Structure and Working of Exhibits

40th Jawaharlal Nehru National Science, Mathematics and Environment Exhibition for Children

2013

Gangtok, Sikkim

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NCERT

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Preface

The learning of Science and Mathematics are instrumental in developing well-defined abilities and skills such as spirit of enquiry, creativity, objectivity, logical thinking and aesthetic sensibilities among children. Children learn through interactions with the environment around, nature, things and people. They actively engage with the world around them in exploring, responding, inventing, working things out and interpreting. Science Exhibition offers an opportunity to children to express and exhange their creative ideas with joy of scientific investigation. It helps them to learn the methods of science and mathematics, provide them with opportunity to develop their problem-solving skills and creative abilities.

The National Council of Educational Research and Training (NCERT) organises the Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE) for Children as an annual event in collaboration with a State or Union Territory. The JNNSMEE is the culminating activity of a series of exhibitons organised at school, zonal, district, regional and state levels. A large number of students and teachers participate in such events.

The present publication, i.e., 'Structure and Working of Exhibits' includes write-ups of a few exhibits selected for display in the 40th JNNSMEE – 2013 which is being organised in Gangtok, Sikkim. Other materials like 'List of Exhibits' which contains the titles and synopsis of exhibits selected for participation in the JNNSMEE–2013 along with information brochures stating objectives and other details of the exhibition have also been published. It is expected that these publications will motivate and help children to participate in future Exhibitions.

The write-ups included in the present pubication were selected out of the entries received from all the states/UTs and other agencies. These were reviewed and edited by an expert committee

in the Department of Education in Science and Mathematics, NCERT, comprising Professor Sunita Farkya, Professor R.K. Parasher, Dr Alka Mehrotra, Dr Anjni Koul, Dr Rachna Garg, Dr Shashi Prabha, Dr T.P. Sarma, Shri R.R. Koireng and Dr A.K. Srivastava. I appreciate the sincere efforts of the committee.

Further, I thank Arun Verma, *DTP Operator;* Puneet Bhola, *Computer Operator;* Swati Kumar and Meenakshi Lohani for their consistent help. I also thank the Publication Division, NCERT for the cooperation in bringing out this publication.

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National Council of Educational
Research and Training

New Delhi
1 November 2013

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Empowerment of Girl Child, Responsibility of All

1

NANO BIO-TECHNOLOGY

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INTRODUCTION

K. Eric Drexler popularied the word 'nanotechnology' in the 1980s, for building machines on the scale of molecules, a few nanometers wide, far smaller than a cell. Nanomedicine is the medical application of nanotechnology. Nanomedicine ranges from the medical applications of nanomaterials to nanoelectronic biosensors, and even possible future applications of molecular nanotechnology.

RATIONALE

Current problems for nanomedicine involve understanding the issues related to toxicity and environmental impact of nanoscale materials. One nanometer is one-millionth of a millimeter. The nanomedicine initiative has two major goals: (1) to understand how the biological machinery inside living cells is built and operates at the nanoscale; and (2) to use this information to re-engineer these structures, develop new technologies that could be applied to treating diseases, and/or leverage the new knowledge to focus work directly on translational studies to treat a disease or repair damaged tissue.

Scientific Principle Involved

It is based on the principle of manipulation of matter at a nano scale which is being explored widely and applied in the field of nanomedicines.

Materials Required

Materials used for the following items are:

Nano Robot
Tripod stand, black cellophane tape, card board, iron nails, aluminium foil wooden box and double sided tape.

Drug Delivery
Hard Plywood, foam sheet, glue, transparent water pipe, electric water pump, black chart paper, black cellophane tape, red water colour and medical syringes.

Nano Particle Targetting
Plastic ball, white chart paper, cotton, small bouncing balls, medical dressing tape, black Pastel sheets, black cellophane tape, yellow LEDs, battery eliminator, wires, wooden box and water colours.

Cell Repairing Machine
Hollow 4 inches metallic tube, small motor, cone shaped plastic axel, battery eliminator and aluminium foil.

Neuro Electronic Interface
Model of human brain,7 inches long screw, wooden box, black pastel sheet, black cellophane tape, 1 inch long screw, white medical dressing tape and silver metallic poster colour.

Construction

Nano Robot
A tripod stand is covered by black cellophane tape, a 3D hexagonal structure is of hard cardboard, covered by aluminium foil fixed on tripod stand with the help of double sided tape is the prototype of nano robot. This unit is placed in a wooden box fully covered by black pastel sheet.

Drug Delivery
Human kidney is made with foam sheet, coloured red, inserted with water pipe fixed with pump. At the other end of pipe two medical syringes are inserted for drug delivery.

Nano Particle Targetting
Tumour cell is depicted with a plastic ball is covered by cotton and painted with red and black. With wide use of LEDs, wires and battery eliminators done along with wooden box and colours. The nano robots are placed at the different positions facing at tumour cell.

Cell Repairing
A motor is fixed at one end of 4 inch long hollow metallic tube fixed with a cone shaped plastic axle revolving needle. Motor is connected with a battery eliminator. 3 foldable metallic strips attached with it, works as its arms. It is covered with aluminium foil and is placed on the tumour cell with the support of its working arms.

Neuro Electronic Interface
A 7 inches long screw is inserted in inverted form at the bottom of wooden box. A model of human brain is fixed with the help of screw and cellophane tape. Unit is black painted.

Working

Nano Robot
These are made up of isotope 'C13' of carbon which is synthesised from 'C12' elemental carbon. According to Robert Freitas of the Institute for Molecular Manufacturing a nano robot is 0.5 to 3 nm in size because that is the maximum size possible due to capillary passage requirement. 'C13' is used to make them because it has non-zero magnetic moment. Firstly these are injected in the human body and the doctor can control them with the help of computers while monitoring it in MRI machine.

Drug Delivery
Nano robots are used due to their specific size. There are 3 steps of drug delivery - Sufficient encapsulation of drug, Synthesis of drug at the targeted region, and after synthesis, clearing of the drug from the targeted region. The drug is firstly encapsulated in nano robot and then the nano robot is injected in the patient's body then the doctor will give it the instructions to the targeted region and after reaching the targeted region it will release the drug in the specific region and after sufficient time interval the drug is cleared by the nano robot otherwise the drug will start the process of toxicity in the patient's body.

Cell Repairing Machine

Cell repairing machine is a nano robot which can regenerate the cells followed by tissue and then regenerate the whole organ.

Nano Particle Targetting

The nano robots are targeted to the tumour site in cancer patient and will project the beam of specifically charged gold nanoshells on the tumour cell to destroy it. The positively charged gold nanoshells were found to enter the kidneys while negatively charged gold particles in the liver and spleen. The positive surface charge of the nanoparticle decreases the rate of opsonisation in the liver. Even at the size of 5 nm these sometimes can be accumulated by the peripheral tissue and may cause toxicity.

For Neuro Electronic Interface

By this technology patients with delayed neuron response due to some accident or mental disorders like multiple sclerosis and paraplegia can be treated. The doctor will inject the nano robots in the patient's body and then the nano robots will attach themselves on the neurons of the patient and send the low frequency electromagnetic signals to the attached controlling computer which can amplify, store and respond.

Flow Chart of Process of Curing a Disease by Nano Bio-Technology

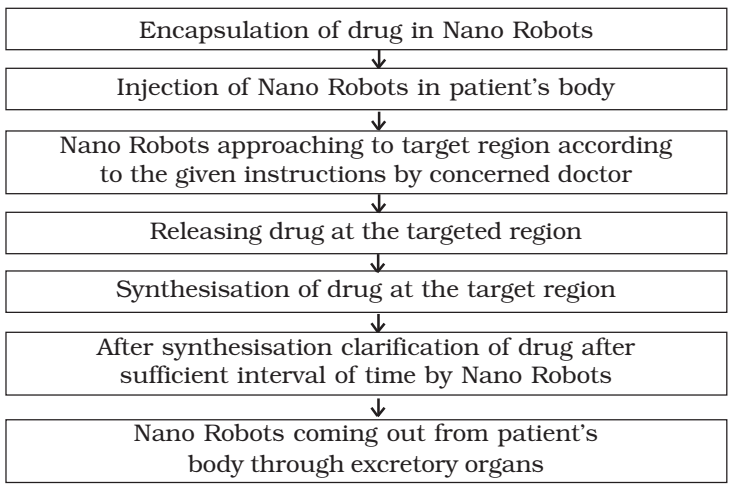

Fig. 1.1: Construction of the Model

Applications

Nano bio-technology is future medicine ready to revolutionise the world by which even deadliest diseases could be cured. It can be used in cases related to:

1. Cardiovascular diseases and stroke;
2. Drug delivery;
3. Cancer treatment;
4. Surgery;
5. Immune system.

2

Solution of Railway Accident

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Introduction

Train is a major and cheap source of transportation in India. Maximum people use it, but at the same time it is not 100% safe. Maximum accidents occur on the track and people either lose their lives or suffer from physical disorder.

Even government has to spend lots of money to over-come from such accidents like to the family of the injured and dead people. Our main aim to develop this project is to avoid train accidents and reduce economic burden of our country and to provide safe transportation.

Scientific Principle Involved

Working through Cooperation of Solenoid and IR Sensor and KEIL programme principle.

Materials Required

Toy train and track, Sensor, LED light, wire, IC, Solenoid, Battery, Transistor, Capacitor, Ply, Acrylic, etc.

Construction and Working

First of all take wooden ply 2" × 3" feet size. Then fix the track of toy train on the ply with the help of screw. Then join another By-pass track at a proper place on the main track. Now at the junction where the main and By-pass track are both meet together, there to join track with solenoid so that solenoid can change the track, and with the help of pin join the solenoid in the circuit. Then set IR sensor for Case-1 and Case-2 on both the tracks. Fit Capacitor, Transistor and converting regulator with circuit so it can supply necessary power to the circuit. For controlling of all the things connect in IC, then to pin IC with circuit and give it power supply so it will work (Fig. 2.1).

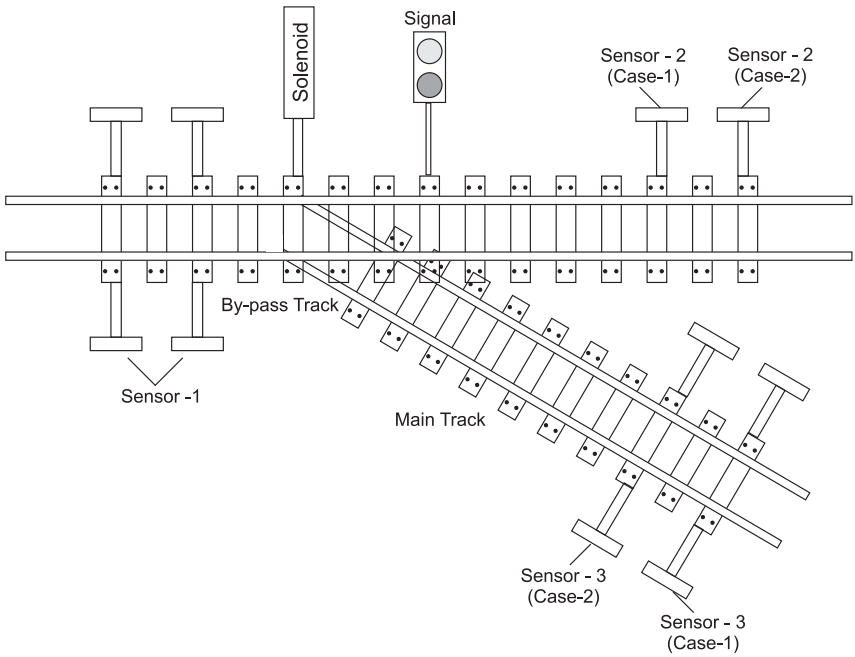

Fig. 2.1: Construction of the Exhibit

Working of the Model

There are three possibility of accidents in case of train.

Case-1

When couple of trains are going on the same track back to back. First, train which will go on the main track when it will reach on

its sensor, the track will automatically change and the next train will go on that track called By-pass track so accidents will not occur.

Suppose, both tracks are engaged the upcoming train will be indicated by the stop signal. So an accident will not occur.

Case-2

When two trains move on different tracks and gathered on the same track. In this case, the train which will enter first in to sensor will command the stop signal to the other train.

Case-3

When two trains move on the same track from opposite directions. When both trains will enter into sensor (station) suddenly the stop signal will start on all tracks. So accidents will not happen.

APPLICATIONS

1. It is helpful for the Railways.
2. It will guide other factors which are concerned with human resources.
3. It will be helpful to avoid road accidents by using sensors.
4. It will be helpful to avoid economic burden of our country.

3

AUTONOMOUS ROBOT

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INTRODUCTION

It is a totally Micro-controller based project which is specially designed for Indian Defence. It can be used by Army as Spy Gadgets and as wireless bomb diffuser. This model is designed using infra-red sensors which automatically detect the distance of the obstacles and gives different types of command to Micro-controller. The Micro-controller takes these commands and gives the output command to the motors. Thus the robot can perform some tasks. We also use white line follower and black line follower as well as obstacle detection.

RATIONALE

Now-a-days terrorism is a very big issue for the entire world. This working model of an autonomous robot has been made to tackle this issue. It can find its own path, diffuse bombs, keep watch on the activites of terrorists and give us updated information about them.

Scientific Principle Involved

Using infra-red sensors, our robot can find its own path and perform some tasks as per given command. Artificial Intelligence based robot can be very useful for Indian Army.

Materials Required

1. IC AT Mega
2. 2-Stepper Motors
3. 4-IR sensor
4. Wires, Digital Multimeter, 12V DC battery
5. Wood Sheet
6. Hot Gun Glove Machine

Construction and Working

In this robot we have used two moving wheels which are connected with motors. We have used one cast iron ball each in the front and back side for its balancing. These are not connected with any motor. All these are supported on the wood sheet which we are using as the main body of our robot. Under the guidance of my class teacher we have developed AT Mega 32 micro-controller and its development board using LCD, Motors, IR sensors and LED blinking interfacing kit.

Based on simple C-programming in the Micro-vision 4 software we have created our own programme and loaded it in our controller kit with the help of Flash Magic Software. In this programme we have used IR sensor detection logic, Motor command logic, LCD display logic with the help of error and correction method. We have developed one type of Artificial Intelligence programme which can find its own path and own way detecting obstacles on its way. If there is front or back side IR sensor danger level, then controller gives the command to LED. LED blinks, indicating danger level.

Application

1. Line follower
2. Spy Gadgets
3. IR Sensor Detector
4. Bomb Diffuser
5. Land Rover Machines etc.

4

Low-Cost Portable Solar Water Disinfection System

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Introduction

We know that water in sufficient quantity and good quality is essential for life. However, though availability of safe drinking water for everyone throughout the year is an urgent need, it remains an unsolved problem. People rely on streams, rivers, ponds, rainwater from roofs, public cisterns, unreliable wells or fountain water. Since children are especially vulnerable to water-borne diseases caused by pathogens (e.g. typhoid, cholera, diarrhoea, dysentery etc.), it is a major cause of infant and children mortality. Therefore, Low-cost water purification techniques are required to provide safe drinking water. Such techniques, preferably applied at household level, e.g. boiling, chlorination, filtration, seem to be more feasible and their implementation more likely to be effective and sustainable. Among the home-based water treatment methods, Low-cost Portable Solar Water Disinfection System - developed and constructed under the principles which are already used in

Solar Water Disinfection (SODIS), recognised by WHO, and about which EAWAG/SANDEC (Swiss Federal Institute for Environmental Science and Technology) started worldwide SODIS dissemination to promote this method in areas where safe water is unavailable, is an attempt to provide safe drinking water with one time low cost investment and portable, durable and useable anywhere.

Scientific Principles Involved

1. UV-A interferes directly with the metabolism and destroys cell structures of bacteria.
2. UV-A (wavelength 320-400 nm) reacts with oxygen dissolved in the water and produces highly reactive forms of oxygen (oxygen free radicals and hydrogen peroxides) that are believed to also damage pathogens.
3. Cumulative solar energy (including the infrared radiation component) heats the water. If the water temperature rises above 50° C (122° F), the disinfection process is three times faster.

At a water temperature of about 30° C (86° F), a threshold solar irradiance of at least 500 W/m^2 (all spectral light) is required for about 5 hours for SODIS to be efficeint. This dose contains energy of 555 Wh/m^2 in the range of UV-A and violet light, 350-450 nm, corresponding to about 6 hours of mid-latitude mid-day summer sunshine.

At water temperatures higher than 45° C (113° F), synergistic effects of UV radiation and temperature further enhance the disinfection efficiency.

Materials Required

Wooden frame of length 22 inches, width 8 inches and height 14 inches, Aluminium sheets/stainless steel of dimension 22 × 18 inches, UV-light transmissible glass less than 2 mm (Pyrex, corex, vycor, quartz) of dimension 21 × 12 inches, two steel handles, nails, plywood (3mm) of dimension 22 × 14 inches, PET bottles, etc.

Construction and Working

The innovative Low-cost portable Solar Water Disinfection System is constructed with a Wooden frame of lenght 22 inches, width 8 inches and height 14 inches and five sided by ply and wooden plank. Aluminium sheet (or stainless steel) of dimension 22 × 18

inches and 12 × 8 inches are fixed on backside (inside) and other two sides in curvature shape. On the front a glass sheet (pyrex or corex or vycor or quartz) of dimension 21 × 12 inches having horizontal sliding arrangement with a knob is fitted (this glass enclosure will protect the glass bottles from cooling down due to outside wind). There are two small wooden columns in the middle so that PET bottles should not fall. On the backside a stand is fixed which will help the unit to be placed according to the latitude of the place for maximum exposed to solar radiation (Fig. 4.1).

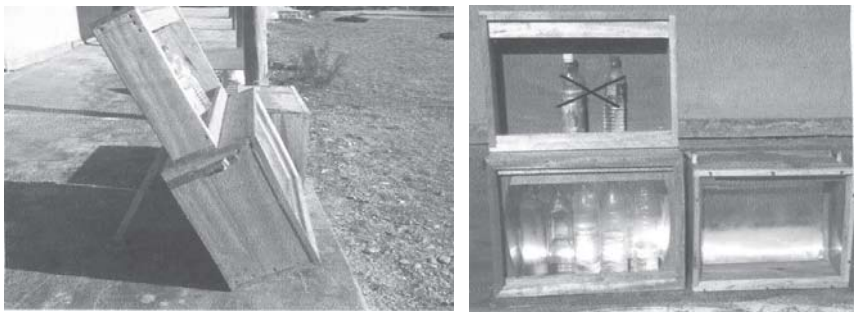

Fig. 4.1: Construction of the Exhibit

In this solar water disinfection system, plastic PET (Polyethylene Terephtalate) bottles are used. Bottles are washed well before they are used. The bottles are filled 3/4 full with clean water and shaken 20 seconds after which they are filled fully and lids are closed. Such bottles are kept inside and the front glass is closed and finally exposed to sunlight at least 6 hours. Such water is ready for consumption.

ADVANTAGES

1. It provides safe drinking water under one's own control and responsibility.
2. It is low-cost, portable, durable and usable forever.
3. It minimises to use firewood and kerosene / gas.
4. It reduces air Pollution, deforestation and enviornment problem.
5. It improves family health and reduces household expenditures.
6. The poorest family can afford it.

Limitations

1. It requires sufficient solar radiation. Therefore it depends on the weather and climatic conditions.
2. It requires clear water.
3. It does not change the chemical quality of water.

Application

It can be used anywhere to make potable water.

5

Testing of Quepem Canal Water for Heavy Metals

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Introduction

Our Hypothesis was that the Quepem canal water contained high content of heavy metal like manganese, iron, nickel, chromium, cadmium, lead, due to manganese and iron mines in and around Sanguem and Quepem Taluka.

Rationale

We decided to test the Quepem canal water which is used for growing paddy crops and to bring awareness due to the news some months back that drinking water from Salaulim dam was high in manganese.

Scientific Principle Involved

The trace elements concentrated in an irregular way are usually metals especially the heavy metals density > 6g cc^{-1} .

Heavy metals are the natural components of the earth's crust. The term heavy metals refers to any metallic chemical elements that has a relatively high density and is toxic or poisonous at low concentration e.g. mercury, cadmium, arsenic, chromium, thallium, lead, manganese etc. The heavy metals at relatively high density are toxic at low concentration and can even cause death. They can neither be created nor destroyed nor can be transformed into another. Some are essential for life process but all are toxic to organisms at higher concetration.

Metallic contaminants (Hg, Pb, Zn, As, Cd, Mn, Cr, Na, K, Cu, etc.) destroy the bacteria and beneficial micro-organisms in the soil. Heavy metal leads to precipitate phosphate compounds and catalyze their decomposition and are non-degradable poisons and their accumulation in soil for a long period will destroy the living organisms.

METHODOLOGY

We collected water from Quepem canal on 17th January and gave for testing in Goa state Pollution Control Board, Panjim for the following parameters:

- Iron
- Manganese
- Cadmuim
- Lead
- Chromium
- Nickel
- Simultaneously, we collected the paddy seed (Jyoti) from the south zone Agricultural Department, Margao and soaked them in water for a might and left them to sprout.
- Same day (18 Jan) we collected clayey soil from the fields, dried and powdered it. Then we filled in 20 plastic cups and kept ready for the experiment to perform.
- We went to Shantudurga Scientific Tradess in Margao and purchased Manganese sulphate ($MnSo_4$) and we weighed 80mg, 90mg, 100mg, 110mg, 120mg, 130mg, 140mg, 150mg, 160mg, 170mg, 180mg, 190mg, 200mg, 210mg, 220mg, 230mg, 240mg and 250mg of $MnSo_4$ on his electronic balance with least count 0.01 gm.
- We mixed 80, 90 ----- 250 mg of $MnSo_4$ in the clay and refilled the plastic cups. Next we sowed the germinated paddy seeds in the clay plastic cups on 24 January 2013 and observed the growth of paddy seeds subsequently same day we weighed about 5gm of Manganese sulphate added to one contatiner clay and sowed sees in it and we also had

a container with paddy seeds as a control pot without any manganese sulphate.

We collected the results of the canal (Quepem) water from Goa State Pollution Control Board on 28 January 2013.

Data Analysis

Result of Quepem Canal water testing by Goa State Pollution Control Board.

We saw that cadmium is just at the permissible limits that is 0.01 mg/litre. Rest are within permissible limit except manganese which is 1.61 mg/litre which is very high as compared to the permissible limit of 0.20 mg/litre.

1. **Cadmium** is just at the permissible limit, that is, 0.01mg/l.
2. **Nickel** is below its permissible limit it is 0.03 mg/l and its permissible limit is 0.20.
3. **Chromium** is not present in the Salaulim canal water.
4. **Lead** is not more than 5.00 mg/l which is its permissible limit. It is only 0.09 mg/l.
5. **Iron** is also less than its permissible limit, that is, 5.00 mg/l. It is only 0.34 mg/l.
6. **Mangenese** is very high 1.61mg/l as compared to its permissible limit 0.20

Parameters	Units	Test Result	Permissible Units
Cadmium as Cd	mg/l	0.01	0.01
Nickel as Ni	mg/l	0.03	0.20
Chromium as Cr	mg/l	N.D.	0.10
Lead as Pb	mg/l	0.09	5.00
Iron as Fe	mg/l	0.34	5.00
Manganese as Mn	mg/l	1.61	0.20

Analysis of the Plants

The container with 80-250 mg/l of manganese sulphate did not show any harmful effects on the Jyoti rice growth for eight day. Effects were seen on the container with 5 mg/l of manganese sulphate as the growth of the plants was stunted as compared to the control container with no manganese sulphate.

It appears that manganese is being observed by the plant tissue and it enters human food chain causing biological magnification.

Conclusion

Quepem Salaulim canal water is contaminated with heavy metal manganese which is harmful to the plants, humans and animals.

These manganese heavy metal may be collected (accumulated) in the plant tissue which will be passed on to other living organism like cows and humans through the grains, milk and fish causing biological magnification.

Inference

The Salaulim river water canal is contaminated with the heavy metal manganese. So we infer that the salaulim river water is contaminated with manganese as this Quepem canal gets water from the dam built on the river Salaulim.

The manganese may be absorbed by the plants and present in the plant tissue.

Effects of Manganese on Humans

- Affects the central nervous system causing Manganism resembling the Parkinson syndrome.
- Damage respiratory system and eyes.
- Behavior disorders.

Effects of Manganese on Plants

- Affects the flowering and fruits.
- Causes marginal chlorosis.
- Manganese in acidic soil reduces nitrogen fixing capacity.
- Absorption of iron increases with increasing concentration of manganese in soil.
- Manganese stops zinc absorption by plant roots.
- The application of molybdenum decreases the concentration of copper and manganese.

Solutions for Manganese Effect on Plants

- Phosphorous calcium affords to plants from manganese.
- Application of potassium consistently decreases the manganese and iron content in rice fields.
- Copper decreases content of iron and manganese in submerged soils.
- Grow *Vetivera zizanioides* in the fields as they absorb heavy metals.
- Also grow Water Hyacinths as they absorb heavy metals.

6

Solar Grain Dryer

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Introduction

Solar energy has been used since time immemorial by man for his energy needs. We can say that food drying is a very simple ancient skill. It requires a safe place to spread the food where dry air in large quantities can pass over. Sun is often used to provide the hot dry air. Dry, clean air including dry cold air from any source will dehydrate food.

Rationale

Traditionally solar energy has been used to dry agricultural products by spreading them on the ground in open sun. This method of open sun drying is very time consuming. Also the product gets contaminated by dirt and insects. The use of solar dryers overcome these problems to large extent. Solar dryers make use of solar heated air for drying agricultural products. Usually we see that people dry the grains in open space by spreading them on the floor or on the roofs, but by doing so the food gets

contaminated by rodents, insects, dirt etc. The same food that we take in is very risky. The main purpose behind the construction of the model is to provide a safer, easier and faster way of drying the grains. Also in big industries where the quantity of produce is more and harmful techniques like radiation are used to dry them, these solar dryers can play a very important role. These solar dryers are very low cost. Even a middle class farmer can also make them at a cost of a few hundred rupees and can use them for many years. Use of solar dryers for agriculture purpose in developing countries like India has a wide scope as water for irrigation is available for us for a few days on counting system and we have a limited time to save our crops after harvesting and to sowing next crops. This time shortage problem can be overcome by using low cost solar dryers because they dry the crops which need 7 days for drying, in 7 hours. Another factor that is very important to remember (which is one of the major reasons to use solar dryers) is our regional weather, which is severe and not reliable and destroys a substantial amount of our food, vegetables and crops. This solar dryer can be used on a small scale in our houses and on a large scale in the industries. Only there is a need of a few modifications such as in place of manual input of the hot air there must be a faster and safer way like using an air pump. Apart from these advantages these solar dryers can be used for drying pulses also.

Scientific Principle Involved

Solar dryers make use of solar heated air for drying agricultural products. The air in the heater gets heated up by the solar radiations and when we blow the air it will pass through the pipe into the drying chamber. As hot air rises upwards it will absorb moisture from different layers of grains.

Materials Required

Hard Cardboard	Binding wire	White adhesive
M-Seal	Oil Paint	Motor
Battery	Blower	Plain glass
Plane Mirror	Wooden Box	Plastic-Pipe
Rubber Sheet	Wire	Thermocol Sheet
Net	Plywood	Sand
Iron Stand		

CONSTRUCTION

1. Take a cubical wooden box and fix mirror on its lid and the plane glass on its open surface temporarily (Fig. 6.1).
2. For making the drying chamber take an iron stand and fix the cardboard on its four sides with the help of a binding wire.
3. Make sufficient passage on one of its side so that trays should be properly inserted.
4. Take a piece of thermocol sheet and fix it on the bottom of the drying chamber.
5. Apply M-seal on all the four edges carefully so that it would get packed properly and make a hole on the lower part of one side
6. Make a fan by using cardboard and motar and connect it to a battery and fit on the top of the drying chamber in the inward direction.
7. Make three holes on the wooden box, two on one side and one on the side opposite to it.
8. Fix the blower in one of the holes on the side where two holes are made on the same side, fix the rubber sheet on the other hole from inside so that it would act as a valve.
9. Connect pipe from the solar heater to the drying chamber, fix it properly.
10. Fill sand in the heater and place it in the sun. Load the grain trays and blow air through the blower.

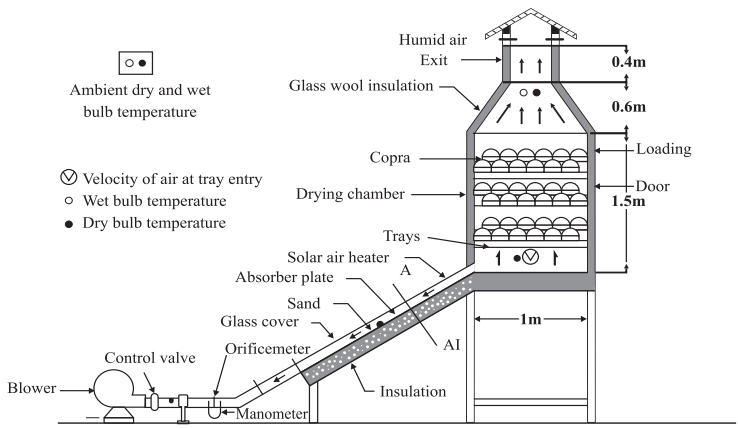

Fig. 6.1: Line Diagram of the Exhibit

Working

Place the model in the sun. Fill sand in the heater and put the grains into the trays. Open the lid of the heater and let the air in, the heater become hot. Insert the trays in the drying chamber. Switch on the fan and blow air through the blower. After some time the grains will be dry.

Application

It is used for drying agricultural products.

7

Removal of Dyes from Waste Water of Dyeing Industry by Emulsion Liquid Membrane Technology

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Maya N. Sethia

Introduction

Surat is known for its textile and diamond industries. Surat adds colour in day-to-day life all over the world. The disadvantage of dyeing industry is the 'Water Pollution'. The waste water which is pretreated is finally discharged into the natural stream. This waste water contains colour which is rich in carcinogenic Aromatic Dyes and Heavy Metals. This has become a major environmental concern. The conventional methods for removal of colour, heavy metals are adsorption, filtration using nanofiltration, ultra filtration and reverse osmosis etc. The drawbacks of this technology are: low mass transfer rate, low selectivity, large equipment size, membrane fouling etc. The presence of carcinogenic aromatic amines and heavy metals in extremely low concentrations cannot be removed by the above methods. These can be successfully removed by ELM methods.

In order to develop a novel effective separation process, which is expected to be more energy saving and economical, the liquid membrane (LM) separation method has been studied. Li made the first attempt at the separation of hydrocarbons by emulsion liquid membranes (ELMs) in 1968.

Scientific Principle Involved

Solute is transported by liquid membrane diffusion partition mechanism.

The membrane is a thin layer of liquid between two liquid phases. Solute is transported by a partition - diffusion-partition membrane.

Separation and recovery of different heavy metal ions, organic acids, bases and hydrocarbons, biocompounds can be achieved by this technique.

Phase 1	Membrane	Phase 2

Materials Required

1. Beakers
2. Blender [Agitator High Speed]
3. Magnetic Stirrer [Agitator Low Speed]
4. Pulley Systems
5. Electric Motor
6. Plastic Containers
7. Filter Papers and Funnels

Chemicals

1. n-heptane
2. Dil. HCL
3. Dil. NaOH
4. Span 80
5. Ferrous Sulphate
6. Calcium hydroxide
7. Dyes
8. Methylene blue

Scientific Principle Involved

In the above project liquid membrane as double emulsion is used.

It can achieve higher mass transfer area as compared to bulk liquid membrane or supported liquid membrane.

W/O/W Type of double emulsion is used : Water in oil emulsion dispersed in external aqueous phase. The membrane phase is the immiscible oil phase separating the aqueous phase.

Major significance of liquid membrane processes are occurrence of simultaneous extraction and stripping involving a selective membrane phase. Separation is achieved by permeation of solute through this liquid phase from a feed phase to a receiving phase. The feed and receiving phase are normally miscible while the membrane phase is immiscible.

The water is removed and the gelatinous substance i.e. W/O/W emulsion with the impurities is decemulsified.

Construction and Working

1. Washing of grey cloth to remove grease and dirt in hot water.
2. Dyeing of grey cloth.
3. Removal of Waste water.

Purification of Waste Water

1. Treatment of waste water with $Ca(OH)_2$ or $FeSO_4$.
2. Preparation of emulsion by using n-heptane, dil.HCL or dil.NaOH and Span-80 using high speed agitator.
3. Treatment of pre-treated waste water with emulsion using magnetic stirrer [low speed agitator].
4. Separation of pure water and insoluble part in the settling tank.
5. Recovery of pure water by filtration.
6. Testing of water.
7. The electrostatic de-emulsification techniques are: heat treatment, phase dilution and high shear.
8. The purified water can be used as shown in Fig. 7.1.

Advantages of Elm

1. Simple operation
2. High efficiency
3. Extraction and stripping in one stage: Extraction is change of thin to thick phase; stripping is change of thick phase to thin phase.

The Methods of De-emulsification

- Electrostatic de-emulsification technique
- Heat treatment
- Phase dilution
- High shear
- Finally the solid waste is sent to the solid disposable plant.

LIMITATIONS

Stability of emulsion is affected by two phenomenon – Globule Rupture and Osmotic Swell:

1. Saves Energy
2. Cost Effective
3. Continuous operation of industry
4. Purification of water
5. Removal of carcinogenic substance upto required standards.
6. Save water towards greener earth.

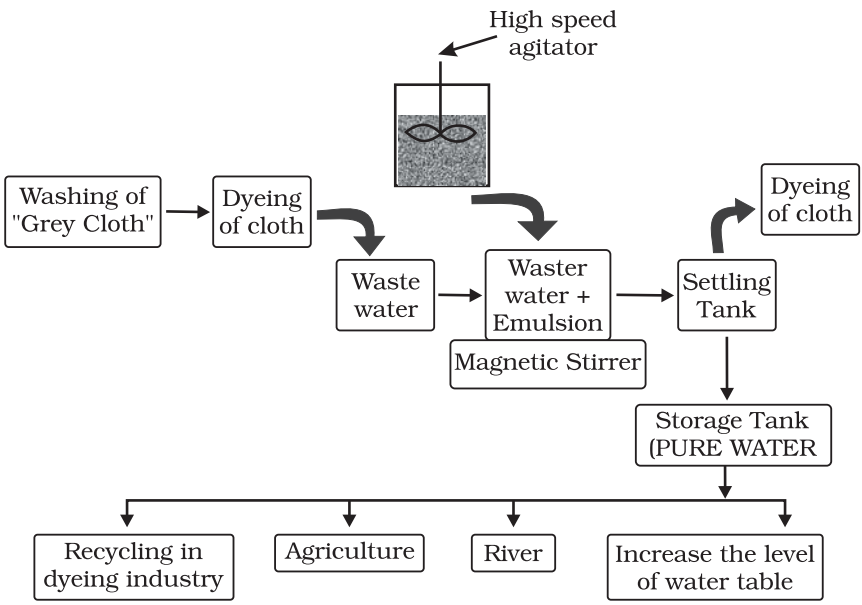

Fig. 7.1: Flow Chart of the Exhibit

8

Molten Salt Solar Technology

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Introduction

Molten salt solar plant is a rich source of electricity, fuel and fertilizer. So using this plant we can cut-short the shortage of electricity, fuel and fertilizer.

Materials Required

1. PVC Pipe
2. Joints and Bents
3. Plastic Bottle
4. Cardboard Box
5. Paint
6. Decoration Paper

Description

The salt storage medium is a mixture of 60 per cent sodium nitrate and potassium nitrate. This salt is stored in a receiver at the top of the solar power tower. The salt medium is heated to 565 ^{0}C (1049 ^{0}F) by concentrating sunrays towards the receiver using heliostat. [The heliostat is made up of convex lens and it can concentrate sunrays to a fixed point and it can absorb and radiate sunrays very effectively because of the presence of silica gel]. The molten

salt then reaches the hot salt storage tank. From this tank the liquid salt is pumped to the steam-generator to convert liquid salt into vapour through Superheater. This vapour is used to rotate generator system. HP turbine (High Power Turbine) rotates using superheated steam of molten salt produces 20 - 30 MV/day. This steam again passes through LP turbine (Low Power Turbine) and produces about 10-15 MV/day. After this process vapourised salt is cooled with the help of condenser and it is stored in cold salt storage tank.

When the receiver is heated to 290 ^{0}C (554 ^{0}F) the salt is stored in the cold salt storage tank after a series of cyclic process and it is again pumped to the receiver and is heated at 565 ^{o}C (1049 ^{o}F). It is a re-cyclic process.

During a day the plant produces 40-50MV. The annual capacity of plant is 1080 GV (Fig. 8.1).

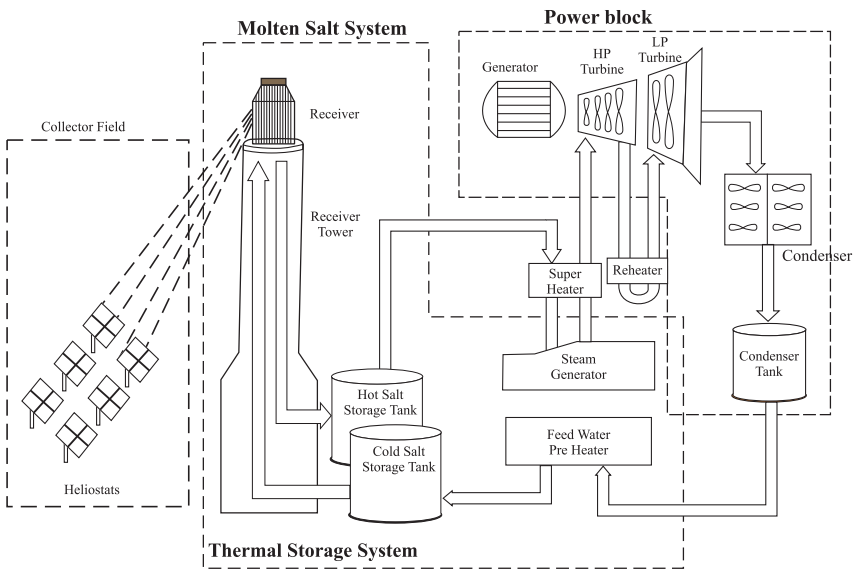

Fig. 8.1: Construction of the Exhibit

The maximum output is at 1:00 pm and the process continues to generate power until 11:00 pm. This is because the steam pipe can hold heat remain for 13 hours which is mild carbon steel.

Using feed water Pre-heater we can separate potassium and nitrate which can be used as fertilizers which are very essential for the growth of plants.

Using HRSG (Heat Recovering Steam Generator) system plant can produce fuel also.

Parts of the Plant

1. Heliostats
2. Receiver Tower
3. Cold salt storage tank
4. Steam Generator
5. HP and LP Turbine
6. Condenser
7. Receiver
8. Hot salt storage tank
9. Superheater
10. Reheater
11. Generator
12. Feed water preheater

Working of the Parts

1. Heliostats : Concentrates sunrays towards the receiver.
2. Receiver : Stores the mixture of salts (sodium nitrate and potassium nitrate)
3. Hot Salt Storage Tank : Stores hot molten salt
4. Cold Salt Storage Tank : Stores cooled molten salt
5. Super Heater and Reheater : Reheat the molten salt
6. Steam Generator : Evaporates molten salt
7. Condenser : Condenses molten salt vapours
8. Generator : Generates power

Advantages of the Plant

- Eco-Friendly Plant.
- Hot salt storage tank and cold salt storage can absorb poisonous gases because of the presence of carbon in the mild carbon steel which is used to make the tank.
- It can produce large amount of electricity which is required for all the purpose in a country.
- The plant can also produce fertilisers and fuel.

9

Flow of Liquid

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Introduction

This project explains the measurement of flowing water from high level to low level in a stream, canal, river etc. We can measure the actual quantity of flowing water in cusec. This will lead to the proper use of water for commercial and daily use like in irrigation. Also, it will help in the proper distribution of water among the people.

Rationale

Water problem is being faced now a days in the society. We don't have the proper information about what quantity of water we use or waste through a source. This project can explain how much water we use and the quantity of water we waste. This project helps us in understanding the commercial unit of measuring water like cusec. At the time of floods people come to know how much quantity of water is reaching them in a unit of time.

Apparatus

A metal cuboid open from two faces, thermocol sheet, decorating material, bucket, water container etc.

Construction

On a rectangular platform, place the water container in such a way that its opening valve opens at the closed end of the cuboid type canal which is placed under it. The canal type cuboid is placed in such a way that it's one end is placed high with respect to another open end. Water falls in the high end and flows to lower end.

Working

When water falls at higher end in canal, this water gains some potential energy because of height with respect to another end. This potential energy of water is converted into kinetic energy. This kinetic energy leads to the velocity of water in such a way:

$$mgh = \frac{1}{2}mv^2$$

$$v=(2gh)^{1/2}$$

From the above we get velocity with which the water flows. Now, we have to calculate how much volume of water is flowing per second from a point. This can be calculated by multiplying the velocity of water with the breadth of canal and height/level of water at which it is flowing, that is:

$$\text{Volume of Water} = \text{Velocity of Water} \times \text{Breadth of Canal} \times \text{Level of Water}$$

10

Imagination Redefined as Mathematics

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Introduction

To understand any complex system, we need to divide it into simpler parts and master them, making the system easier to understand. Hence by understanding simple items we can understand the complex system.

"The Key of mastery is simplicity".

"Mathematics is the mother of all sciences".

To demonstrate the above idea we approach as follows:

Objects with different shapes like sphere, cube, and cylinder having equal voulme are used. The objective is to fill these objects with balls of equal volumes and to find:

- Whether object of equal volume would accommodate equal number of small balls?
- What is the amount of void volume in each shape?

- If we reduce the volume (size) of small balls, does void volume reduce?
- What are the different ways of filling the balls and what would be the void voulme of space?

Applications

This concept is useful in medical industries, chemical industries, research and it is mainly used in Reactors. There are two types of reactors viz., Thermal Reactors and Fast Breeder Reactors.

1. Thermal Reactors

Natural uranium (i.e. U^{235}) 0.7 per cent is used in thermal reactors. The nuclear fuel geometry in case of thermal reactors is optimised based on the fuel used to moderator ratio. Hence, nuclear reactor designers use square pitch for their fuel configuration in case of thermal reactor.

2. Fast Breeder Reactor

In case of fast breeder reactor we do not use moderator and the fast neutrons as they are elaboratly used for fusion reaction in there. Hence, fuel has to be placed in a very tight geometry to avoid any neutron leakage.

Hence, reactor designer use triangular pitch for their fuel configuration, in the case of fast breeder reactor.

Conclusion

Hence, our project can even make nuclear scientist who has designed successful fast breeder reactor in the world to rethink about present triangular pitch that I suggest.

In this reactor there are two compounds-plutionium and uranium - the fertile U-238 get converted to fissile Pu- 239 during rector operation, Surrounding the fuels sections in the core, in the radial direction are the sub-assemblies of the fertile Th-232. This is the breeding blanket that generates U-233. In this reactor the neutrons are in their own speed and the percentage of Uranium is almost 20 per cent to 30 per cent. Therefore, the void space between the two neutrons is very less. So that the leakage of neutrons is very less. Even the leaked neutrons go and get bombarded with U-238 and are converted to fissile Pu-239 during reactor operation, in this operation as the void volume reduces, the leakage of neutrons is very less.

Calculations

Step I (Cube)

Let us consider a cube with side = 5 cm

Volume of the cube = 125 cm^3

Now let us spread 125 balls properly in 5 × 5 × 5 matrix.

Volume of 125 balls = 65.75 cm^3

Void volume = 125 – 65.75

= 59.75 cm^3

Percentage of void volume = $\frac{65.75}{125} \times 100$

If the balls are spread balls in random lattice, 136 balls can be accommodated.

Volume of 136 balls = 70.99 cm^3

Percentage of void volume = $\frac{70.99}{125} \times 100$

= 56.8%

100-56.8% = 43.2%

Step II (Sphere)

Let us consider a sphere with diameter = 6.2 cm

Volume of sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3} \times 3.14 \times (3.1)^3$

= 125 cm^3 (approx.)

If the sphere is filled with small balls in a regular lattice (i.e, asumming that the small sphere occupy the space of a cube having the side length equal to the diameter of the small sphere including the void volume.) then it can accommodate 116 small spheres in it.

It the sphere is filled with small ball in a random lattice (random manner) then the sphere can accommodate 124 balls.

Step III (Cylinder)

Let us consider a cylinder with diameter = 6.2 cm

Height of the cylinder = h = 4.45 cm

Volume of the cylinder = $\pi r^2 h$

= $3.14 \times (3.1)^2 \times 4.42$

= 125 cm^3 (approx.)

If the cylinder is filled with small balls in a regular lattice then it can accommodate 108 small spheres in it, consisting of 27 balls in each layer with 4 layers. When the cylinder is filled in regular lattice, 0.42 cm height of the cylinder will be left empty. If the cylinder is filled with small balls in a random lattice (random manner) then the cylinder can accommodate 136 balls.

11

GREEN BUILDING

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INTRODUCTION

Green Buildings are designed to reduce the overall impact of the built environment on human health and natural environment by efficiently using natural energy, water and other resources and by reducing waste, pollution and global warming.

Green buildings are considered to be the 21st century's buildings. Main reason of global warming is carbon dioxide. 80 percent of CO_2 is produced at the time of construction of buildings. Inside the concrete house the temperature is 39°C to 40°C while outside temperature is 35°C. Inside is very hot but in green building we feel very cool.

SCIENTIFIC PRINCIPLE INVOLVED

Principle of green building is "reuse, reduce and recycle". By remembering this mantra we can save our earth and health. All the materials used for the building can be reused.

The green buildings have rainwater harvesting, portable biogas plant, electricity from hybrid energy-system that is from wind and sunlight and kitchen garden.

Materials Required

Cardboard sheets, plastic bottle, p.v.c pipe, fan, artificial grass, water colour and fevicol.

Construction

Rain water harvesting cement tank is made underground. On top of the tank there are grasses and stone bricks. When the tank is filled, water will go to the well. All pipes are connected on the underground. Portable biogas plant that can be shifted from one place to another is in place. Kitchen waste can be used for this. From this we will get cooking gas and the slurry can be used in kitchen garden. We get electricity from hybrid energy system that is from wind and electricity at night and in summer and sunny days we can produce electricity from solar energy (Fig. 11.1).

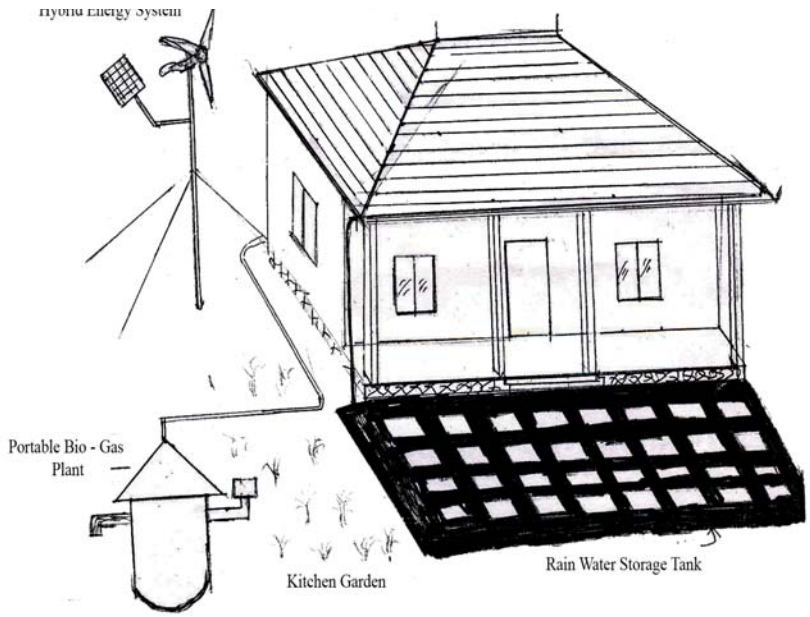

Fig. 11.1: Construction of Green Building

12

A Method for the Preventive Measures against Damages of Bridges

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Introduction

In this project we are trying to exhibit an innovative idea for efficient management of road, rail, water and air transport ystems.

Rationale

Now-a-days, we come across some incidents where vehicles get overloaded and for that reason bridges are damaged and we face a lot of problems in transportation due to such man made hazard. But here we have an unique idea to save people and properties and to make them aware about the capacity of bridges to take loads.

Scientific Principle Involved

The model is based on the principle that overloaded bridges in which weighing machine is located below the bridges and both alarm and signal machines are also connected which convey signal

and produces an alarm sound at a time when overloaded vehicles pass over that point.

Materials Required

1. Electrical Wires
2. Signal and Alarm Post
3. Battery
4. Solar Panel
5. Vehicle (Toy)
6. Fabric Colours

Construction and Working

The system comprises of solar panel, weighing machine and an alarm machine. There is a solar panel which is connected to a battery. The solar panel absorbs sunlight and then converts it to electrical energy which is stored in the battery as DC power. This supplies power to the alarm and weighing machine. Alarm machine is connected to a weighing machine which is located below the bridge at both the sides of the bridge and it is fixed at the point of ten tonnes. Some wires coming from weighing machine are connected to the battery and some are connected to the alarm as well as signal post. The alarm post is again connected to the battery. When any vehicle more than 10 tonnes passes over this weighing machine, it immediately conveys the information to the alarm machine and then an alarm rings. Thus, a person can understand that his vehicle is overloaded.

Significance

Some of the significance of this method are as follows:

1. It will safeguard the lives and properties of people.
2. It will save both money, time and labour.
3. As some people unknowingly overload their vehicles, it will be helpful to them to be aware about the possible accidents.
4. As it works automatically, no extra effort is needed.
5. Many people are illiterate in our society. It will be of no use to them if any warning board is kept on the roadside. But this method will be helpful to them.

Conclusion

This enables us to understand our fault and to take necessary precautions to avoid such man-made calamities.

13

SOLAR AC

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INTRODUCTION

This exhibit can help us to meet the challenge of scarcity of electricity and reduce global warming by reducing the use of electriciy.

MATERIALS REQUIRED

Wood, water pipes, brick stones, storage box and black paint.

CONSTRUCTION

A small house of wood is made. A black painted chimney is connected inside from the roof of the house. An underground one meter deep hole is dug out from the house. The hole is connected with a water pipe to the house floor and hole. Hole is provided with brick stones and water.

WORKING

During day time the sunlight falls on chimney as a result the temperature of the chimney rises. We know that hot air rises up. As a result of very high temperature inside the chimney, the air

inside the chimney comes out into the atmosphere and a suction is created behind. In this way, hot air from inside the building is exhausted. As the pipe is connected with a brick box containing water, to overcome the suction created in the building, the air comes from the brick box in the building through the inlet pipe. When air flows over water, it carries moisture along with it. This makes the room cool. Thus natural AC is made without any use of electricity.

A solar chimney can serve many purposes. Direct gain is it warms air inside the chimney causing it to rise up the top and drawing air from the bottom. This air drawn can be used to ventilate a home or office, to draw air through a geothermal heat exhange, or to ventilate only a specific area such as a composting toilet.

Natural ventilation can be created by providing vents in the upper level of a building to allow warm air to rise by convection and escape to the outside. At the same time cooler can be drawn in through vents at the lower level. Trees may be planted on that side of the building to provide shade for cooler outside air.

This natural ventilation process can be augmented by a solar chimney. The chimney has to be higher than the roof level and has to be constructed on the wall facing the direction of the sun. Absorption of heat from the sun can be increased by using a glazed surface on the side facing the sun. Heat absorbing material can be used on the opposite side. The size of the heat absorbing surface is more important than the diameter of the chimney.

To further maximise the cooling effect, the incoming air may be led through under ground ducts before it is allowed to enter the building. The chimney can be improved by intergranting it with a trombe wall.

The use of solar chimney may benefit natural ventilation and passive cooling strategies of building thus help reduce energy use, CO_2 emission and pollution in general. Solar chimney are painted black so that they absorb the sun heat more easily and efficiently. When the air inside the chimney is heated, it rises and pulls cold air out from under the ground via heat exchange tubes.

Air conditioning and mechanical ventilation have been used for decades as the standard method of environmental control in many building types, especially office, in developed countries. Pollution and reallocating energy supplies have led to a new environmental approach in building designs. The solar chimney is one of these concepts currently explored by scientists as well as designers, mostly through research and experiment.

Advantages

1. It saves electricity, economic in use and efficient.
2. It can reduce global warming.
3. It can utilise the heat energy trapped in desert area.
4. It uses a non-conventional source of energy.

14

PROJECT ON ELECTRONICS

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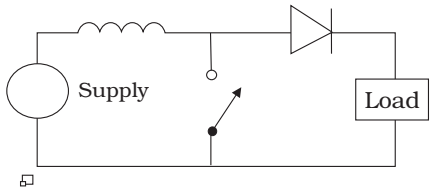
INTRODUCTION

A Switched-Mode Power Supply (SMPS) or switcher is an electronic power supply that incorporates as switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a source, like mains power to a load, such as a personal computer while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimises wasted energy. Ideally, a switched-mode power supply dissipates no power.

Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight are required. They are, however, more complicated; their switching currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor. In contrast, a switched-mode power supply regulates either output voltage or current by switching ideal storage elements, like

inductors and capacitors, into and out of different electrical configurations. Ideal switching elements (e.g., transistors operated outside of their active mode) have no resistance when 'Closed' and carry no current when 'Open', and so the converters can theoretically operate with 100 per cent efficiency (i.e., all input power is delivered to the load; no power is wasted as dissipated heat).

In an SMPS, the output current flow depends on the input power signal, the storage elements and circuit topologies used, and also on the pattern used (e.g., pulse-width modulation with an adjustable duty cycle) to drive the switching elements. The spectral density of these switching waveforms has energy concentrated at relatively high frequencies. As such, switching transients and ripple introduced onto the output waveforms can be filtered with small LC filters.



Advantages and Disadvantages

The main advantage of this method is greater efficiency because the switching transistor dissipates little power when it is outside of its active region (i.e., when the transistor acts like a switch and either has a negligible voltage drop across it or a negligible current through it). Other advantages include smaller size and lighter weight (from the elimination of low frequency transformers which have a high weight) and lower heat generation due to higher efficiency. Disadvantages include greater complexity, the generation of high-amplitude, high-frequency energy that the low-pass filter must block to avoid Electromagnetic Interference (EMI), a ripple voltage at the switching frequency and the harmonic frequencies thereof.

Very low cost SMPSs may couple electrical switching noise back onto the mains power line, causing interference with A/V equipment connected to the same phase. Non-power-factor-corrected SMPSs also cause harmonic distortion.

SMPS and Linear Power Supply Comparison

There are two main types of regulated power supplies available: SMPS and linear. The following table compares linear regulated and unregulated AC-to-DC supplies with switching regulators in general:

	Linear Power Supply	Switching Power Supply	Notes
Output voltage	With transformer used, any voltages available; if transformer less, not exceeding input. If unregulated, voltage varies significantly with load.	Any voltages available, limited only by transistor breakdown voltages in many circuits. Voltage varies little with load.	A SMPS can usually cope with wider variation of input before the output voltage changes.
Efficiency, heat, and power dissipation.	If regulated: efficiency largely depends on voltage difference between input and output; output voltage is regulated by dissipating excess power as heat resulting in a typical efficiency of 30-40 per cent. If unregulated; iron and copper losses in transformer may be the only significant sources of inefficiency.	Output is regulated using duty cycle control; the transistors are switched fully on or fully off, so very little resistive losses between input and the load. The only heat generated is in the non-ideal aspects of the components and quiescent current in the control circuitry.	Switching losses in the transistors (especially) in the short part of each cycle when the device is partially on), on-resistance of the switching transistors, equivalent series resistance in the inductor and capacitors, and core losses in the inductor, and rectifier voltage drop contribute to a typical efficiency of 70-80 per cent. However, by optimizing SMPS design (such as choosing the optimal switching frequency, avoiding saturation of inductors, and active rectification), the amount of power loss and heat can be minimized; a good design can have an efficiency of 95 per cent.
Electronic cause at the output terminals.	Unregulated PSUs may have a little Cripple superimposed upon the DC component at twice mains frequency (100-120 Hz). It can cause audible mains hum in audio equipment, brightness ripple or banded distortions in analog security cameras.	Noisier due to the switching frequency of the SMPS. An unfiltered output may cause glitches in digital circuits or noise in audio circuits.	This can be suppressed with capacitors and other filtering circuitry in the output stage. With a switched mode PSU the switching frequency can be chosen to keep the noise out of the circuits working frequency band (e.g., for audio systems above the range of human hearing)

Input Rectifier Stage

Voltage Converter and Output Rectifier

If the output is required to be isolated form the input, as is usually the case in mains power supplies, the inverted AC is used to drive the primary winding of a high-frequency transformer. This converts the voltage up or down to the required output level on its secondary winding. The output transformer in the block diagram serves this purpose.

If a DC output is required, the AC output from the transformer is rectified. For output voltages above ten volts or so, ordinary silicon diodes are commonly used. For lower voltages, Schottky diodes are commonly used as the rectifier elements; they have the advantages of faster recovery times than silicon diodes (allowing low-loss operation at higher frequencies) and a lower voltage drop when conducting. For even lower output voltages, MOSFETs may be used as synchronous rectifiers; compared to Schottky diodes, these have even lower conducting state voltage drops.

The rectified output is then smoothed by a filter consisting of inductors and capacitors. For higher switching frequencies, components with lower capacitance and inductance are needed.

Power Factor

Simple off-line switched mode power supplies incorporate a simple full-wave rectifier connected to a large energy storing capacitor. Such SMPSs draw current from the AC line in short pulses when the mains instantaneous voltage exceeds the voltage across this capacitor. During the remaining portion of the AC cycle the capacitor provides energy to the power supply.

As a result, the input current of such basic switched mode power supplies has high harmonic content and relatively low power factor. This creates extra load on utility lines, increases heating of building wiring, the utility transformers, and standard AC electric motors, and may cause stability problems in some applications such as in emergency generator systems or aircraft generators. Harmonics can be removed by filtering, but the filters are expensive. Unlike displacement power factor created by linear inductive or capacitive loads, this distortion cannot be corrected by addition of a single linear component. Additional circuits are required to counteract the effect of the brief current pulses. Putting a current regulated boost chopper stage after the off-line rectifier

(to charge the storage capacitor) can correct the power, but increases the complexity and cost.

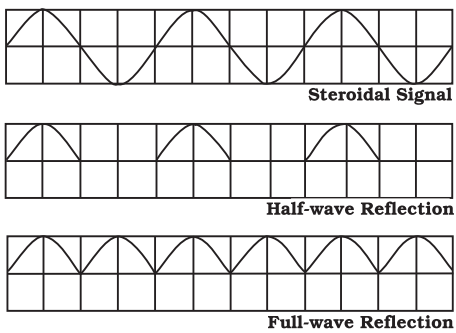
Failure Modes

Power supplies which use capacitors suffering from the capacitor plague may experience premature failure when the capacitance drops to 4 per cent of the original value. This usually causes the switching semiconductor to fail in a conductive way. That may expose connected loads to the full in input volt and current, and precipitate wild oscillations in output.

Failure of the switching transistor is common. Due to the large switching voltages this transistor must handle (around 325 V for a 230 V_{AC} mains supply), these transistors often short out, in turn immediately blowing the main internal power fuse.

Precautions

The main filter capacitor will often store up to 325 Volt long after power cord has been removed from the wall. Not all power supplies contain a small "bleeder" resistor to slowly discharge this capacitor. Any contact with this capacitor may result in a server electrical shock. The primary and secondary side may be connected with a capacitor to reduce EMI and compensate for various capacitive couplings in the converter circuit, where the transformer is one. This may result in electric shock in some cases. The current flowing from line or neutral through a 200 Ω resistor to any accessible part must according to IEC 60950 be less than 250 μ A for IT equipment.



AC, Half-wave and Full-wave Rectified Signals

Applications

A 450 Watt SMPS for use in personal computers with power input, and output cords visible.

Switched-mode power supply units (PSUs) in domestic products such as personal computer often have universal input, meaning that they can accept power from mains supplies throughout the world, although a manual voltage range switch may be required. Switch-mode power supplies can tolerate a wide range of power frequencies and voltages.

In 2006, at an Intel Developers Forum, Google engineers proposed the use of a single 12 V supply inside PCs, due to the high efficiency of switch mode supplies directly on the PCB. Due to their high volumes mobile phone chargers have always been particularly cost sensitive. The first chargers were linear power supplies but they quickly moved to the cost effective ringing choke converter (RCC) SMPS topology, when new levels of efficiency were required. Recently, the demand for even lower no load power requirements in the application has meat fly back topology is being used more widely; primary side sensing flyback controllers are also helping to cut the bill of materials (BOM) by removing secondary-side sensing components such as opt couplers.

Switched-mode power supplies are used for DC to DC conversion as well. In automobiles where heavy vehicles use a nominal 24 V_{DC} cranking supply, 12 Volts for accessories may be furnished through a DC/DC switch-mode supply. This has the advantage over tapping the battery at the 12 position that all the 12 Volt position that all the 12 Volt load is evenly divided over all cells of the 24 Volt battery. In industrial setting such as telecommunications racks, bulk power may be distributed at a low DC voltage (from a battery back up system, for example) and individual equipment items will have DC/DC switched-mode converters to supply whatever voltages are needed.

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INVENTION THROUGH OBSERVATION

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INTRODUCTION

Through observation of rangoli patterns formula for area of a polygon has been derived.

RATIONALE

Rangoli pattern are drawn on the front and back yards in many homes. These paterns contained polygons. By observing the total points on the sides and in the interiors of a polygon it was found that area of a polygon could be found. This was done for all the polygons in the rangoli. This led to development of a formula for the area of a polygon.

SCIENTIFIC PRINCIPLE INVOLVED

If equidistant vertical and horizontal points are taken in a plane then area of polygon of which some of the above points are the vertices is equal to

$$\frac{\text{Total points on sides of polygon}}{2} + \text{Total interior points of polygon} - 1$$

$$\text{i.e. Area of polygon} = \frac{\text{Total points on sides of polygon}}{2} + \text{Total interior points of polygon} - 1$$

$$\text{i.e. Area of polygon} = \frac{\text{Boundary Points}}{2} + \text{Interior Points} - 1$$

Materials Required

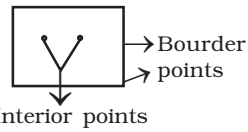
Two boards to verify the formula of 'Area of polygon'. Materials used for each board are Plywood (16" × 7"), 2 woodenplates (16" × 1.5"), 2 woodenplates (12" × 1.5), 45 coloured drawing pins, transparency (4.5" × 7"), thread.

Construction and Working

Draw horizontal and vertical lines at equal distances on plane surfacel Rangoli by joining the points. In that rangoli, there were many polygons. The explanation of this achievement is as followings.

The Rectangle in Rangoli: At first I observe the rectangle in rangoli observations :

Boundary points = Points on sides of polygon.
Interior points = Points inside the polygon.



Here, 1. Boundary points = 10
2. Interior points = 02
3.

$$\text{Area of Rectangle} = \frac{\text{Boundary points}}{2} + \frac{\text{Interior points}}{2}$$

$$= \frac{10}{2} + \frac{2}{2}$$
$$= 5 + 1$$
$$= 6 \text{ sq. Unit}$$

Verification : Area of a square having length of each side on unit is one square unit. Here rectangle is made by six squares. So the area of ractangle is 6 square units.

According to this verification, area of rectangle found by above formula is correct.

One New Rectangle : Now we use formula for new rectangle.
Observations:
Here, Boundary points = 12
Interior points = 03

$$\text{Area of New Rectangle} = \frac{\text{Boundary points}}{2} + \frac{\text{Interior points}}{2}$$

$$= \frac{12}{2} + \frac{3}{2}$$

$$= 6 + 1.5$$

$$= 7.5 \text{ sq. Unit}$$

Verification: But this rectangle is made by eight squares
Area of this rectangle will be 8 square units.
According to this verification, above formula,

$$\text{Area of Rectangle} = \frac{\text{Boundary points}}{2} + \frac{\text{Interior points}}{2}$$

is not true for above new rectangle.

So it can be thought in different manner, that is

$$\frac{\text{Boundary points}}{2} + \text{Interior points}$$

$$= 6 + 3$$
$$= 9 \text{ Square unit}$$

But the area of above rectangle is 08 sq. units

Subtract 1 from 9

The new formula is as follows:

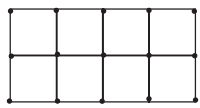
$$\text{Area of Rectangle} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1$$

$$= \frac{12}{2} + 3 - 1$$
$$= 6 + 3 - 1$$
$$= 8 \text{ Square units}$$

Rectangle in Rangoli: Now this new formula is going to be used for rectangle in rangoli:

Here, Boundary points = 10
Interior points = 02
Area of Rectangle

$$= \frac{\text{Boundary points}}{2} + \text{Interior points} - 1$$



$$= \frac{10}{2} + 2 - 1$$
$$= 5 + 2 - 1$$
$$= 6 \text{ Square units}$$

From this, Area of Rectangle $= \frac{\text{Boundary points}}{2} + \text{Interior points} - 1$

This formula is correct for rectangle in rangoli.

Triangle in Rangoli: Now we use this formula for triangle in Rangoli:

Here, Boundary points = 04, Interior points = 00

By this verification,

Area of triangle $= \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$

$$= \frac{4}{2} + 0 - 1$$
$$= 2 + 0 - 1$$
$$= 1 \text{ Square unit}$$

Verification : from this figure,

Area of triangle = 1/2 square unit + 1/2 square unit
= 1 square unit

By this verification,

Area of triangle $= \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$

this formula is also applicable for the area of triangle in rangoli.

Hexagon in Rangoli

Here, Boundary points = 06, Interior points = 02

Area of hexagon $= \frac{\text{Boundary points}}{2} + \text{Interior points} - 1$

$$= \frac{6}{2} + 2 - 1$$
$$= 3 + 2 - 1$$
$$= 4 \text{ Square units}$$

Verification - from figure

Area of Hexagon = 1/2 + 1/2 + 1 + 1 + 1/2 + 1/2
4 square unit

this formula is applicable for the area of Hexagon also.

Star in Rangoli

Here, Boundary points = 12

Interior points = 03

$$\text{Area of this star} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

$$= \frac{12}{2} + 3 - 1$$

$$= 6 + 3 - 1$$

$$= 9 - 1$$

$$= 8 \text{ Square units}$$

Verification : from figure

Area of star = 1/2 + 1/2 + 1/2 + 1/2 + 1/2 + 1/2 + 1/2 + 1/2 + 1 + 1 + 1 + 1 = 8 sq. units

By this verification,

$$\text{Area of star} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

this formula is also applicable for the area of this star.

In this way,

$$\text{Area of polygon} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

this formula is applicable for various polygon, i.e. rectangle, triangle, hexagon and star in rangoli.

Now I made two boards to verify this formula for various polygon other than polygon in rangoli.

PENTAGON

Observation :

Here, Boundary points = 12

Interior points = 07

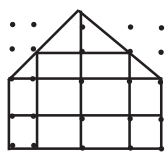
$$\text{Area of pentagan} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

$$= \frac{12}{2} + 3 - 1$$

$$= 6 + 7 - 1$$

$$= 13 - 1$$

$$= 12 \text{ Square units}$$



Verification : from figure,

Area of Pentagon = 1/2 + 1/2 + 1/2 + 1/2 + 10

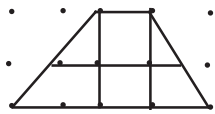
= 12 sq. unit

According to this verification, the formula,

$$\text{Area of this star} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

is also true for above pentagon's area.

TRAPEZIUM



Observation

Here, Boundary points = 10

Interior points = 02

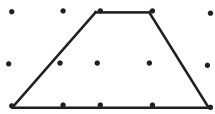
$$\text{Area of trapezium} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

$$= \frac{10}{2} + 2 - 1$$

$$= 5 + 2 - 1$$

$$= 7 - 1$$

$$= 6 \text{ Square units}$$



Verification : from figure,

Area of trapezium = 1/2 + 1/2 + 1/2 + 1/2 + 4

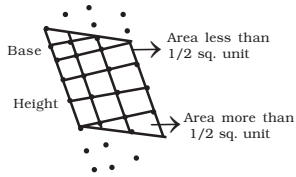
= 6 sq. unit

According to this verification, the formula,

$$\text{Area of trapezium} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

is also correct for above trapezim.

PARALLELOGRAM



Observation

Boundary points = 08

Interior points = 06

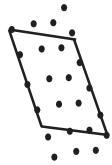
$$\text{Area of parallelogram} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

$$= \frac{8}{2} + 6 - 1$$

$$= 4 + 6 - 1$$

$$= 10 - 1$$

$$= 9 \text{ Square units}$$



VERIFICATION

Here area of some part in parallelogram is less than 1/2 square unit and some part more than 1/2 sq. unit. It is difficult to decide the area of such part by the figure. So I verify the area of such polygon by using corresponding present formula.

Area of parallelogram = Base × Height

= 3 × 3

= 9 square units

According to this verification, the formula,

$$\text{Area of parallelogram} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

is true for above parallelogram.

$$\text{Area of polygon} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1,$$

Then I verified, formula,
The formula proved true for each polygon.

CONCLUSION

After verifying the truthness and correctness of this formula for various polygon. I came to conclusion that if equidstant vertical and horizontal points are taken in a plane then area of polygon of which some of the above points are the vertices is as follow:

$$\text{Area of polygon} = \frac{\text{Boundary points}}{2} + \text{Interior points} - 1.$$

IMPORTANT POINTS

1. Here we must draw horizontal and vertical points at the equal distance on a plane.
2. Some of those points on plane must be vertices of polygon.
3. Boundary points mean points on the sides of polygon.
4. Interior points mean points in interior portion of polygon. Now boundary points is denoted by B and interior points is denoted by I.

Formula is, $\text{Area of Polygon} = \frac{B}{2} + I - 1$

APPLICATIONS

1. $\text{Area of Polygon} = \frac{B}{2} + I - 1$

This formula is useful for any polygon's area. (According to conditions in conclusion.)

2. I made two boards to verify my above formula, they should be useful for verifying following various geometrical formule.

   (a) Area of Triangle = 1/2 × base × height
   (b) Area of Rectangle = length × breadth
   (c) Perimeter of Rectangle = 2 (length × breadth)
   (d) Properties of Rectangle
      - Opposite sides are congruent
      - Diagonals are congruent
   (e) Area of Parallelogram = base × height
   (f) Properties of Parallelogram
      - Opposite sides are congruent
      - Diagonals are not congruent
   (g) Area of Square = $side^2$
   (h) Properties of Square
      - All sides are congruent
      - Diagonals are congruent
   (i) Area of Trapezium = 1/2 × (sum of parallel sides) × height etc.

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पुष्पीय पौधों में बिना मौसम पुष्पन कराना

विद्यार्थी
पायल नामदेव
बिलासपुर

महारानी लक्ष्मी बाई शासकीय
कन्या उच्च. माध्यमिक विद्यालय

अध्यापक
पूर्णिमा मिश्रा
निरंजन पांडे

भूमिका

जलवायु परिवर्तन के कारण भारत में वनस्पतियों एवं जंतुओं की प्रजातियों का लुप्त होना जारी है। इनका संवर्धन संतुलित एवं नियंत्रित वातावरण में अनुकूल परिस्थिति देकर किया जा सकता है। इसी अवधारणा के साथ बिना मौसम पुष्पीय पादपों का पुष्पन (दहलिया, डायन्थस, सिलोसिया) प्रोजेक्ट में किया गया है।

सिद्धांत

ताप और मिट्टी में परिवर्तन करके विरोध जैविक खाद के प्रयोग से बिना मौसम दहलिया के पौधे में स्वस्थ पुष्पों का खिलना।

आवश्यक उपकरण

राख, सब्जियों का छिलका, सड़ा-गला मैटेरियल, कोयले का चूरा, सूखा गोबर, हरी घास।

कीटनाशक

मिट्टी का तेल, नीम, नीम का रस, सीताफल के पत्तों का रस।

क्रियाविधि

दहलिया का पौधा लगाने से पहले मिट्टी तैयार करना। क्यारियों में गोबर की खूब सड़ी खाद एवं लान की घास डालकर करीब डेढ़ से दो फुट तक मिट्टी खोद कर मिला दीजिए। कटी हुई हरी घास मिट्टी में नमी रखती है जो दहलिया के लिए अत्यंत आवश्यक है। यह उपचार क्यारियों में दहलिया लगाने के एक माह पूर्व कर लेना चाहिए, जिससे हरी घास अच्छी तरह सड़ जाए।

प्रदर्श की संरचना एवं कार्यप्रणाली

खाद बनाने का तरीका

खाद बनाने के लिए लगभग 3 से 4 फुट गहरा गढ्ढा आयताकार खोदकर उसमें सबसे नीचे अच्छी भुरभुरी मिट्टी डालते हैं। उसके ऊपर गोबर के उपलों की जली हुई राख डालते हैं जो दहलिया व अन्य पुष्पों के लिए सबसे अच्छी खाद होती है। फिर लकड़ी के जले हुए कोयले की एक परत डालते हैं क्योंकि यह जला कोयला फूलों में आकर्षक रंग प्रदान करता है। फिर उसके ऊपर सब्जियों के छिलके की एक परत डालते हैं और उसके ऊपर लान की कटी घास जो कि नमी प्रदान करती है और ऊपर से मिट्टी व थोड़ी मात्रा में पानी डालकर उसे ऊपर से ढक देते हैं ताकि उसमें हवा व बाहरी बैक्टिरिया न जा पाएं और यह ध्यान रखते हैं कि उसमें गीला गोबर इस्तेमाल ना हो क्योंकि उसमें कीड़े पनपते हैं जोकि और अपघटन करके अन्य जीवों को पैदा करते हैं इस कारण गीले गोबर का प्रयोग नहीं करते हैं।

लगाने की विधि

पौधा निश्चित स्थान पर लगाने के पूर्व ही हरे रंग की चौकोर छड़ी लगा देनी चाहिए। छड़ी की ऊँचाई पौधे की संभावित ऊँचाई से कम नहीं होनी चाहिए। लकड़ी को पौधों के सहारे के लिए पहले से ही इसलिए लगाते हैं क्योंकि पौधों

के बड़े होने पर उनके कंदों को क्षति पहुँच सकती है। पौधों के बढ़ने पर उन्हें लकड़ी का सहारा देकर स्थान-स्थान पर बांध दिया जाता है।

पौधों को स्थानांतरित करके कम से कम सात दिन तक ऊपर से छाया करके रखिए जब तक पौधे लग न जाएँ। जब पौधे लग जाएँ व अंकुर निकलने लगें तो ऊपर से छाया हटा कर क्यारियों की मिट्टी कोड़ देनी चाहिए। मिट्टी में हवा और सूर्य का प्रकाश तीन से चार दिन तक जाने दीजिए जिससे मिट्टी भुरभुरी हो जाए।

खाद मिट्टी में डालने के बाद मिट्टी की सतह से 5 सेमी. ऊपर तक पानी भर सकें तो अच्छा होगा जिससे पौधे पानी व खाद का उपयोग अधिक कर पाएँगे। पानी 15-20 दिन के अंतराल में दीजिए। पानी देने के चार-पाँच दिन पहले मिट्टी की कोड़ाई कर देना चाहिए।

गमलों में गोबर की खूब सड़ी खाद और सब्जियाँ जो सड़ गई हों 15 दिन के अंतराल में डालिए। दहलिया के पौधों में पत्तियाँ जोड़े में आमने-सामने होती हैं। अतः प्रत्येक जोड़े में आमने-सामने दो अंकुर निकलते हैं। नीचे के जोड़े को प्राथमिकता देते हुए बढ़ने के लिए छोड़ दीजिए और ऊपर के अंकुर को एक छोड़ एक अंकुर एकांतर क्रम से तोड़ दीजिए।

कलियाँ गुच्छों में आती हैं, अतः केवल मध्य की कली को छोड़कर उस शाखा से अन्य सभी कलियों को तोड़ दीजिए। केवल एक ही कली एक शाखा में रहने दीजिए। इससे पुष्प अच्छे एवं आकार में बड़े होंगे।

सावधानियाँ

1. जब पौधे को 15 सेमी. गहरा खोदकर लगाएँ तो यह याद रखें कि पौधा गढ्ढे में न रह जाए, मिट्टी की सतह से कुछ ऊपर लगाएँ।
2. खाद को पौधे के तने से 15 सेमी दूर चारों तरफ डालिए, पास होने पर पौधे मर जाते हैं।
3. ध्यान रखें कि गमले की सिंचाई के पश्चात् खाद तने से हर गमले के किनारे छिड़किए अन्यथा खाद पानी में घुल कर गमले के छेद से बह जाएगी।
4. जब दहलिया के पौधे बढ़ने लगें तो उनके अंकुर को ऊपर से दो पत्तों के नीचे से तोड़ दीजिए। पौधों की शाखाएँ सुदृढ़ हो जाएँगी व अंकुर भी मोटे आएँगे।

5. जब कलियाँ आएँ तो ये ध्यान रखें कि एक तने पर दो से ज्यादा कली न हों। बाकी कलियों को तोड़ दें इससे फूल का आकार भी बड़ा होता है। ज्यादा होने पर पोषक पदार्थ सभी कलियों में बंट जाते हैं व फूल छोटे होते हैं।

फूल के रंग व आकार के लिए जानकारी

नीम की खली व सरसों की खली को एक मटका में डालकर पानी को पूरा भरकर, ढककर एक से डेढ़ माह के लिए रख दें। जब वह पानी सड़ जाए तो वह चाय की तरह कलर पर आ जाएगा। फिर आप उसे फूलों के पौधों पर छिड़कें। इससे फूल का आकार भी बड़ा होगा तथा उससे कलर भी अच्छे होंगे।

प्रोजेक्ट के विषय में महत्वपूर्ण जानकारी

जलवायु परिवर्तन के कारण भारत में वनस्पतियों एवं जंतुओं की प्रजातियों का लुप्त होना जारी है। इनका संवर्धन संतुलित एवं नियंत्रित वातावरण में अनुकूल परिस्थिति देकर किया जा सकता है। इसी अवधारणा के साथ बेमौसम पुष्पीय पादपों का पुष्पन (दहलिया, डायन्थस, सिलोसिया) प्रोजेक्ट में किया गया है।

वैज्ञानिक सिद्धांत

ताप और मिट्टी में परिवर्तन करके पुष्पीय पादपों के लिए अनुकूल वातावरण तैयार करके विशेष जैविक खाद के प्रयोग से बिना मौसम दहलिया के पौधे में स्वस्थ पुष्पों का खिलना।

कार्यविधि

यदि अम्लीय मिट्टी है तो यह शीतकालीन पौधे के लिए अनुकूलन का काम करती है। मिट्टी की अम्लीयता को बढ़ाए रखना चाहिए। बगीचे का तापमान रोड लगाकर, हरियाली लगाकर कम रखें तो दहलिया, कार्नेशन, डायन्थस जैसे फूल वर्ष भर खिलेंगे।

दैनिक जीवन में उपयोगिता

1. फ्लोरीकल्चर को बढ़ावा देना।
2. पुष्प विन्यास एवं पुष्पों की खेती के लिए फूलों का उत्पादन।
3. सुंदरता बढ़ाना, पर्यावरण का महत्व बढ़ाना।

4. आसपास का तापक्रम कम होना।
4. फूलों के उत्पादन से बेरोजगारी को कम करना।
5. आय की प्राप्ति।
6. औषधि में प्रयोग।

कीटनाशक का प्रयोग

मिट्टी का तेल, नीम की पत्ती को उबालने से प्राप्त रस तथा सीताफल की पत्ती को उबालने से प्राप्त रस, तीनों को बराबर मात्रा में मिलाकर छिड़काव करने से सारे कीट-पतंगे खत्म हो जाते हैं।

लाभ

1. यह पुष्प भी विलुप्तप्राय जीवों की तरह सिर्फ तीन माह तक खिलते हैं लेकिन हमारे प्रयोग के इस तरीके से बारह मास खिलेंगे।
2. इस पौधे को लगाकर फ्लोरीकल्चर को बढ़ावा देना है।
3. इन फूलों को लगाकर बेरोजगार लोग रोजगार पा सकते हैं तथा आय की प्राप्ति भी होती है।
4. खाद को हम खेतों में भी प्रयोग कर सकते हैं।
5. कीटनाशक का प्रयोग भी सभी पौधों में व खेतों में कर सकते हैं।
6. इस पौधे के जड़ व तने का औषधीय प्रयोग भी करते हैं। इसे धोकर तथा पीस कर लगाने से जहाँ दर्द होता है वहाँ दर्द निवारक की तरह प्रयोग किया जाता है।

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सोलर रिक्शा

विद्यार्थी
मनीष

आर्य उच्च माध्यमिक विद्यालय
जी.टी. रोड, पानीपत

अध्यापक
आर. के. गर्ग

भूमिका

जैसा कि आप जानते हैं कि हमारे देश में यातायात साधनों का बहुत ज्यादा निर्माण हो रहा है। यातायात साधनों को अमीर लोगों को ध्यान में रखकर विकसित किया जा रहा है तथा उन्हीं की सुख-सुविधाओं को ध्यान में रखकर उन्हीं के लायक उपयोगी वाहनों का निर्माण किया जा रहा है। इसी बात को ध्यान देकर मैंने इस रिक्शा का निर्माण किया है।

सौर रिक्शा के द्वारा एक व्यक्ति दिन में कम से कम ₹ 800-900 तक कमा सकता है व दिन भर में 40 से 50 चक्कर लगा सकता है।

इन पैसों के द्वारा वह अपने बच्चों को एक अच्छे स्कूल में शिक्षा दिला सकता है। इसके साथ वह अपने परिवार में किसी के बीमार होने पर उसका अच्छे से इलाज भी करवा सकता है। यह सौर रिक्शा वायु प्रदूषण तथा ध्वनिरहित है। इससे हमारे आस-पास के वातावरण पर बुरा प्रभाव नहीं पड़ता तथा आजकल जी.टी. रोड पर वाहनों की बहुत ज्यादा आवाज होती है परंतु यह

ध्वनि प्रदूषण से रहित है। इससे मजदूर वर्ग को भी इस समाज में आगे बढ़ने में सहायता मिलेगी। इसका नाम सौर रिक्शा है।

इसके अलावा साधारण रिक्शा के द्वारा मजदूर वर्ग के लोग जो दिन भर मेहनत कर रिक्शा चलाते हैं और पूरे दिन काम करके ₹ 200–250 ही कमा पाते हैं, सारा दिन काम करने के बाद वे थक जाते हैं। उन्हीं पैसों के द्वारा उनके परिवार में शाम का खाना मुश्किल से बन पाता है। अगर किसी स्थिति में बीमार हो जाएँ तो अगले दिन वे काम पर नहीं जा पाएँगे। उन्हीं पैसों के द्वारा उन्हें अगले दिन तथा अपना दवाई खर्च निकालना होगा। जो बहुत ज्यादा मुश्किल है।

वैज्ञानिक सिद्धांत

इस सौर रिक्शा के अंदर सौर ऊर्जा को यांत्रिक ऊर्जा में बदला जाता है।

आवश्यक सामग्री

1. पाँच सरिये
2. 1 एक्सल
3. 1 मोटर (ट्रक वाइपर 12 V)
4. 3 टायर
5. 3 गरारी
6. 12 V की बैटरी
7. 2 सौर प्लेट
8. 1 लाइट
9. 4 बैरिंग
10. 2 चैन
11. 2 पैडल

संरचना एवं कार्यप्रणाली

1. सौर रिक्शा के अंदर सबसे पहले एक गोल एक्सल की जरूरत पड़ती है। इसके दोनों सिरों पर टायर लगाने होते हैं तथा उसी एक्सल के बीचोंबीच एक गरारी लगाई जाती है। गरारी के दोनों तरफ एक एक बैरिंग लगाया जाता है।

2. बैरिंग के ऊपर एक गोल पत्ती लगाई जाती है जिस पर उस रिक्शा का भार आ जाता है और वह एक्सल अपनी जगह पर निरंतर घूमता रहता है।
3. बैरिंग के ऊपर लगी पत्ती से ऊपर उन्हीं सरियों को आगे बढ़ाकर आगे वाले हैण्डल से जोड़ दिया जाता है।
4. उन्हीं दो सरियों से ऊपर की तरफ तीन सरियों को उठाया गया है जिससे सौर रिक्शा की छत का निर्माण किया गया है।
5. उन्हीं दोनों सरियों के नीचे की तरफ बैटरी तथा मोटर को लगाया है। मोटर की गरारी को एक्सल की गरारी से एक चैन के द्वारा जोड़ा गया है।
6. मोटर को बैटरी के साथ जोड़ा गया है। बैटरी की तारों को सौर प्लेट की तारों से जोड़ा गया है। बैटरी दिन में सूर्य के प्रकाश से चार्ज हो जाती है तथा वह रात मे आसानी से कार्य कर सकती है।
7. छत के ऊपर दो सौर प्लेट रखी गई हैं। इन्हीं दोनों सौर प्लेट की तारों को बैटरी से जोड़ा गया है।
8. पैडलों को भी जोड़ा गया है।
9. मीटर को जोड़ा गया है जो दर्शाता है कि हमारी बैटरी कितनी चार्ज है। सौर प्लेट के द्वारा हम अपनी बैटरी को चार्ज करते हैं। रिक्शा के अंदर लगी मोटर बैटरी से करन्ट प्राप्त करने के बाद चलना शुरू कर देती है। दिन के समय हमारी रिक्शा धूप से चलती है तथा रात के समय हम अपनी दिन में चार्ज की गई बैटरी का उपयोग कर सकते हैं। बैटरी तथा धूप दोनों चीज़ें न होने की स्थिति यदि कभी उत्पन्न भी हो जाए तो हम पैडल भी मार सकते हैं।

उपयोगिता

1. यह रिक्शा प्रदूषणरहित है जैसे वायु प्रदूषण, ध्वनि प्रदूषण।
2. यह रिक्शा ज्यादा दूरी कम समय में तय करता है।
3. मजदूर वर्ग के लोग सारा दिन रिक्शा चलाने के बाद थक जाते हैं परन्तु इस रिक्शा के द्वारा वह दिन भर काम करने के बावजूद थकेंगे नहीं।
4. इस रिक्शा द्वारा वे पहले से अधिक पैसे कमा सकते हैं।
5. सौर ऊर्जा न खत्म होने वाली ऊर्जा है जिससे यह रिक्शा चलता है।

6. यह पैट्रोल तथा डीजल रहित है।
7. मजदूर वर्ग के लोग इससे अपने बच्चों को एक अच्छे स्कूल में पढ़ा सकते हैं।
8. इसकी लागत ₹ 1483 है।

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दोनों हाथों से अशक्त व्यक्तियों की पढ़ाई हेतु पृष्ठ पलटने की एक युक्ति

विद्यार्थी
रवि रंजन कुमार

तिरहु एकादमी इन्टर विद्यालय
समस्तीपुर, बिहार

अध्यापक
प्रमोद कुमार मिश्र

भूमिका

शिक्षा मनुष्य का मौलिक अधिकार है। शिक्षा के बिना मनुष्य और पशु में कोई फर्क नहीं है।

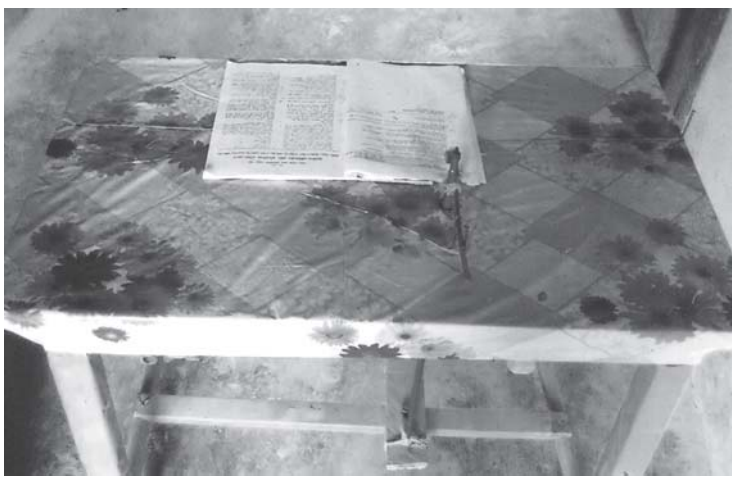
समाज में कुछ ऐसे लाचार एवं निरीह व्यक्ति हैं जो शिक्षा के दीपक से दूर रहकर अपना जीवन अंधेरे में निर्वाह करने पर मजबूर हैं। ऐसी ही घटना मेरे मुहल्ले के रमेश की है जो मेधावी होते हुए भी दोनों हाथों से अशक्त होने के कारण पुस्तक से पढ़ाई नहीं कर सकता है। वह हम लोगों के बीच आकर बैठता है। हम लोगों की पढ़ी हुई बात सुनता है, समझता है, किंतु हाथ नहीं होने के कारण वह पुस्तक के पृष्ठ न पलट पाने के कारण खुद से पुस्तक पढ़ने में असमर्थ है। एक रमेश ही नहीं, हाथ से अशक्त उन सभी व्यक्तियों के जीवन में शिक्षा का चिराग जलाने के लिए मेरे मन में इस परियोजना की सोच आई।

सिद्धांत

चुंबक लोहे की वस्तु को अपनी ओर आकर्षित करता है। यह मॉडल इसी सिद्धांत पर आधारित है।

संरचना

सर्वप्रथम मैंने एक टेबल लिया। उस टेबल के बाएँ भाग में 1/2 सेमी व्यास का एक छिद्र किया। उसके बाद टेबल के नीचे वाले आधार से एक पैडल लगा छड़ टेबल में बने छिद्र में नीचे से लगा दिया। टेबल के ऊपर से निकले छड़ में एक दूसरा छड़ लेकर (जिसके ऊपर मैंने चुंबक लगा रखा था) उसे एक दूसरे से जोड़ दिया। लकड़ी का एक तख्ता लेकर उसे टेबल के दोनों तरफ सरकाने के लिए टेबल के दोनों तरफ एक-एक छिद्र बनाया, फिर तख्ते के दोनों तरफ पतली डोरी लेकर टेबल में बने दोनों तरफ के छिद्रों से डोरी को नीचे लटकाकर उसमें मैंने पैडल लगा दिया। इस प्रकार मेरी यह परियोजना तैयार हो गई। यह सर्वसाधारण को कम खर्च पर उपलब्ध हो सकती है।



कार्यविधि

यह प्रदर्श हाथों से अशक्त व्यक्तियों के लिए बनाया गया है। इसकी सहायता से यदि पुस्तक के बाएँ पृष्ठ को पलटना है तो पुस्तक में लगे धातु के टुकड़े को चुंबक के नीचे लाकर पैडल को दबाते हैं तथा पैडल को दबाकर ही बाईं ओर की रस्सी वाले पैडल को दूसरे वाले पैर से खींच देते हैं। इसी प्रकार अगर, दाएँ

पृष्ठ को पलटना है तो उपर्युक्त प्रक्रिया की तरह कार्य करते हुए दाईं ओर की रस्सी वाले पैडल को दूसरे पैर से खींच देते हैं।

लाभ

इस परियोजना से उन सभी दोनों हाथों से अशक्त लोगों को सहायता मिली है जो शिक्षा की रोशनी से दूर थे।

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उद्योगों में सुरक्षा प्रणाली

विद्यार्थी
अभिलाषा सुथार

मीरा निकेतन बा.उ.मा. विद्यालय
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प्रस्तावना

मेरा गाँव किसानों का गाँव है। जहाँ पर प्राय सभी लोग खेती करते हैं। कुछ ही लोग लघु उद्योगों में सक्रिय हैं। खेती करने के साथ-साथ पशुपालन का काम भी जुड़ा हुआ है। पशुपालन व खेती के अतिरिक्त समय में थोड़ा बढ़ईगीरी, कुम्हार, लुहार आदि का कार्य भी चलता रहता है। पशुओं को चारा दिया जाता है जो खेत में उगी हुई खरपतवार को बारीक काट कर दिया जाता है। कटाई के काम में तथा बढ़ईगीरी के काम में आरे का उपयोग करते है जो बिजली से चलता है। गत दिनों हमारे पड़ोसी अपने पशुओं को चारा देने के लिए खरपरतवार को आरे से काट रहे थे। इसी तरह गत वर्ष हमारे गाँव के एक बढ़ई को लकड़ी की कटाई करते समय किसी ने बीच में बोल कर उनका ध्यान हटा दिया और वे उस व्यक्ति की तरफ देखते हुए लकड़ी को काटते रहे, अचानक दुर्घटनावश हाथ की अंगुलियाँ आरे के पास पहुँच गईं और कट गईं। यही घटना हमारे पड़ोसी

के साथ चारा काटते समय पिछली गर्मी की छुट्टियों में हुई। इन दोनों घटनाओं ने मुझे सोचने के लिए मजबूर कर दिया और इसी सोच के कारण मैंने आरे में ऐसी व्यवस्था करने की सोची ताकि आरे से हाथ नहीं कटें।

उद्देश्य

कृषि अथवा औद्योगिक क्षेत्र में काम आने वाले विद्युत चालित आरे का उपयोग करते समय मानवीय भूल अथवा अन्य कारणों से होने वाली दुर्घटनाओं को रोकने के लिए सुरक्षित आरे अथवा इसी प्रकार के अन्य यन्त्र का निर्माण करना।

सिद्धांत

1. विद्युत के सामान्य नियमों का ज्ञान।
2. इलेक्ट्रॉनिक्स व इलेक्ट्रिकल परिपथों का ज्ञान तथा व्यवहारिक कार्यों में उनका उपयोग।
3. विद्युत मोटर, सामान्य गियर, टच सर्किट आदि का ज्ञान व उपयोग।

सामग्री

प्लास्टिक, लकड़ी, प्लाई, इलेक्ट्रॉनिक पार्टस-आई. सी., रिले, कन्डेनसर, ट्रांसफॉर्मर, प्रतिरोध, पी.सी.बी., एल.सी.बी., एल.ई.डी., गियर बॉक्स, विद्युत मोटर तथा सामान्य नट-बोल्ट आदि।

कार्यप्रणाली

सर्वप्रथम लकड़ी का आयताकार डिब्बा बनाकर उसके नीचे की ओर एक विद्युत मोटर लगाई गई। इसकी धुरी पर छोटा हाथ से बना हुआ गोलाकार आरा फिट किया गया। इस मोटर को चलाने व बन्द करने की व्यवस्था सीधे स्विच से न करके एक 12 वोल्ट की रिले से की गई। जब रिले में 12 वोल्ट डीसी करेंट भेजा जाता है तो रिले के कॉन्टेक्ट चुम्बकीय प्रभाव के कारण नीचे की ओर आने से चिपक जाते हैं तथा दो कॉन्टेक्ट आपस में जुड़ जाने के कारण मोटर का विद्युतीय परिपथ पूरा हो जाता है जिससे मोटर गोल गति प्राप्त कर आरे को गति प्रदान करती है तथा जैसे ही रिले में 12 वोल्ट डीसी की विद्युत का प्रवाह बन्द किया जाता है, रिले के कॉन्टेक्ट हट जाते हैं और मोटर का घूमना बन्द हो जाता है तथा आरा भी रुक जाता है अब इस रिले का सम्बन्ध टच स्विच

सर्किट से कर दिया गया है। आरा भी रुक जाता है। इस प्रकार इस व्यवस्था से इतना हो पाया कि जैसे ही सेन्सर पर हाथ लगाया जाता है, आरा रुक जाता है।

परिणाम

प्रथम, द्वितीय व तृतीय प्रयास के अन्तर्गत अन्तिम प्रयास में किए कार्य से एक प्रायोगिक रूप से तथ्य सामने आया कि गति करता हुआ आरा एक सैकण्ड के दसवें भाग में अपनी स्थिति बदल कर नीचे की ओर चलते हुए रुक जाने पर मानवीय दुर्घटना नहीं होती है। इसी प्रकार की व्यवस्था मैंने फ्लेट बेल आरे की मशीन पर भी की तथा वांछित सफलता प्राप्त की।

उपयोग

1. आरे के द्वारा होने वाली दुघर्टनाओं को रोकने के लिए यह एक विशेष प्रकार का इलेक्ट्रॉनिक एवं मैकेनिकल अटैचमेंट है जो साधारण परिवर्तन के पश्चात किसी भी आरे में व्यवस्थित किया जा सकता है।
2. इस अटैचमेंट में एक अत्यन्त सामान्य इलेक्ट्रॉनिक परिपथ है जो साधारण PNP एवं NPN ट्रांजिस्टरों के द्वारा बनाया गया है। इस पूरे इलेक्ट्रॉनिक परिपथ की कीमत मात्र ₹ 200 से ₹ 300 तक ही है।
3. यह अटैचमेंट पूर्व में चल रहे आरे अथवा नए सामान्य सस्ते बाज़ार में पाए जाने वाले आरे को खरीद कर इस व्यवस्था को अपनाया जा सकता है।
4. पूरा अटैचमेंट इलेक्ट्रॉनिकली व मैकेनिकली अत्यन्त सरल होने के कारण इसकी मेन्टेनेन्स काफी सरल है जिसे सभी कुटीर उद्योगपति काम में ले सकते हैं।

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जादुई अग्निशमन बॉक्स

विद्यार्थी
गन्तमणि रस्तोगी

श्री गुरुनानक रिख्सी सिंह
गर्ल्स इण्टर कॉलेज, बरेली

भूमिका

इस मॉडल को बनाने का मुख्य उद्देश्य मानव जीवन में सिलेण्डर में आग लगने से होने वाली घटनाओं को ऑटोमैटिकली रोकना है जिससे धन व जन की हानि को खत्म किया जा सके।

समाविष्ट वैज्ञानिक सिद्धांत

यह मॉडल दो वैज्ञानिक सिद्धांतों पर आधारित है। प्रथम सिद्धांत रेत द्वारा आग बुझाने का है व दूसरा सिद्धांत गैस के प्रसार पर आधारित है। पिस्टन के क्रोड से रेगुलेटर के पेंच को बाँध दें तो उसे बन्द किया जा सकता है।

सामग्री

1. एल्युमीनियम व कॉपर की चादरें
2. पिस्टन व सिलेण्डर
3. वाल्व-गैस रोकने के लिए
4. वाल्व-गैस भरने के लिए

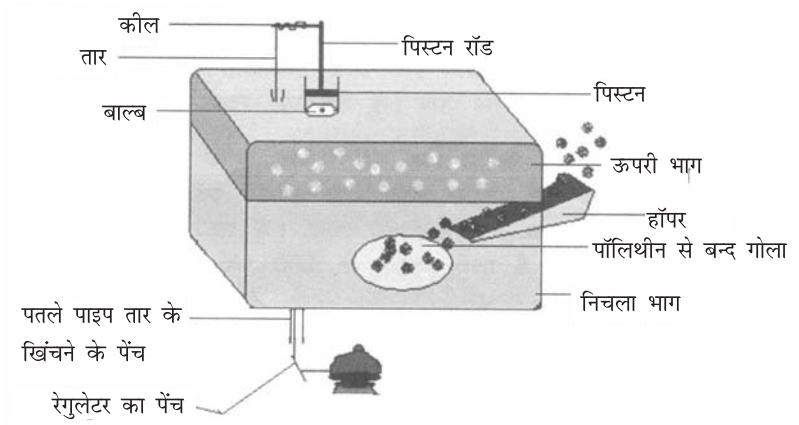
5. पॉलीथीन

6. पतला पाइप एवं तार

यन्त्र का कार्य

इस बॉक्स का कार्य सिलेण्डर में लगी आग को बुझाना है। यह बॉक्स सिलेण्डर के ऊपर चित्रानुसार हर समय रखा रहता है व सिलेण्डर में आग लगने पर उसे तुरन्त व स्वयं बुझाकर सिलेण्डर में ब्लास्ट होने से बचाता है।

यह बॉक्स दो तर्कों पर आधारित है। इस बॉक्स में दो भाग होते हैं। एक भाग रेत द्वारा आग बुझाने के सिद्धान्त पर कार्य करता है तथा दूसरा भाग पिस्टन में बन्द गैस द्वारा कार्य करने के सिद्धान्त पर कार्य करता है। इसके पहले भाग का कार्य आग बुझाना व दूसरे भाग का कार्य ऑटोमैटिकली रेगुलेटर बन्द करना है।

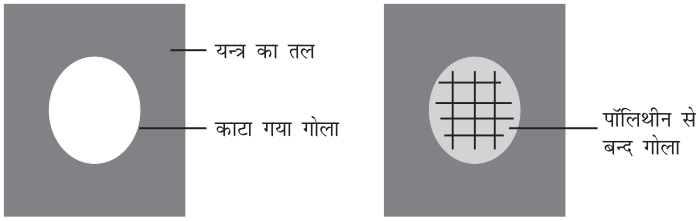


चित्र 19.1: जादुई अग्निशमन बॉक्स

संरचना

यह जादुई अग्निशमन बॉक्स सन्दूक के आकार का होता है। इसमें दो भाग होते हैं। इसमें एक भाग नीचे व दूसरा भाग चित्रानुसार ऊपर होता है। इसका नीचे वाला भाग रेत द्वारा आग बुझाने के सिद्धांत पर व ऊपर वाला भाग गैस द्वारा कार्य करने के सिद्धान्त पर कार्य करता है। इस बॉक्स के दोनों भागों की बनावट व कार्यपद्धति का विवरण नीचे दिया गया है–

1. रेत भरा बॉक्स
2. प्रेशर ब्लॉक



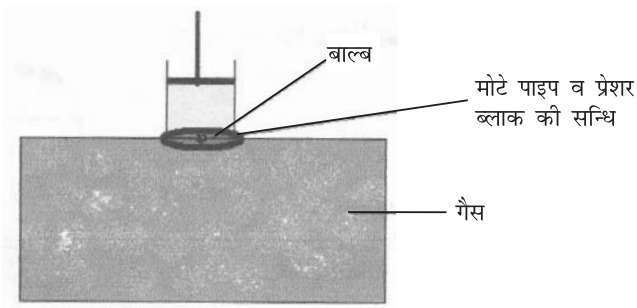
चित्र 19.2: रेत भरा बॉक्स

रचना

यह बॉक्स घनाकार होता है तथा इसकी तली से चित्रानुसार एक गोला काट लिया जाता है व उसे पॉलीथीन लगाकर बन्द कर दिया जाता है। इस बॉक्स में लगे हॉपर द्वारा रेत भर देते हैं। यह भाग लोहे का बना होता है।

क्रियाविधि

आग लगने पर इस बॉक्स की तली पर लगी पॉलीथीन से बन्द गोल छेद पिघल कर खुल जाता है व रेत आग पर गिरकर आग को बुझा देता है। अत: सिलेण्डर में जब आग लगती है तो रेत ऑटोमैटिकली गिरकर आग को बुझा देता है।



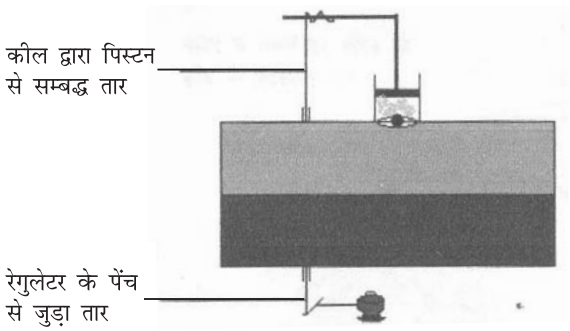
चित्र 19.3: प्रेशर ब्लॉक

रचना

यह बॉक्स भी घनाकार व ताँबे का बना होता है। इस बॉक्स के ऊपरी तल पर बीचोंबीच पिस्टन के चलने के लिए एक मोटा पाइप चित्रानुसार बेल्ड कर दिया जाता है व पाइप के तल व प्रेशर ब्लॉक के मिलने के स्थान पर गैस को रोकने

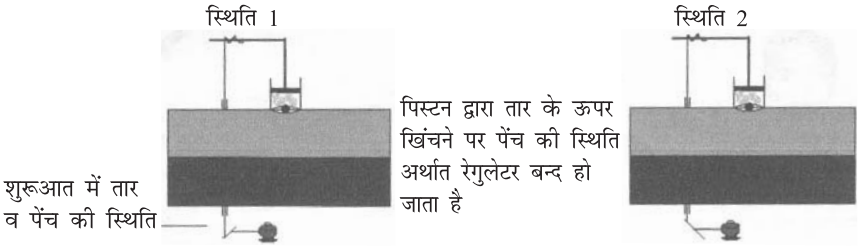
के लिए चित्रानुसार एक वॉल्व लगा देता है। जैसा कि कुकर में होता है। (चित्र 19.3 देखें) जब बॉक्स में भरी गैस का आयतन बढ़ता है तो वॉल्व फट जाता है व मोटे पाइप में गैस भरने के कारण पिस्टन ऊपर की ओर चला जाता है।

अब पूरे बॉक्स में ऊपर से नीचे तक एक पतला पाइप जाता है जिसमें एक तार ऊपर से नीचे तक लगा दिया जाता है।



चित्र 19.4: पिस्टन रेगुलेटर

तार का निचला सिरा रेगुलेटर के पेंच से इस तरह से जोड़ देते हैं कि जब तार ऊपर की ओर खिंचे तो रेगुलेटर बन्द हो जाए व तार का ऊपरी सिरा एक कील द्वारा पिस्टन रॉड से जोड़ देते हैं जिससे कि पिस्टन ऊपर उठे तो रेगुलेटर बन्द हो जाए (चित्र 19.4 देखें)।

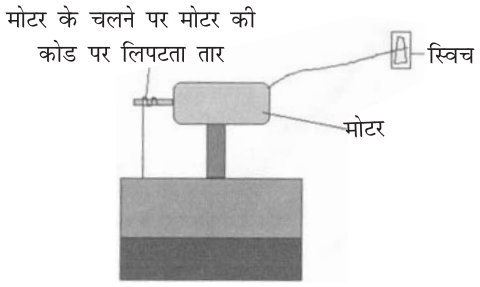


चित्र 19.5: (क) रेगुलेटर की क्रियाविधि

क्रियाविधि

यदि कभी आग रेत वाले बॉक्स द्वारा नहीं बुझती है तो आग बढ़ने से ताँबे से बना यह प्रेशर ब्लॉक गर्म होने लगता है जिससे इसमें भरी गैस का आयतन बढ़ जाता है व इसके कारण मोटे पाइप के तल पर लगा वॉल्व फट जाता है व पाइप

में गैस का आयतन बढ़ने से पिस्टन ऊपर की ओर चला जाता है व तार द्वारा इससे संयुग्मित रेगुलेटर का पेंच चित्रानुसार ऊपर की ओर घूमकर बन्द हो जाता है और सिलेण्डर ब्लास्ट होने से बच जाता है।



चित्र 19.6: (ख) रेगुलेटर की क्रियाविधि

यदि पिस्टन रॉड में जहाँ पर कील लगी होती है, वहाँ पर एक मोटर इस तरह से लगा दी जाए कि मोटर चलने से कील पर धागा लिपटने लगे जिससे तार खिंचने से रेगुलेटर बन्द हो जाए तो यह काम हम कमरे के बाहर से ही स्विच दबाकर कर सकते हैं।

विद्ययाऽमृतमश्नुते

एन सी ई आर टी
NCERT

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