

LINEARLY CIRCULATING FAN

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Abstract - This report present a linear circulating mechanism applied in an ordinary ceiling fan support. the present scenario usually fans are placed right above the head if a person seated below and he is the one who gets the maximum wind out of it . Persons who are seated at the corners are usually exempt from it. So in order to solve this, we have come up with a design which equally distribute the air throughout the room The mechanism consists of rack and pinion, an electrical motor and ball bearings. A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. Electrical motor which drives the gear mechanism contains a hollow shaft. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. This project is mainly focused to increase the air circulation inside the room or halls. The project aims to change the direction of air flow by the linear reciprocating motion of fan. The rack, pinion and frame is made up of cast iron which help us to reduce the vibration. Rack follows a circulating path to reduce the inertial force.

Key Words: linear circulating mechanism , fans, rack and pinion, electrical motor, ball bearings

1. INTRODUCTION

The fan is usually composed of flat blades which are attached to an electric motor. The motor, most commonly, has several speeds and can often be operated in a clockwise direction or counter clockwise direction. The fan blades are normally positioned at an angle to the vertical axis of the motor. The result of the angled blades turning is that air will be gathered by the leading edge of the blade and forced to the trailing edge and a breeze is felt coming off of the trailing edge. Within an enclosed environment such as a room in a home or business, the ceiling fan can be used to accelerate the distribution of warm or cooled air within the defined space, reducing energy bills and improving comfort. In the winter, when a warmer interior is required, it is generally considered the most effective operation of the ceiling fan is to "push" the air up toward the ceiling, the lower edge of the blades will be leading as the blades circle.

The ceiling fan operating by itself blowing air down will provide some relief on a hot day. A ceiling fan operating in conjunction with an air conditioner will reduce the run time of the AC unit and allow higher temperatures to be set because moving air is "cooler" than still air. Now a days we are facing a problem that as we move away from a ceiling fan we don't get enough cooling effect. This is usually experienced In large rooms or halls where the space

between two adjacent fan is more. So to rectify this problem we are introducing a linear moveable mechanism in an ordinary ceiling fan. By which we can decrease the number of fans and increase the comfort ability. This project is mainly focused to increase the air circulation inside the room or hall. We aim to change the direction of air flow by the linear reciprocating motion of fan . One of the benefit of this project is that we can reduce the number of fans used inside the hall. By this we can increase the overall satisfaction.

Air cooling is a method of dissipating. It works by making the object to be cooled have a larger surface area or have an increased flow of air over its surface, or both. An example of the former is to add to the surface of the object, either by making them integral or by attaching them tightly to the object's surface (to ensure efficient heat transfer). In the case of the latter it is done by using a fan blowing into or onto the object one wants to cool. In many cases the addition of fins adds to the total surface area making that makes for greater efficiency in cooling.

2. MECHANISM

Rack and pinions are simple mechanisms where a pair of gears come together to steer a vehicle by circular and lateral motions. As the pinion, which interlocks with the rack, makes circular movements, the rack is moved side-to-side.

A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called the pinion engages teeth on a linear gear bar called the rack rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a railcar engages a rack between the rails and forces a train up a steep slope .For every pair of conjugate involute profile, there is a basic rack. This basic rack is the profile of the conjugate gear of infinite pitch radius (i.e. a toothed straight edge).A generating rack is a rack outline used to indicate tooth details and dimensions for the design of a generating tool, such as a hob or a gear shaper cutter.

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls

and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other. Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races.

3. DIAGRAMS

Followings are the design sketches and photos of the working model.

A circular gear called the pinion engages teeth on a linear gear bar called the rack rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion Fig 4.1 3D view of linearly circulating ceiling fan

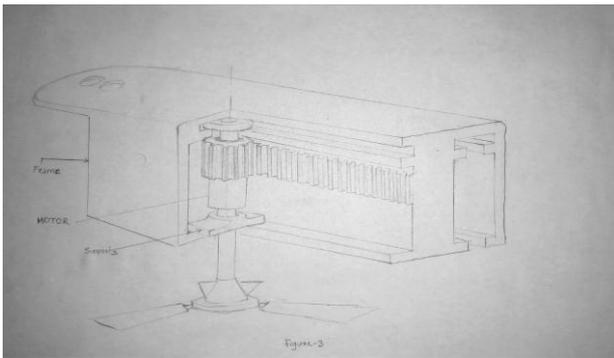


Fig - 1. 3D view of linearly circulating ceiling fan

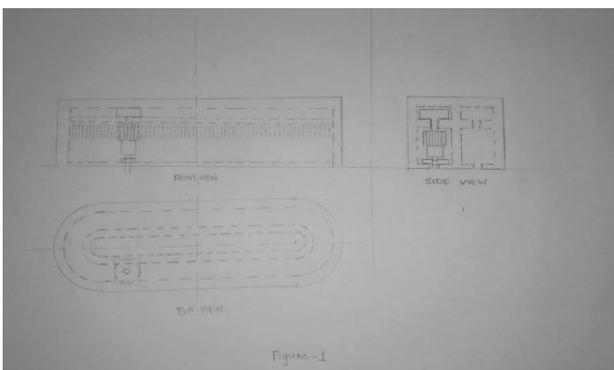


Fig - 2. 2D view of linearly circulating ceiling fan

Pinion is meshed to the rack on the frame.as pinion rotates it will start moving in the rack. Here rack is fixed to the frame and it is capsule in shape. Here the rotary motion of pinion is converted into the linear motion of the shaft.



Fig - 3. Motor shaft front view



Fig - 4. Rack and Pinion Arrangement

4. REPRESENTATION OF MECHANISM

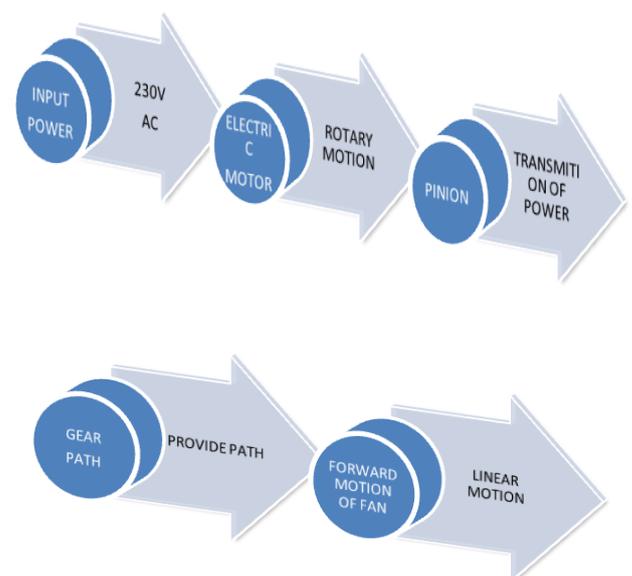


Fig - 5. Block Diagram

The input power is 230 V AC is given to the electric motor inside the frame the connection is given through the hollow shaft provided in the system. This input electric power is converted into mechanical power by the electric motor, as a result rotor of the electric motor rotates. This rotary motion is passed on to the pinion which is attached to the rotor of the electric motor. so the pinion rotates. Pinion is meshed to the rack on the frame. as pinion rotates it will start moving in the rack. Here rack is fixed to the frame and it is capsule in shape. Here the rotary motion of pinion is converted into the linear motion of the shaft. The fan is attached to this shaft and the fan begins to move in circular path provided. So in this system electric power is first converted into rotary motion and then it is converted into linear motion. The illustration is shown in block diagram.

When the electrical supply is given to the electric motor, motor rotates. the pinion is attached to the motor which is meshed with the rack. when the pinion rotates it moves through the rack gives the linear motion of the ceiling fan. The structure of the path is in capsule shape. The entire system is mounted on a hollow shaft which is supported by ball bearings at top and bottom of the frame.

Air cooling is a method of dissipating. It works by making the object to be cooled have a larger surface area or have an increased flow of air over its surface, or both. An example of the former is to add to the surface of the object, either by making them integral or by attaching them tightly to the object's surface (to ensure efficient heat transfer). In the case of the latter it is done by using a fan blowing into or onto the object one wants to cool. In many cases the addition of fins adds to the total surface area making that makes for greater efficiency in cooling.

5. COMPONENTS AND MATERIALS USED

5.1 Materials Used

Cast iron is a group of iron-carbon alloys with a carbon content greater than 2%. [1] Its usefulness derives from its relatively low melting temperature. The alloy constituents affect its colour when fractured: white cast iron has carbide impurities which allow cracks to pass straight through, grey cast iron has graphite flakes which deflect a passing crack and initiate countless new cracks as the material breaks, and ductile cast iron has spherical graphite "nodules" which stop the crack from further progressing.

Carbon (C) ranging from 1.8–4 wt%, and silicon (Si) 1–3 wt% are the main alloying elements of cast iron. Iron alloys with lower carbon content (~0.8%) are known as steel. While this technically makes the Fe–C–Si system ternary, the principle of cast iron solidification can be understood from the simpler binary iron–carbon phase diagram. Since the compositions of most cast irons are around the eutectic point (lowest liquid point) of the iron–carbon system, the melting temperatures usually range from 1,150 to 1,200 °C (2,100 to

2,190 °F), which is about 300 °C (540 °F) lower than the melting point of pure iron.

Mild steel is the most commonly used steel. It is used in the industries as well in the different every day objects we use. Even the pan sand spoon soft the kitchen are some times made of mild steel. The main target of this article is to discuss about different mild steel properties. The mild steel is very important in the manufacturing of metal items.

Almost 90% steel products in world is made up of mild steel because it is the cheapest form of steel. Mild steel is the most widely used steel which is not brittle and cheap in price. Mild steel is not readily tempered or hardened but possesses enough strength.

5.2. Components Used

Electric Motor 230v AC motor an induction motor or asynchronous motor is an ac electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connections to the rotor. An induction motor's rotor can be either wound type or squirrel-cage type.

Ceiling fan is a mechanical fan, usually electrically powered, suspended from the ceiling of a room, That uses hub-mounted rotating paddles to circulate air. Ceiling fans typically rotate more slowly than other types of circulating fans, such as electric desk fans. They cool people effectively by introducing slow movement into the otherwise still, hot air of a room. Fans never actually cool air, unlike air-conditioning equipment, but use significantly less power (cooling air is thermodynamically expensive). Conversely, a ceiling fan can also be used to reduce the stratification of warm air in a room by forcing it down to affect both occupants' sensations and thermostat readings, thereby improving climate control energy efficiency

A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion.

Frame is made up of cast iron to reduce vibration. A group of iron-carbon alloys with a carbon content greater than 2%. Its usefulness derives from its relatively low melting temperature. The alloy constituents affect its colour when fractured: white cast iron has carbide impurities which allow cracks to pass straight through, grey cast iron has graphite flakes which deflect a passing crack and initiate countless new cracks as the material breaks, and ductile cast iron has spherical graphite "nodules" which stop the crack from further progressing.

6. RESULTS

We have calculated the forces acting in the fan and noted how these forces acts in a fan. We resolved these forces into different components and checked whether the forces affects the working of our project. We got that these forces have only a minute affect in our project. We also created a prototype to see the working of our project linearly circulating ceiling fan and it worked properly. The speed and power of the motor has to be restricted to maintain the stability of the ceiling fan. We decreased the speed using a regulator and increased the initial torque was increased by providing a separate starter winding. The friction between pinion and shaft was decreased by providing two ball bearings for each motor and pinion.



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7. CONCLUSIONS

The objective has been successfully achieved

This project is mainly focused to increase the air circulation inside the room or halls. We aim to change the direction of air flow by the linearly circulating motion of fan. One of the benefits of this project is that we can reduce the number of fans used inside the hall. By this we can increase the overall satisfaction.

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BIOGRAPHIES



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