .Feff

151.885 m^2 =1.5× $\frac{2\times1}{\frac{6}{6+0.0439m}} \times \frac{1136.82}{m}$

Solving by above equation by trial & error, we get,

Dimensions of gear pair -

m = 1.87 = 2 mm

Z_P = 14

Zg =36

B = 10 m = 20 mm

Dp = m×zp = 2 ×14 = 28 mm

Dg = m×zg = 2×36 = 72mm

ha = 1m = 2 mm

hf = 1.25m = 1.25× = 2.5 mm

6. PROCESS SHEETS

6.1.PART NAME: Tank supporting frame.

Part weight – 10 kg

Part material – M.S. Angle

Part quantity – 01

Part size – mm x mm x mm.

Sr. No.	Operation	Machine	Tool	Time
1	Cutting the material as per our required size.	Hand cutter	Cutting blade	30 min
2	Welding the frame as per required size.	Welding machine	Arc Welding tool	45 min
3	Grinding the frame.	Grinding machine	Grinding machine	20 min

6.2. PART NAME: Vertical Slider frame.

Part weight – 8 kg

Part material – M.S. Angle & Plate

Part quantity – 01

Part size – mm x mm x mm.

Sr. No.	Operation	Machine	Tool	Time
1	Cutting the material as per our required size.	Hand cutter	Cutting blade	20 min
2	Welding the frame as per required size.	Welding machine	Arc Welding tool	35 min
3	Grinding the frame.	Grinding machine	Grinding machine	15 min

6.3. PART NAME: Central Screw Rod.

Part weight – 1 kg

Part material – M.S.

Part quantity – 01

Part size – Ø16mm x mm.

Sr. No.	Operation	Machine	Tool	Time
1	Cutting the material as per our required size.	Hand cutter	Cutting blade	10 min
2	Grinding the power screw for washer welding.	Grinding machine	Grinding machine	25 min
3	Welding the power screw as per required size.	Welding machine	Arc Welding tool	20 min

6.4.PART NAME: Vertical Slider frame holding pipes

Part weight – 2 kg

Part material – M.S. Pipe

Part quantity – 04

Part size – mm x mm x mm.

Sr. No.	Operation	Machine	Tool	Time
1	Cutting the plate as per our required size.	Hand cutter	Cutting blade	20 min
2	Welding the pipes as per required size.	Welding machine	Arc Welding tool	20 min
3	Grinding the plate.	Grinding machine	Grinding machine	10 min

6.5.PART NAME: Mechanism Mounting Plate.

Part weight – 1 kg

Part material – M.S. Plate

Part quantity – 1

Part size – mm x mm x mm.

Sr. No.	Operation	Machine	Tool	Time
1	Cutting the plate as per our required size.	Hand cutter	Cutting blade	25 min
2	Drilling the holes for Bearing and gear.	Drilling Machine	Drilling Machine	35 min
3	Welding the plate to vertical	Welding	Arc	10 min

	sliding frame.	machine	Welding tool	
4	Grinding the plate.	Grinding machine	Grinding machine	10 min

7.COST ESTIMATIONS

7.1. TOTAL COST OF MATERIAL

Part Name	Material	Wt in kg	Rate / kg	Total Rate
Plate	M.S	2	90	180
Pipe	M.S	2	80	160
Angle	M.S	18	70	1260

TOTAL COST OF MATERIAL: 1,600/- RS.

7.2. COST OF MACHINENING

Machine Name	Using Time (min)	Rate /hr	Total Rate Rs/-
Cutting	115	500	950
Welding	120	800	1600
Grinding	80	500	660
Drilling	35	500	300

TOTAL COST OF MACHINENING: 3,510/- RS.

7.3. COST OF STANDARD PART

Sr.No.	name	Qty.	rate	Total rate
1	PVC Tank	1	600	600
2	Lead screw	1	360	360
3	Handle	1	150	150
4	Nut & bolt	4	10	40
5	Spur Gear Pair	1	800	800
6	Gear Motor	1	750	750
7	Pedestal Bearing	1	230	230
8	Pipe	1	30	30
9	12 V, 5A, Transformer	1	1500	1500

TOTAL COST OF STD PART: 4,450/- Rs.

7.4. COST OF TRANSPORTATION & OVERHEAD = 1000 / - Rs.

COST OF PROJECT =

Cost of material + Cost of machinating + Cast of STD part + Cost of transportation & overhead

= 1600 +3510+4450+1000

= 10,560/- (Approximately)

8. ADVANTAGES AND APPLICATION

8.1. Advantages:

- These cleaners are easy cheapest way to fix drainage problems. Easy to operate.
- Reduction of labour-oriented method of cleaning, thus upgrading dignity of labour. Light weight and easily cartable. Requires nearly 12 Volts of power.

- Working principle is quite easy.
- Compact & portable machine.
- It is used almost in all types if Drainage holes. (Large, Small & medium).
- Highly Efficient in working.
- Manual assistance is not required.
- The Initial Cost of this system is low.
- Skill Worker not required to drive of this system.
- Proper timing of mechanical control operations can improve control and reduce the spread of propagates.
- These systems Environment friendly which do not have any harmful effects on eco system.
- This system is more efficient & Pollution free.
- It is portable and compact in size which initiates easy handling.

8.2. Application:

- It can be installed for domestic sewage treatment.
- It can be used for proper treatment of sewage as well as to avoid blockage of drains.

9. CONCLUSION

Cleaning of sewage/drains/gutters has always been a problem. Labours cleaning gutters & drain seems unethical and leads to a high risk of them catching infections or poisoning due to large amounts of waste/chemicals in them. Also throwing of bottles/plastics and other such objects into the gutters lead to narrowing and eventually blockage in gutter flow. This leads to overflow in many cases. So here we provide a sewage/drainage/gutter cleaning mechanism to tackle these modern-day sewage jamming issues. Our system uses a mechanical machine sewage/gutter/drain cleaning system that lets fluids flow through it but catches large solid waste like bottles & plastic and accumulates it. So gutter cleaners need to just clean these sewage cleaning systems installed at points instead of cleaning over the drainage holes. Our system consists of metal teeth-based jaws blade to churn the sewage as well as screw to lift the sewage plastics, bottles & other wastage from the bottom of the drainage hole. It is mounted in a frame to hold the system upright in the drainage hole. The vertical frame bed is used to let liquid flow but catch all solid waste. The system is a very efficient way to cleaning gutters & drains and also requires very low power. Our project is very useful in monsoon because in rainy season our drains are usually are over flowing and they can be blocked by solid wastes**.** We can incorporate this project with SWACCH BHARAT ABHIYAAN which

is a revolution in present times.

10. FUTURE SCOPE

The projects sewage cleaning system will serve for the human needs and definitely presents a bright future aspect in this domain. With technological advancement this project can be revolutionized to include the technology with automation, to make the working of the Municipal Boards of the cites more viable. The project can be incorporating the automatic sewage cleaning system and hence the project can be tech-abled. The Project and the health of area waterways may be at risk if financing depends solely on Water's rate structure. The present approach puts the burden to pay for this project on District residents, businesses, and property owners based on the "polluter pays" principle. project continue through to completion at a cost that can be borne by the household base by this project model at that stage need some future improvements.

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APPENDEX

TYPICAL USES OF CARBON STEEL

Steel Designation	Typical uses
C07, C10	Used for cold forming and deep drawing. Rimming quality used for Automobile bodies, cold heading wires and rivets. Killed quality used for forging and heat treating applications.
C10 and C14	Case hardening steels used for making camshafts, cams, light duty gears, worms, gudgeon pins, selector forks, spindles, pawls, ratchets, chain wheels, tappets, etc.
C15	Used for lightly stressed parts. The material, although easily machinable is not designed specifically for rapid cutting, but is suitable where cold work, such as bending and riveting may be necessary.
C15Mn75, C20, C25 and C25Mn75	General purpose steels for low stressed components.
C30	Used for cold formed levers - Hardened and tempered tie rods, cables, sprockets, hubs and bushes - steel tubes.
C35	Steel for low stressed parts, automobile tubes and fasteners.
C35Mn75	Steel for making low stressed parts in machine structures, cycle and motorcycle frame tubes, fish plates for rails and fasteners.
C40	Steel for crankshafts, shafts, spindles, automobile axle beams, push rods, connecting rods, studs, bolts, lightly stressed gears, etc.
C45	Steel for spindles of machine tools, bigger gears, bolts and shafts.
C50	Steel for making keys, shafts, cylinders, machine components requiring moderate wear resistance. In surface hardened condition it is also suitable for large-pitch worms and gears.
C50Mn1	Rail steel. Also used for making spike bolts, gear shafts, rocking levers and cylinder liners.
C55 and C55Mn75	Steels used for making gears, cylinders, cams, keys, crank shafts, sprockets and machine parts requiring moderate wear resistance for which toughness is not of primary importance.
C60	Steel for making spindles for machine tools, hardened screws and nuts, couplings, crank shafts, axles and pinions.
C65	High tensile structural steel for making locomotive carriage and wagon tyres. Typical uses of this steel in the spring industry include engine valve springs, small washers and thin stamped parts.

CARBON STEELS : PROPERTIES

Designation	condition	tensile strength N/mm²	yield strength N/mm²	Izod Impact value, Nm
C 07	sheets, cold rolled and annealed	300—380		
C 10	—do—	320—400		
	Case hardened—refined & quenched	500		55
	bars, cold drawn upto 20 diam	500		
	20—40 ,,	460		
	40—63 ,,	420		
	over 63 ,,	340		
C 14	Case hardened—refined & quenched	500		55
	tubes, cold drawn and annealed;	340	190	
	cold drawn and tempered;	440	380	
C 15	tubes cold drawn and annealed	340	190	
	Cold drawn & tempered	440	380	
	sheets, cold rolled & annealed	320—440		
C 15 Mn 75	bars, cold drawn			
	upto 20 dia	520		
	20—40 ,,	480		
	40—63 ,,	440		
	Over 63 ,,	420		
	tubes, cold drawn & annealed	340	190	
	,, & tempered	440	380	
C 20	bars, cold drawn			
	upto 20 diam	560		
	20—40 ,,	540		
	40—63 ,,	480		
	Over 63 ,,	440		
	sheets, cold rolled & annealed	390—510		
	tubes, cold drawn & annealed	370	220	
	cold drawn & tempered	520	420	
C 25	tubes, cold drawn & annealed	390		250
	cold drawn & tempered	560		460
C 25 Mn 75	tubes, cold drawn & annealed	390		250
	,, & tempered	560		460
C 30	bars & forgings:			
	hardened & tempered	600—750	400	55
	bars: upto 20 diam	620		
	20—40 ,,	580		
	40—63 ,,	540		
	Over 63 ,,	500		
C 35	tubes, cold drawn & annealed	440	280	
	,, & tempered	620	500	

CARBON STEEL : PROPERTIES (Contd.)

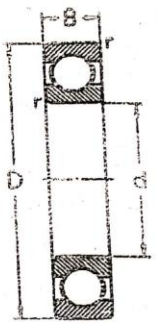
Designation	Condition	tensile strength N/mm²	yield strength N/mm²	Izod impact Nm
C 35 Mn 75	bars & forgings			
	hardened & tempered	600—750	400	55
	tubes, cold drawn & annealed	440	280	
	„ & tempered	620	500	
C 40	bars, cold drawn			
	upto 20 diam	680		
	20—40 „	640		
	40—63 „	600		
	Over 63 „	580		
	bars & forgings, hardened and tempered	600—750	380	41
C 45	bars & forgings, hardened & tempered	600—750	380	41
	tubes, cold drawn & annealed	520	340	
	„ & tempered	700	600	
C 50	bars, cold drawn			
	upto 20 dia.	740		
	20—40 „	700		
	40—63 „	680		
	Over 63 „	660		
	bars & forgings, hardened & tempered	700—850	460	—
	tubes, cold drawn & annealed	520	340	
	„ & tempered	700	600	
C 55 Mn 75	bars, cold drawn	720—780		
	bars & forgings, hardened & tempered	700—850	460	—
C 55 Cr 75	Wear resisting, hardened & tempered	900—1050	660	35 (BHN 255 — 311)

TENSILE STRENGTH OF STRUCTURAL STEELS : N/mm²

grade	St 30	St 32	St 34	St 37	St 39	St 42	St 44	St 47	St 50	St 52	St 55	St 58	St 63	St 88
tensile strength	300 to 380	320 to 440	340 to 460	370 to 490	390 to 510	420 to 540	440 to 540	470 to 570	500 to 600	520 to 620	550 to 650	580 to 680	630 to 710	880 to 1000

DEEP GROOVE BALL BEARINGS (Contd.)

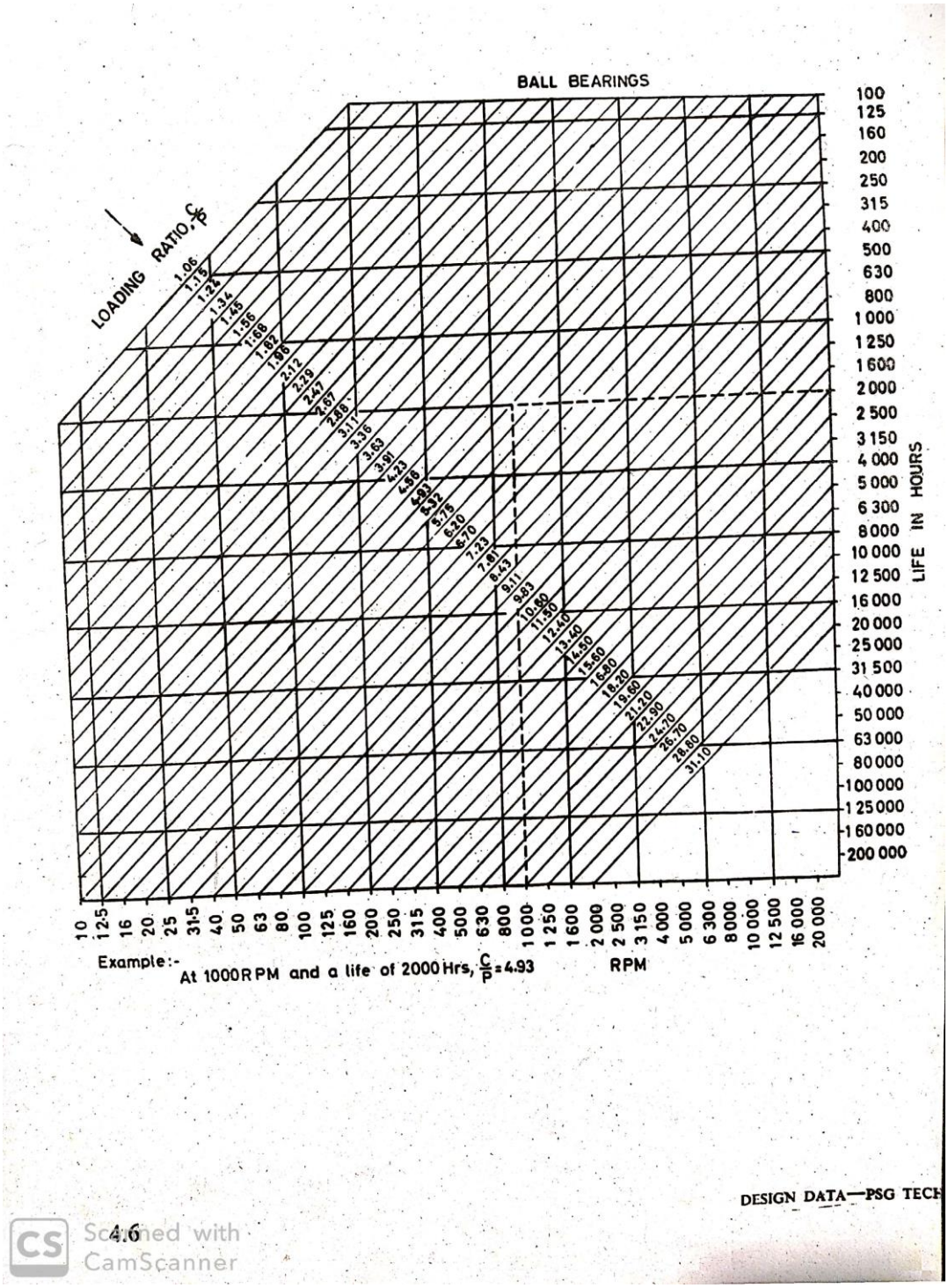
Series 62



Series 62

ISI No.	Bearing of basic design No. (SKF)	d mm	D_1 min	D mm	D_2 max	B mm	r ≈ mm	r_1 mm	Basic capacity, kgf Static C_o	Dynamic C	Max. permissible speed rpm
10BC02	6200	10	14	30	26	9	1	0.6	224	400	20000
12BC02	01	12	16	32	28	10	1	,,	300	540	20000
15BC02	02	15	19	35	31	11	1	,,	355	610	16000
17BC02	6203	17	21	40	36	12	1	,,	440	750	16000
20BC02	04	20	26	47	41	14	1.5	1.0	655	1000	16000
25BC02	05	25	31	52	46	15	1.5	,,	710	1100	13000
30BC02	6206	30	36	62	56	16	1.5	,,	1000	1530	13000
35BC02	07	35	42	72	65	17	2	,,	1370	2090	10000
40BC02	08	40	47	80	73	18	2	,,	1600	2280	10000
45BC02	6209	45	52	85	78	19	2	,,	1830	2550	8000
50BC02	10	50	57	90	83	20	2	,,	2120	2750	8000
55BC02	11	55	64	100	91	21	2.5	1.5	2600	3400	8000
60BC02	6212	60	69	110	101	22	2.5	,,	3200	4050	6000
65BC02	13	65	74	120	111	23	2.5	,,	3550	4400	6000
70BC02	14	70	79	125	116	24	2.5	,,	3900	8400	5000
75BC02	6215	75	84	130	121	25	2.5	,,	4250	5200	5000
80BC02	16	80	91	140	129	26	3	2.0	4550	5700	5000
85BC02	17	85	96	150	139	28	3	,,	5500	6550	4000
90BC02	6218	90	101	160	149	30	3	,,	6300	7500	4000
95BC02	19	95	107	170	158	32	3.5	,,	7200	8500	4000
100BC02	20	100	112	180	168	34	3.5	,,	8150	9650	3000
105BC02	6221	105	117	190	178	36	3.5	,,	9300	10400	3000
110BC02	22	110	122	200	188	38	3.5	,,	10400	11200	3000
120BC02	24	120	132	215	203	40	3.5	,,	10400	11400	3000
	6226	130	144	230	216	40	4	2.5	11600	12200	2500
	28	140	154	250	236	42	4	,,	12900	12900	2500
	30	150	164	270	256	45	4	,,	14300	13700	2500
	32	160	174	290	276	48	4	,,	15600	14300	2000
	6234	170	187	310	293	52	5	3.0	19000	16600	2000
	36	180	197	320	303	52	5	,,	20400	17600	1600
	38	190	207	340	323	55	5	,,	24000	20000	1600
	40	200	217	360	343	58	5	,,	26500	21200	1600

D_1, abutment diam. on shaft
D_2, abutment diam. on housing
r_1, corner radii on shaft & housing.



DESIGN DATA—PSG TECH

4.6