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Design and Fabrication of an AUTOMATIC BLACK BOARD CLEANER

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ABSTRACT: The growth of technologies requested higher performance machine in order to fulfill human needs and market. This project is implemented to make human work easier and can reduce the use of human power because of its potential applications.
The project automatic blackboard duster is device that clean the blackboard automatically and reduces the time consume in hand erasing.

The report puts forward a kind of mechanism design scheme, the mechanism can automatically detect the blackboard chalk stains, and erase the font, keep the blackboard clean.

The duster includes a track structure to permit reciprocation of the duster laterally of an elongate blackboard frame.

The chain which is connected to duster includes a drive motor to effect rotation of a drive duster positioned above the blackboard frame.

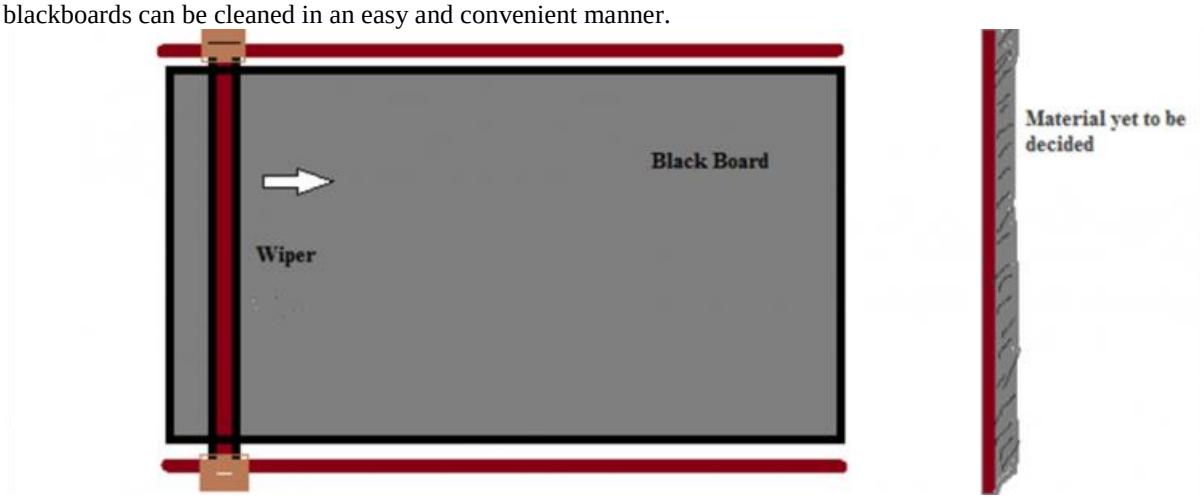
This appertains to new and useful improvements and more particularly to an apparatus whereby blackboards can be cleaned in an easy and convenient manner.

The principal object of the present automatic blackboard duster is to provide an attachment for blackboards in the form of a power driven erasing apparatus which can be set in operation by the throw of a switch, thus eliminating the drudgery of manually cleaning blackboards.

INTRODUCTION

An automatic blackboard duster is a device that is generally used to clean board automatically with the help of duster. By the use of this automatic blackboard duster we can save time and energy.
It is a new technology that is generally used now a day. A device for automatically erasing a blackboard wherein a duster is mounted for longitudinal movement on the blackboard and has a motor mounted thereon that is mechanically interconnected to a drive assembly for producing the movement of the duster in an erasing operation.

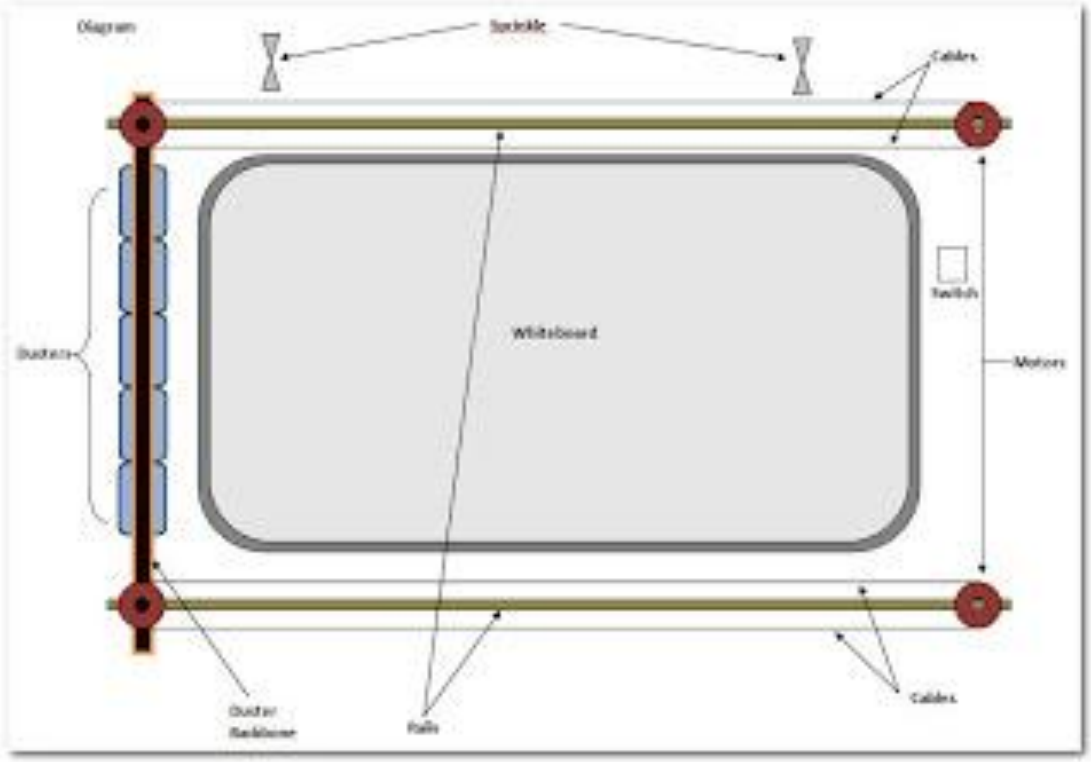
This appertains to new and useful improvements and more particularly to an apparatus whereby blackboards can be cleaned in an easy and convenient manner.



The principal object of the present automatic blackboard duster is to provide an attachment for blackboards in the form of a power driven erasing apparatus which can be set in operation by the throw of a switch, thus eliminating the drudgery of manually cleaning blackboards. Another important object of the invention is to provide an automatic apparatus of the character described, which is positive-acting in operation, and wherein the erasing elements can be conveniently replaced and the other details of the mechanism easily repaired in the event of the development of defects. The utility model relates to teaching aid.

The prior blackboard has no automatic cleaning function, a teacher wastes time in writing and erasing, and the use is not ideal.

The utility model provides an automatic blackboard cleaning system consisting, an electric blackboard eraser, and a soft-covered blackboard.



The automatic blackboard cleaning system is characterized in that the soft-covered blackboard which can move circularly is arranged between the upper and the lower frame and the electric blackboard eraser for cleaning chalk dust is arranged on the surface of the blackboard.

The structure is simple; the use is convenient, clean and sanitary; and the effect of saving time is good.

1.1. Problem Identification

1. The time consumes in hand erasing is more.
2. The problem of dust in hand erasing affect the human being.
3. Hand erasing requires human power thus wastage of human energy.

1.2. Solution of the Problem

1. In this automatic blackboard duster the time require in erasing is very less as compare to hand erasing.
2. The problem of dust in automatic blackboard duster is controlled by the use of vacuum cleaner.
3. By automation of erasing mechanism, human energy can be saved.

1.3. Automation:

Automation or automatic control is the use of various control systems for operating equipments such as machinery, processes in factories, boilers and heat treating ovens and other applications with minimal or reduced human intervention. Some processes have been completely automated. The biggest benefit of automation is that it saves labor; however, it is also used to save energy and materials and to improve quality, accuracy and precision.

1.4. General review of automatic Duster:

The invention relates to blackboards and has particular applications to a device for mechanically erasing the blackboard. Improvements in blackboards and chalk for used therewith have occurred over a period of time, but such improvements have not effected the manner in which the blackboard is cleaned or erased.

The most common method of erasing the blackboard is to used a hand-held eraser and to manually erase the blackboard as required. Cleaning of the blackboards by a damp cloth is, of course a technique that has

long been employed but is only used when immediate use of the blackboard is not required some efforts have been made heretofore to improve the materials used in eraser, although such improvements still require manual manipulation of the eraser in the erasing of the

S. No.	
1	Blackboard
2	Motor
3	Duster
4	Frame
5	Steel rod
6	Guide ways
7	wheels

PARTS REQUIRED

2.1.1 Blackboard.

Some attempts have also been made to mechanize erasers, but the prior known mechanical or automatic blackboard erasers since they include complicated mechanical connection and driving elements.

Black board

In this fast growing world automatic techniques are most adopted thus to reduce the time and energy we just created the project that clean the board automatically the small time period. In this project a advanced

technology is used for automatic erasing the board. Yes, this technology is somewhat expensive, but time is more important than money.

Once the technology is adopted on the board than there is saving of time daily. To understand the methodology of automatic blackboard duster, first of all we have to know the parts that are generally used in this automatic blackboard duster.

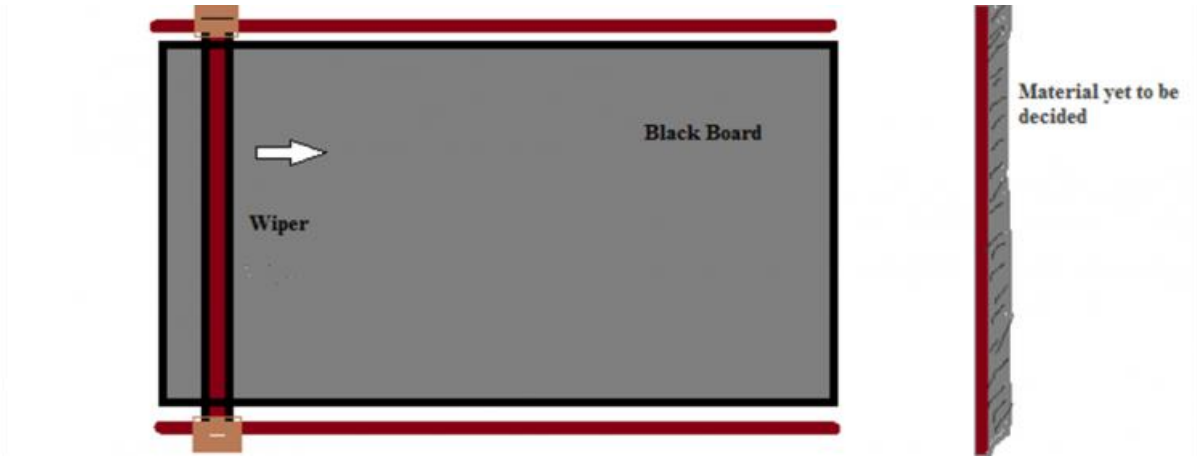
2.1.2. Parts used in automatic blackboard duster

. Blackboard
. motor
. Steel rod
. Duster Frame
. switch
. Guide ways
. wheels

2.1.3. Description of important parts

Blackboard:

A blackboard or chalkboard is a reusable writing surface on which text or drawings are made with sticks of calcium sulphate or calcium carbonate, known, when used for this Mpurpose, as chalk. Blackboardsoriginally made of smooth, thin sheets of black or dark grey slate stone. Modern versions are often green because the color is considered easier on the eyes.



A blackboard can simply be a piece of board painted with matte dark paint (usually black or dark green). A more modern variation consists of a coiled sheet of plastic drawn across two parallel rollers, which can be scrolled to create additional writing space while saving what has been written.

The highest grade blackboards are made of rougher version porcelain enamelled steel (black, green, blue or sometimes other colours). Porcelain is very hard wearing and blackboards made of porcelain usually last 10–20 years in intensive use. Lecture theatres may contain a number of blackboards in a grid arrangement.

The lecturer then moves boards into reach for writing and then moves them out of reach, allowing a large amount of material to be shown simultaneously.

The chalk marks can be easily wiped off with a damp cloth, a sponge or a special blackboard eraser consisting of a block of wood covered by a felt pad. However, chalk marks made on some types of wet blackboard can be difficult to remove. Blackboard manufacturers often advise that a new or newly resurfaced blackboard be completely covered using the side of a stick of chalk and then that chalk brushed off as normal to prepare it for use.

2.2 DC MOTORS

A DC motor relies on the fact that like magnet poles repel and unlike magnetic poles attract each other. A coil of wire with a current running through it generates a electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnet field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°.

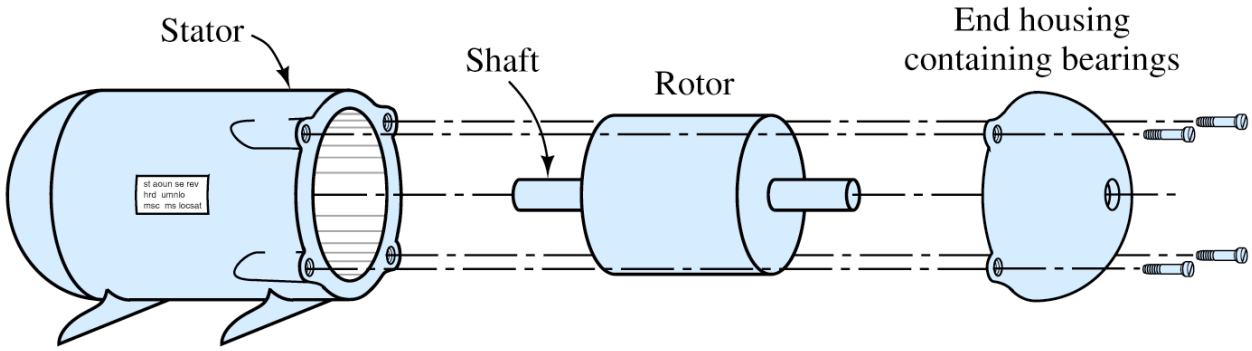


Figure 16.1 An electrical motor consists of a cylindrical rotor that spins inside a stator.

A simple *DC motor* typically has a stationary set of magnets in the stator and an armature with a series of two or more windings of wire wrapped in insulated stack slots around iron pole pieces (called stack teeth) with the ends of the wires terminating on a commutator. The armature includes the mounting bearings that keep it in the center of the motor and the power shaft of the motor and the commutator connections. The winding in the armature continues to loop all the way around the armature and uses either single or parallel conductors (wires), and can circle several times around the stack teeth. The total amount of current sent to the coil, the coil's size and what it's wrapped around dictate the strength of the electromagnetic field created. The sequence of turning a particular coil on or off dictates what direction the effective electromagnetic fields are pointed. By turning on and off coils in sequence a rotating magnetic field can be created. These rotating magnetic fields interact with the magnetic fields of the magnets (permanent or electromagnets) in the stationary part of the motor (stator) to create a force on the armature which causes it to rotate. In some DC motor designs the stator fields use electromagnets to create their magnetic fields which allow greater control over the motor. At high power levels, DC motors are almost always cooled using forced air.

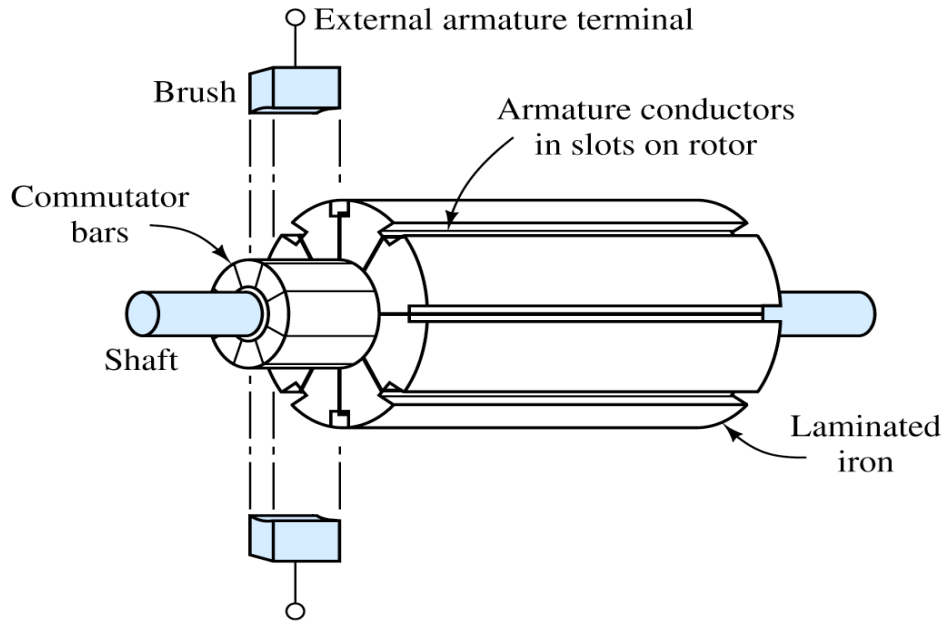
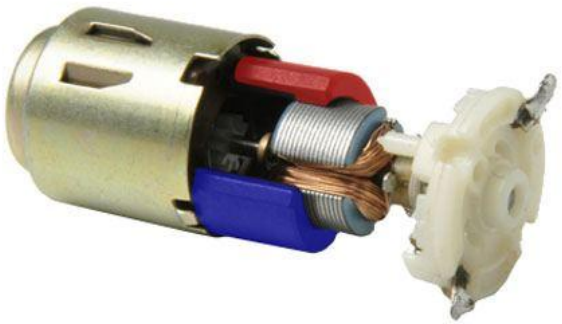


Figure 16.9 Rotor assembly of a dc machine.

The commutator allows each armature coil to be activated in turn. The current in the coil is typically supplied via two brushes that make moving contact with the commutator. Now, some brushless DC motors have electronics that switch the DC current to each coil on and off and have no brushes to wear out or create sparks.

Different number of stator and armature fields as well as how they are connected provide different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motorsare often controlled bypower electronics systems which adjust the voltage by "chopping" the DC current into on and off cycles which have an effective lower voltage.

Since the series-wound DC motor develops its highest torque at low speed, it is often used in traction applications such as electric locomotives, and trams. The DC motor was the mainstay of electric traction drives on both electric and diesel-electric locomotives, street-cars/trams and diesel electric drilling rigs for many years. The introduction of DC motors and an electrical gridsystem to run machinery starting in the 1870s started a new second Industrial Revolution. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles and today's hybrid cars and electric cars as well as driving a host of cordlesstools. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines.



If external power is applied to a DC motor it acts as a DC generator, a dynamo. This feature is used to slow down and recharge batteries on hybrid carand electric cars or to return electricity back to the electric grid used on a street car or electric powered train line when they slow down. This process is called regenerative braking on hybrid and electric cars. In diesel electric locomotives they also use their DC motors as generators to slow down but dissipate the energy in resistor stacks. Newer designs are adding large battery packs to recapture some of this energy.

Contents

- 5.2 Shunt connection
- 5.3 Compound connection
- External links

2.2.2. BRUSH

Main article: Brushed DC electric motor

A brushed DC electric motor generating torque from DC power supply by using an internal mechanical commutation. Stationary permanent magnets form the stator field. Torque is produced by the principle that any current-carrying conductor placed within an external magnetic field experiences a force, known as Lorentz force. In a motor, the magnitude of this Lorentz force (a vector represented by the green arrow), and thus the output torque,is a function for rotor angle, leading to a phenomenon known as torque ripple) Since this is a single phase two-pole motor, the commutator consists of a split ring, so that the current reverses each half turn (180 degrees).

The brushed DC electric motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary magnets (permanent or electromagnets), and rotating electrical magnets.

Advantages of a brushed DC motor include low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. Maintenance involves regularly replacing the carbon brushes and springs which carry the electric current, as well as cleaning or replacing the commutator. These components are necessary for transferring electrical power from outside the motor to the spinning wire windings of the rotor inside the motor. Brushes consist of conductors.

BRUSHLESS

Main articles: Brushless DC electric motor and Switched reluctance motor

Typical brushless DC motors use a rotating permanent magnet in the rotor, and stationary electrical current/coil magnets on the motor housing for the stator, but the symmetrical opposite is also possible. A motor controller converts DC to AC. This design is simpler than that of brushed motors because it eliminates the complication of transferring power from outside the motor to the spinning rotor. Advantages of brushless motors include long life span, little or no maintenance, and high efficiency. Disadvantages include high initial cost, and more complicated motor speed controllers. Some such brushless motors are sometimes referred to as "synchronous motors" although they have no external power supply to be synchronized with, as would be the case with normal AC synchronous motors.

2.2.3. UNCOMMUTATED

Other types of DC motors require no commutation.

- Homopolar motor – A homopolar motor has a magnetic field along the axis of rotation and an electric current that at some point is not parallel to the magnetic field. The name homopolar refers to the absence of polarity change.
  Homopolar motors necessarily have a single-turn coil, which limits them to very low voltages. This has restricted the practical application of this type of motor.
- Ball bearing motor – A ball bearing motor is an unusual electric motor that consists of two ball bearing-type bearings, with the inner races mounted on a common conductive shaft, and the outer races connected to a high current, low voltage power supply. An alternative construction fits the outer races inside a metal tube, while the inner races are mounted on a shaft with a non-conductive section (e.g. two sleeves on an insulating rod). This method has the advantage that the tube will act as a flywheel. The direction of rotation is determined by the initial spin which is usually required to get it going.

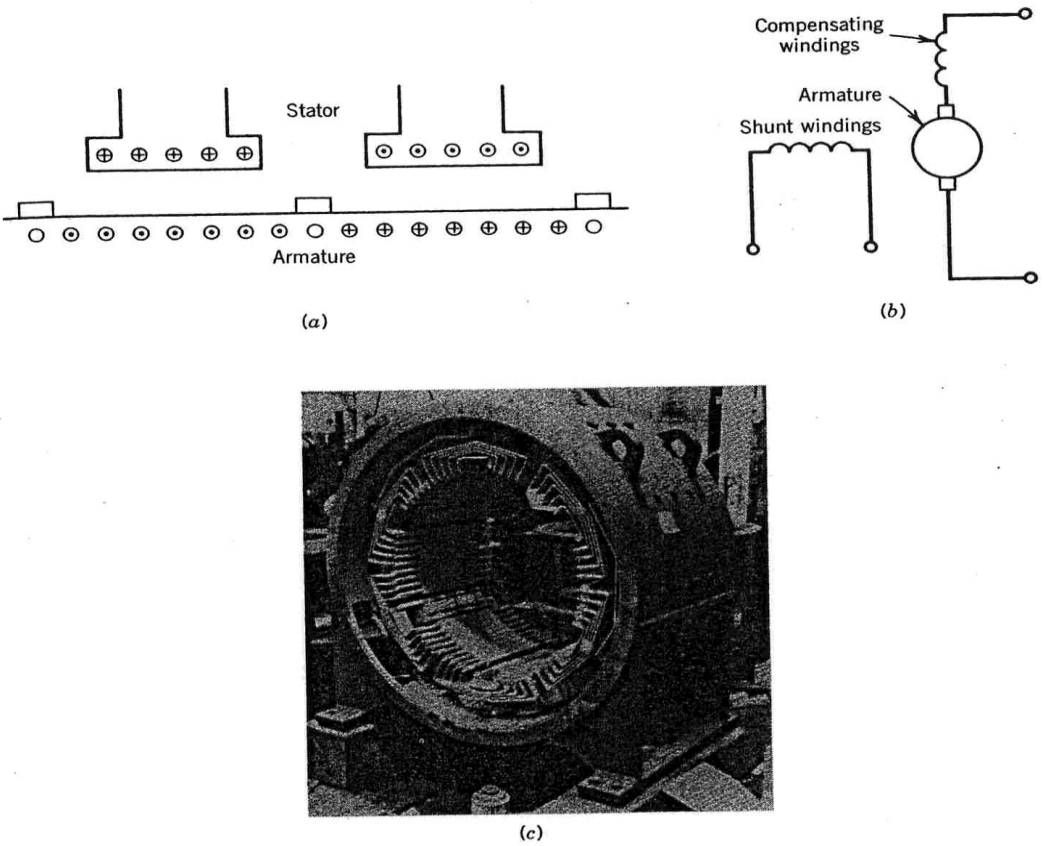
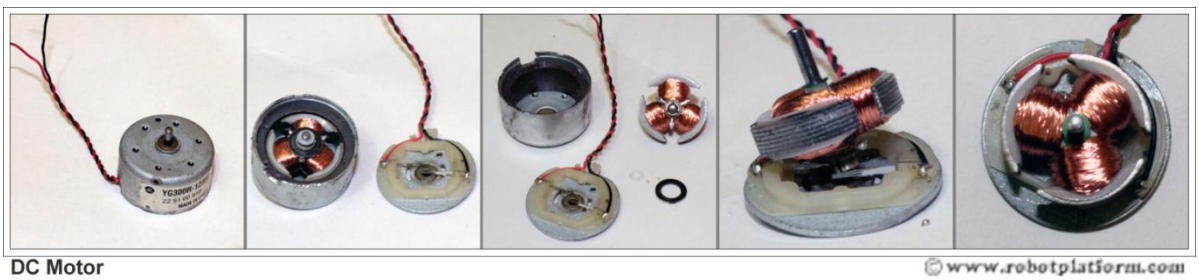


FIGURE 4.33 Compensating winding. (*a*) Developed diagram. (*b*) Schematic diagram. (*c*) Photograph. (Courtesy of General Electric Canada Inc.)

2.2.4. PERMANENT MAGNET STATORS

Main article: Permanent-magnet electric motor

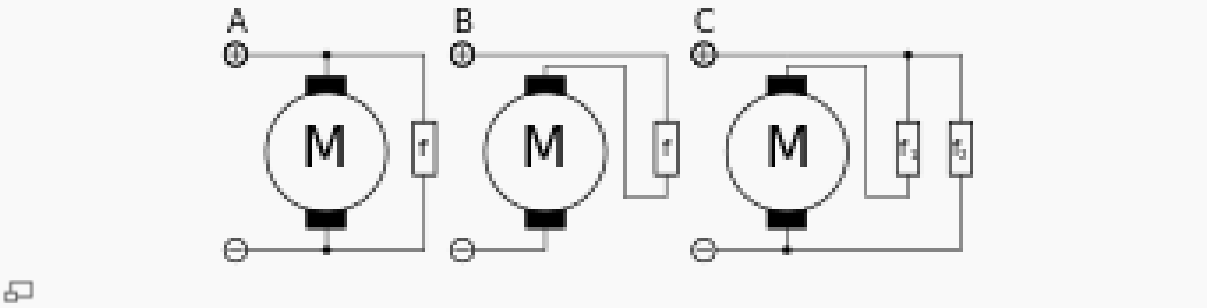
A PM motor does not have a field winding on the stator frame, instead relying on PMs to provide the magnetic field against which the rotor field interacts to produce torque. Compensating windings in series with the armature may be used on large motors to improve commutation under load. Because this field is fixed, it cannot be adjusted for speed control. PM fields (stators) are convenient in miniature motors to eliminate the power consumption of the field winding. Most larger DC motors are of the "dynamo" type, which have stator windings. Historically, PMs could not be made to retain high flux if they were disassembled; field windings were more practical to obtain the needed amount of flux. However, large PMs are costly, as well as dangerous and difficult to assemble; this favors wound fields for large machines.



To minimize overall weight and size, miniature PM motors may use high energy magnets made with neodymium or other strategic elements; most such are neodymium-iron-boron alloy. With their higher flux density, electric machines with high-energy PMs are at least competitive with all optimally designed singly

fed synchronous and induction electric machines. Miniature motors resemble the structure in the illustration, except that they have at least three rotor poles (to ensure starting, regardless of rotor position) and their outer housing is a steel tube that magnetically links the exteriors of the curved field magnets.

WOUND STATORS



A field coil may be connected in shunt, in series, or in compound with the armature of a DC machine (motor or generator)

Main article: universal motor
See also: Excitation (magnetic)

There are three types of electrical connections between the stator and rotor possible for DC electric motors: series, shunt/parallel and compound (various blends of series and shunt/parallel) and each has unique speed/torque characteristics appropriate for diffent loading torque profiles/signatures.[1]

Series connection

A series DC motor connects the armature and field windings in series with a common D.C. power source. The motor speed varies as a non-linear function of load torque and armature current; current is common to both the stator and rotor yielding current squared (I^2) behavior[*citation needed*]. A series motor has very high starting torque and is commonly used for starting high inertia loads, such as trains, elevators or hoists.[2] This speed/torque characteristic is useful in applications such as dragline excavators, where the digging tool moves rapidly when unloaded but slowly when carrying a heavy load.

With no mechanical load on the series motor, the current is low, the counter-EMF produced by the field winding is weak, and so the armature must turn faster to produce sufficient counter-EMF to balance the supply voltage. The motor can be damaged by over speed. This is called a runaway condition.

Series motors called "universal motors" can be used on alternating current. Since the armature voltage and the field direction reverse at (substantially) the same time, torque continues to be produced in the same direction. Since the speed is not related to the line frequency, universal motors can develop higher-than-synchronous speeds, making them lighter than induction motors of the same rated mechanical output. This is a valuable characteristic for hand-held power tools. Universal motors for commercial power frequency are usually small, not more than about 1 kW output. However, much larger universal motors were used for electric locomotives, fed by special low-frequency traction power networks to avoid problems with commutation under heavy and varying loads.

Shunt connection

A shunt DC motor connects the armature and field windings in parallel or shunt with a common D.C. power source. This type of motor has good speed regulation even as the load varies, but does not have the starting torque of a series DC motor.[3] It is typically used for industrial, adjustable speed applications, such as machine tools, winding/unwinding machines and tensioners.

Compound connection

A compound DC motor connects the armature and fields windings in a shunt and a series combination to give it characteristics of both a shunt and a series DC motor.[4] This motor is used when both a high starting torque and good speed regulation is needed. The motor can be connected in two arrangements: cumulatively or differentially. Cumulative compound motors connect the series field to aid the shunt field, which provides higher starting torque but less speed regulation. Differential compound DC motors have good speed regulation and are typically operated at constant speed.

2.3.1. GEARS AND THEIR PROPORIONS

Gears –

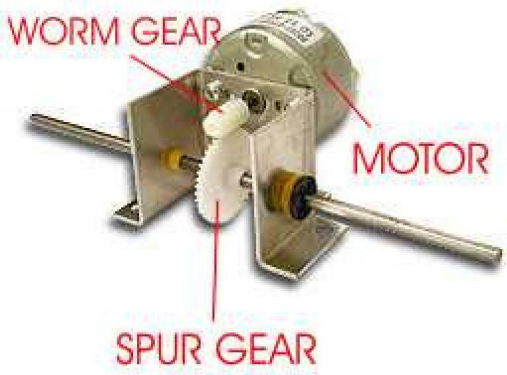
Gears are wheels with teeth. Gears mesh together and make things turn. Gears are used to transfer motion or power from one moving part to another.

2.3.2. Gears – The Purpose

Gears are generally used for one of four different reasons:

- To reverse the direction of rotation
- To increase or decrease the speed of rotation
- To move rotational motion to a different axis
- To keep the rotation of two axis synchronized

Sports cars go fast (have speed) but cannot pull any weight. Big trucks can pull heavy loads (have power), but cannot go fast. Gears cause this. Gears increase or decrease the power or speed, but you cannot generally speaking.



Types of Gears

Spur gears are gears in the same plane that move opposite of each other because they are meshed together. Gear 'A' is called the 'driver' because this is turned by a motor.

As gear 'A' turns it meshes with gear 'B' and it begins to turn as well. Gear 'B' is called the 'driven' gear.

Gears are wheels with teeth. Gears mesh together and make things turn.

Gears are used to transfer motion or power from one moving part to another.

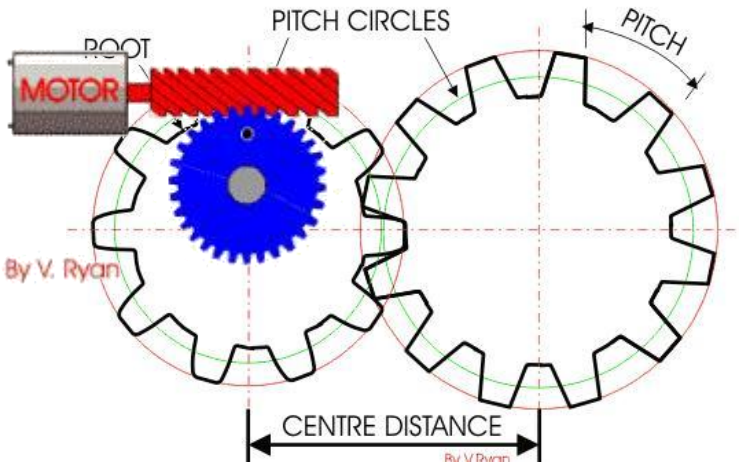
pitch circle of a gear is very important as it is used by engineers to determine the shape of the teeth and the ratio between gears (ratios will be explained later)

2.3.3. Gear Details(Spur)

The circle marked in red shows the outer limit of the teeth whilst the green circles are known as the pitch circles. The pitch circle of a gear is very important as it is used by engineers to determine the shape of the teeth and the ratio between gears (ratios will be explained later).

The pitch of a gear is the distance between any point on one tooth and the same point on the next tooth.

The root is the bottom part of a gear wheel.



RACK AND PINION

A 'rack and pinion' gears system looks quite unusual. However, it is still composed of two gears. The 'pinion' is the normal round gear and the 'rack' is straight or flat.

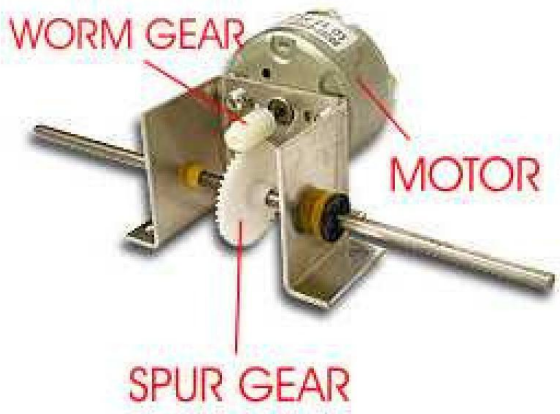
The 'rack' has teeth cut in it and they mesh with the teeth of the pinion gear.

The pinion rotates and moves the rack in a straight line - another way of describing this is to say 'rotary motion' changes to 'linear motion'.

WORM GEARS

The arrangement of gears seen is called a worm and wormwheel. The worm, which in this example is brown in color, only has one tooth but it is like a screw thread.

The wormwheel, colored yellow, is like a normal gear wheel or spur gear. The worm always drives the worm wheel round, it is never the opposite way round as the system tends to lock and jam.



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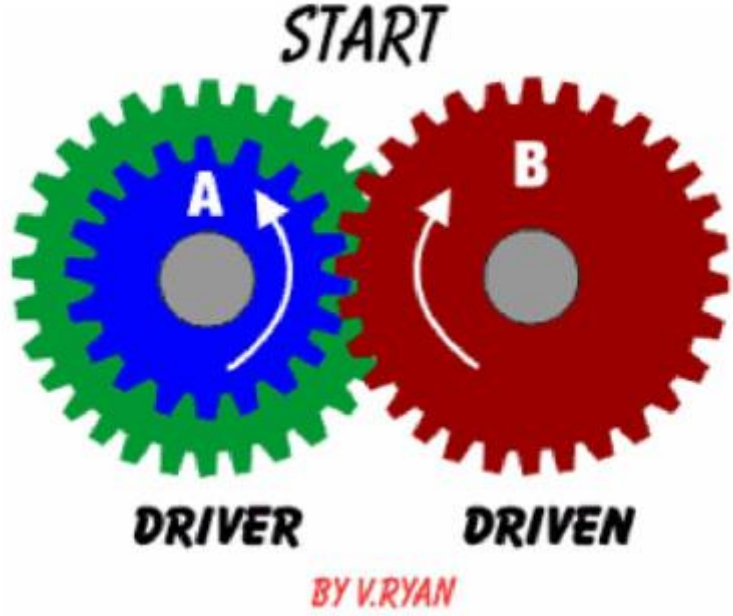
GEAR SYSTEMS



Compound gears are used in engines, workshop machines and in many other mechanical devices. In the diagram, gear 'A' is actually two gears attached to each other and they rotate around the same centre. Sometimes compound gears are used so that the final gear in a gear train rotates at the correct speed.

This is a good example of a 'gear train'. A gear train is usually made up of two or more gears. The driver in this example is gear 'A'. If a motor turns gear 'A' in an Anticlockwise direction;
Does gear 'C' revolve faster or slower than gear 'A ? - explain your answer.'

SLOWER – SMALLER GEAR TURNS A LARGER GEAR

So far you have learned about 'driver' gears, ''driven' gears and gear trains. An 'idler' gearis another important gear. In the example opposite gear 'A' turns in an anticlockwise direction and also gear 'C' turns in an anticlockwise direction. The 'idler' gear is used so that the rotation of the two important gears is the same.

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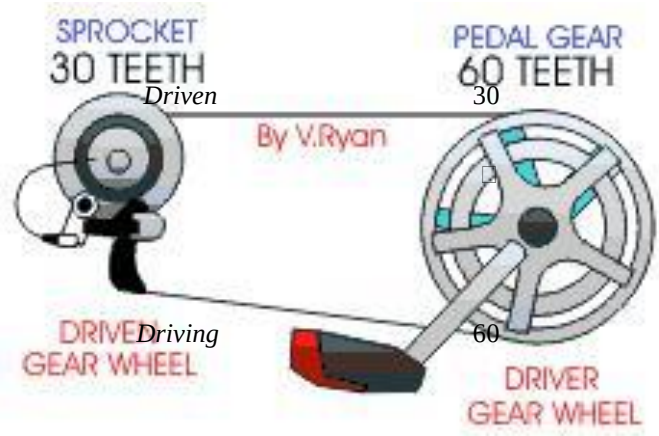
GEAR RATIO (VELOCITY RATIO)

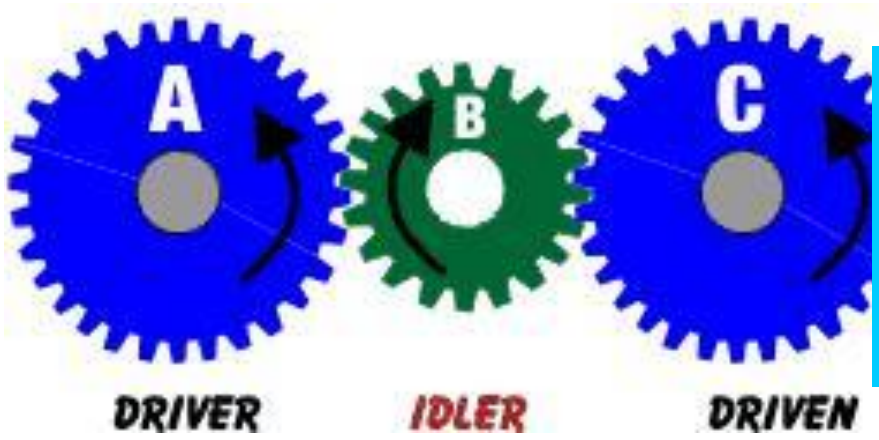
Many machines use gears. A very good example is a bicycle which has gears that make it easier to cycle, especially up hills. Bicycles normally have a large gear wheel which has a pedal attached and a selection of gear wheels of different sizes, on the back wheel. When the pedal is revolved the chain pulls round the gear wheels

The reason bicycles are easier to cycle up a hill when the gears are changed is due to What is called Gear Ratio (velocity ratio). Gear ratio can be worked out in the form of Numbers and examples are shown. Basically, the ratio is determined by the number of teeth On each gear wheel, the chain is ignored and does not enter the equation.

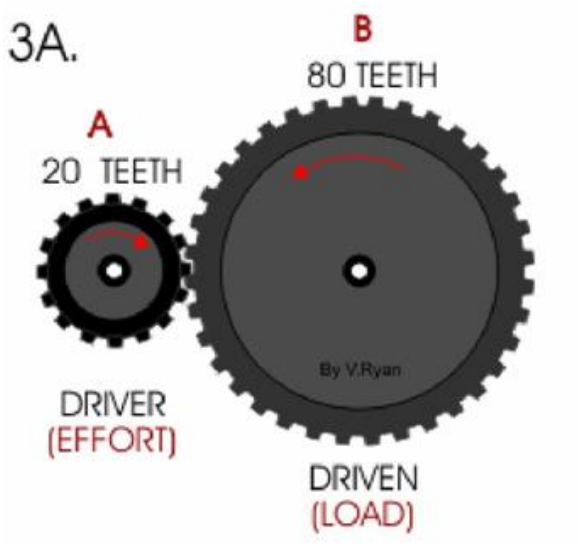


Driven 30 1→1 : 2

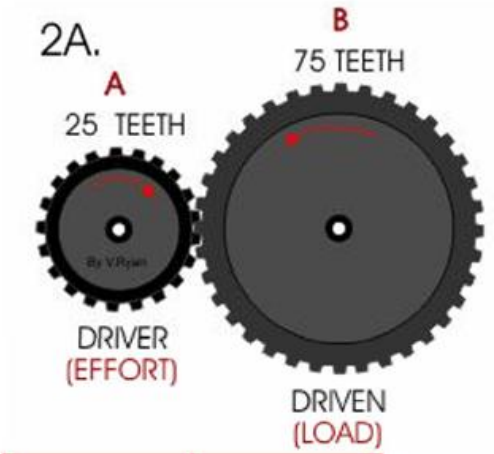
Driving 60 2



ut WHAT does this mean? It means that the DRIVEN gear makes TWO rotations for every ONE rotation of the Driving Gear.



Working out RPMs (revolutions per minute)



GEAR A	GEAR B
25 teeth	75 teeth
60 rpm	?

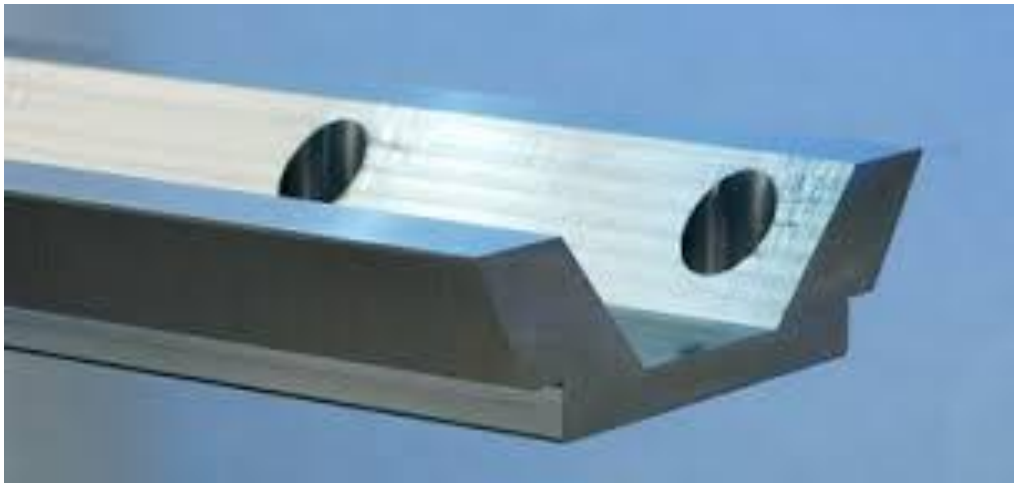
$$\frac{75}{25} = 3$$

$$= \frac{60}{3} = 20 \text{ revs/min}$$

In the example shown, the DRIVER gear is smaller than the DRIVEN gear. The general rule is - small to large gear means 'divide' the velocity ratio(3:1) by the rpm of the first gear. Divide 75 teeth by 25 teeth to find the velocity ratio. divide the 60rpm by the velocity ration (3). The answer is 20rpm.

GUIDEWAYS

- as Linear Motion bearings have a mechanism to bear the load and to guide their linear motion simultaneously.
- Linear Motion Guideways (LM Guideways) also known



WHEELS

* Pinch wheel or pinch roller was the name used for the plastic or rubber wheels in an 8-track cartridge, used to guide and align the magnetic tape. Rubber rollers were known to degrade over time, creating a maintenance

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Construction of an automatic

black board cleaner

Step-1 :

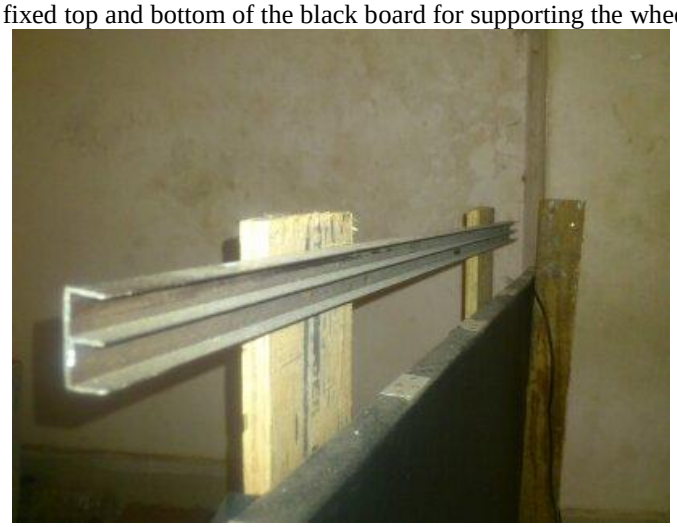
In the construction of automatic blackboard duster the board is supported on a wood frame.

Step-2 :

Two steel rods are placed at the top and bottom of frame in horizontal direction.

Step-3 :

And two guide ways are fixed top and bottom of the black board for supporting the wheels.



The duster running the black board by supported the these two steel rods

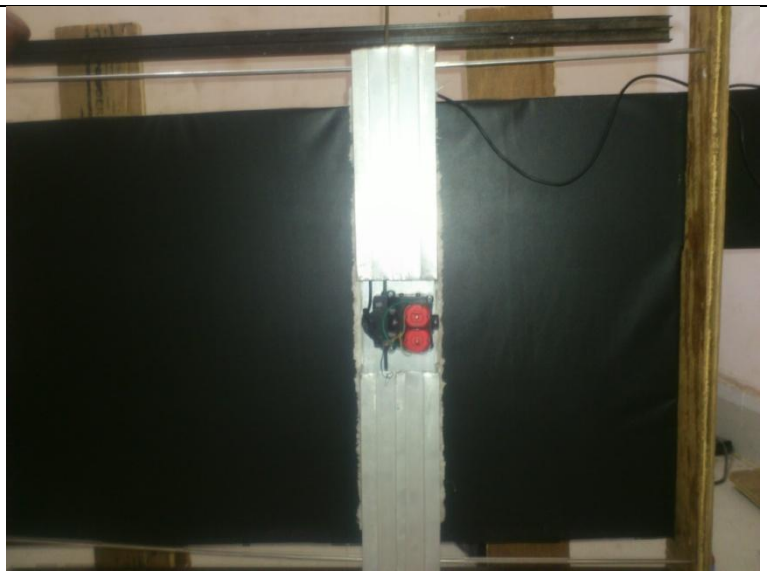
Step-4
A duster is mounted vertically on these two steel rods.

Step-5 :
The motor is fixed in the middle of the duster.the motor connected to the wheel axils through the gear drives.The wheels running on the guide ways

Step-6 :
The power supply to the motor by the external source (battery). The switch circuit provided for to and fro motion of the duster.

Working

In the working of automatic blackboard duster as the power is supplied to the motor the shaft of the motor stars rotating. A gearbox is connected to the motor shaft is connected by another gear.



Thus movement of these gears rotates the wheel axil by which both the upper and lower wheels start rotating. By the rotation of these shafts, the wheels which is mounted on these guideways in horizontal direction,the wheels also starts running.

A duster which is mounted on this wheels starts reciprocating to and fro, thus clean the board.

A switch is provided for to and fro motion of the dusterIn this fast growing world there are different new technologies adopted to increase work rate in minimum time period. Thus, automatic blackboard duster is also a new technology for cleaning the board automatically in minimum time period.

In this advanced world the competition is increasing day by day, thus the time of every person is most precious. As automatic blackboard duster clean the board in less time and saves the time of student which is too important

Specifications **Blackboard**	
Dimensions	2*1.5ft
Weight	3 kg

Motor	
Type	DC
Ampere	1
Volt5	

Duster	
Length	1.5Feet
Width3 inch	

S. No.	Parts	Quantity
1	Blackboard	1
2	Motor	2
3	Duster	1
4	Frame	1
5	Steel rod	2
6	Guide ways	2
7	wheels	2

Advantages

1. Install automation in operations reduce time.

2. Easy and fast operation with maximum wiping area

3. High degree of accuracy.

4. Problem of dust can be reduce

5. Maintenance cost is less

6. Simple in construction and operating

CONCLUSION

Compared with manually wipe, smart wipe has a good effect and runs smooth with good reaction speed. The rate of rotation of the motor can be set in accordance with the requirements of the wiping speed to suit the requirements of different occasions.

The smart eraser has a simple structure, easy to operate, easy to obtain raw materials, manufacturing equipment simple process. Its Control functions, and less susceptible to interference, high reliability, ease of use, can make products with high performance and low cost.

The product is suitable for large, medium and small institutions, the promotion of certain significance

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