



Design and Modification of Rolling Shutter by Using Chain Drive Mechanism

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ABSTRACT

In this paper we are going to discuss about the construction of large rolling shutter. The shutter is made up of variety of slats inter-connected with each other. The configuration of slat must be such that the rain water must not accumulate between two consecutive slats. The shutter curtain travels in the guide channels to open and close, provided at the either side of the shutter. The gear system or direct mechanical mechanism can be installed for the opening and closing of shutter. If the size of the shutter is big then a motor can also be installed for the opening and closing of shutter. In the beginning, current coming from the supply which rotates the circular shaft. Which transfer the torque to the gear box which connected to the shutter shaft. Eventually, shutter roller gets operated automatically as per our requirement.

Key words: Motor, Bevel Gear, Chain Sprocket, Gear Box

INTRODUCTION

Roller shutters are usually defined as a vertical revolving barrier at the entrance of building, traditionally made of metal which its leafs, curtains or slats will be rolled upwards during its opening position and downwards during closing position. Due to the advancement of new inventions, roller shutters are also made of various materials such as aluminum coupled with other insulations. The advantage of using roller shutter is for space efficiency and to provide a clear unobstructed opening, while completely securing and compartmentalizing the entrance hole during closure. it is a type of shutter consisting of many horizontal slats hinged together. The shutter is raised to open it and lowered to close it. Roller shutters have many applications, including doors for garages, warehouses, shops, etc.

LITERATURE SURVEY

Pranshu (2014) Remote controlled Garage shutter Available After working on this project, it can be concluded that among various garage shutters available, sectional garage door is the most efficient, convenient, useful and requires minimum space for installation. Ayodele Sunday Oluwole, Temitope Adefarati, Kehinde Olusyi, Adedayo Babarinde, Ezea Hillary Design of automatic gate control using infrared remote with password protected features to Infrared or wireless technology provides an alternate, more portable, more independent means of accessing, opening and closing of a and other electronic information. This research examines how user can open and close the gate with using of IR control.

MOTOR: A.C. INDUCTION MOTORS**Fig. 1** Motor

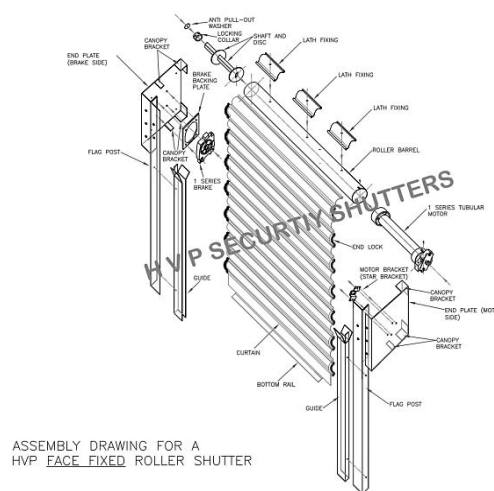
Ac motor is distinguished by a rotor spinning and coil passing magnets at the same rate as the alternating current and resulting magnetic field which drives it. Speed is independent of the load provided sufficient field current is applied. Accurate controlling speed. This motor power factor can be adjusted to unity by using a proper field current relative to the load. Motor converts electrical power to mechanical power in its rotor.

There are several ways to supply power to rotor. This ac motor power is induced in the rotating device. Since motor has no significant current rise on starting, this motor is ideal to an application which requires six or more starts per minute. One winding to other results reversal of motor direction. Single pole three position switch can be used for Forward, Reversed & Off control as show in following fig. Metal visitor oxide may be used to minimize the switch contact arcing. Motor will not be over heated if stalled because starting; full load and no load are same. However prolonged operation against a solid stop will eventually produce bearing failure due to the resultant shaft vibrations. The motors are having extremely rapid starting; there is a limit to the inertia load at which the motor will start from rest. Power coated cast aluminium body with steel shaft.AC motor is that in the latter a current is supplied on to the rotor. This then creates a magnetic field which, through magnetic interaction, links to the rotating magnetic field in the stator which in turn causes the rotor to turn.

BEVEL GEARS**Fig. 2** Bevel gear

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gear is a cone. Independently from the operating angle, the gear axes must intersect. Bevel gear lifts floodgate by means of central screw. Bevel ring gear on the rear wheel of a shaft driven bicycle. Two important concepts in gearing are pitch surface and pitch angle. The pitch surface of a gear is imaginary toothless surface that you would have by averaging out the peaks and valleys of the individual teeth. The pitch surface of an ordinary gear is the angle between the face of the pitch surface of an ordinary gear is the shape of the cylinder. The pitch angle of a gear is the angle between the face of the pitch surface and the axis. Bevel gears that have pitch angles of greater than 90 degrees have teeth that point inward are called internal bevel gear.

The bevel gear has many diverse applications such as locomotives, marine applications, automobiles, printing presses, cooling towers, steel plants, railway track inspection machines, etc. Bevel gears are used in differential drives, which can transmit power to two axles spinning at different speeds, such as those on a cornering automobile. Bevel gears are used as the main mechanism for a hand drill. As the handle of the drill is turned in a vertical direction, the bevel gears change the rotation of the chuck to a horizontal rotation. The bevel gears in a hand drill have the added advantage of increasing the speed of rotation of the chuck and this makes it possible to drill a range of materials.

ROLLER SHUTTER**Fig. 3** Roller shutter

A roller shutter, roller door or sectional overhead door is a type of door or window shutter consisting of many horizontal slats (or sometimes bars or web system) hinged together. The door is raised to open it and lowered to close it. On large doors, the action may be motorized. It provides protection against wind and rain. In shutter firm, it is used in front of a window and protects the window from vandalism and burglary attempts.

Components Used in Shutter

- Slat - The basic component of Shutter is slat. The shutter curtain is formed by inter-locking of number of slats with each other.
- Pipe - The Shutter curtain rolls over the pipe while opening and closing of shutter. The pipe used in shutter assembly should be heavy duty pipe suitable for mechanical applications.
- Guide Channels - U shaped guide channels are used.
- Shaft - The shaft runs inside the overhanging pipe which connects the assembly to the brackets.
- Spring - The spring are used for the counter balancing the rolling shutter.
- Cast Iron Castings - The cast iron casting are used for roller pulleys, cleats, gears.

SPROCKET**Fig. 4** Sprocket

A sprocket or sprocket-wheel is a profiled wheel with teeth, or cogs, that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth. Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles. Sprockets are various designs, a maximum of being claimed for each by its originators. Sprockets typically do not have a flange. Some sprockets are used with timing belts have flanges to keep the timing belt centered. Sprockets and

chains are also used for power transmission from one shaft to another where slippage is not admissible, sprocket chains being used instead of belts or ropes and sprocket-wheels instead of pulleys. They can be run at high speed and some forms of chains are so constructed as to be noiseless even at high speed.

ROLLER CHAINS

Roller chain or bush roller chain is the type of chain drive most commonly used for transmission of mechanical power on many kinds of domestic, industrial and agricultural machinery, including conveyers, wire and tube-drawing machines, printing presses, cars, motorcycles, and bicycles. It consists of a series of short cylindrical rollers held together by side links. It is driven by a toothed wheel called a sprocket. It is a simple, reliable, and efficient means of power transmission. The roller chain design reduces friction compared to simpler designs, resulting in higher efficiency and less wear. The original power transmission chain varieties lacked rollers and bushings, with both the inner and outer plates held by pins which directly contact the sprocket teeth and the plates where they pivoted on the pins. This problem was partially solved by the development of bushed chains, with the pins holding the outer plates passing through bushings or sleeves connecting the inner plates. This distributed the wear over a greater area however the teeth of the sprockets still wore more rapidly than it is desirable, from the sliding friction against the bushings. The addition of rollers surrounding the bushing sleeves of the chain and provided rolling contact with the teeth of the sprockets resulting in excellent resistance to wear of both sprockets and chain as well. There is even very low friction, as long as the chain is sufficiently lubricated. Continuous, clean, lubrication of roller chains is of primary importance for efficient operation as well as correct tensioning.

There are actually two types of links alternating in the bush roller chain. The first type is inner links, having two inner plates held together by two sleeves or bushings upon which rotate two rollers.



Fig. 5 Chain

alternate with the second type, the outer links, consisting of two outer plates held together by pins passing through the bushings of the inner links. The “bushing less” roller chain is similar in operation though not in construction; instead of separate bushings or sleeves holding the inner plates together, the plate has a tube stamped into it protruding from the hole which serves the same purpose. This has the advantage of removing one step in assembly of the chain.

GEAR BOX



Fig. 6 Gear Box

A speed reducer or reducing gearbox is used to reduce the input velocity of a motor while increasing the torque produced by the input. The reducing gearbox or reduction gearbox has teeth on the pinions and wheels that mesh with each other to transfer power from the driver shaft to the driven shaft to reduce speed.

METHODOLOGY

- Roller shutter consist of a corrugated sheet curtain which is made up of interlocking slate
- It is operated with the help of 3phase AC motor, chain and worm gear arrangement
- It works by rolling or sliding up and down through tracks
- Roller shutter are operated manually or remotely.

- As your shutter is lifted or opened up automatically, the corrugations flex, allowing the steel curtain to roll up on itself.

OBJECTIVES

- Ease in handling the system.
- This will significantly reduce human fatigue to operate roller shutters.
- Less skilled person can easily operate
- Safety of the users.
- Making these doors automatic.
- Reduce back injuries due to shutter operation.
- Affordable price

DESIGN & SPECIFICATION

Table-1

Material	Size	Equipment
C.I	33 mm	Main shaft
S.S	20 mm* 12 T	Output shaft (Sprocket)
S.S	20 mm* 12 T	Motor shaft (Sprocket)
S.S	20 mm* 24 T	Input shaft (Sprocket)
S.S	33 mm* 36T	Main shaft (Sprocket)
S.S	1020 mm	Rolling Chain
S.S	1270 mm	Rolling Chain

Power = 1HP

Speed (RPM) = 1440

Voltage 230 V

Product Description

Wattage:

- 350W- 780W (0.5 HP-1HP)

Voltage:

- 1ph, 230V 0.5 HP
- 3ph, 6T 1HP

Speed:

- 1440 RPM

Mounting:

- Flange
- Foot

Gear Box:

- Hollow Shaft planetary is possible

Gear specification:

Shaft length =270 mm

Width of gear box= 80 mm

Calculation:-

To determine the speed of shaft given as follows:

$N_1=1440$ rpm

$N_1T_1=N_2T_2$

$1440*12=N_2*12$

$N_2=1440*12/12$

$N_2=1140$ rpm

$N_2T_2=N_3T_3$

$1440*12=N_3*24$

$$N2=1440*12/24$$

$$N3=730\text{rpm}$$

$$N3T3=N4T4$$

$$720*24=N3*36$$

$$N3=720*24/36$$

$$N3=480$$

Where

N1=Speed of motor shaft

N2= Speed of input shaft gear box

N3= Speed of output shaft gear box

N4= Speed of main shaft

T1= No of teeth on motor shaft

T2= No of teeth on input shaft gear box

T3= No of teeth on output shaft gear box

T4= No of teeth on main shaft

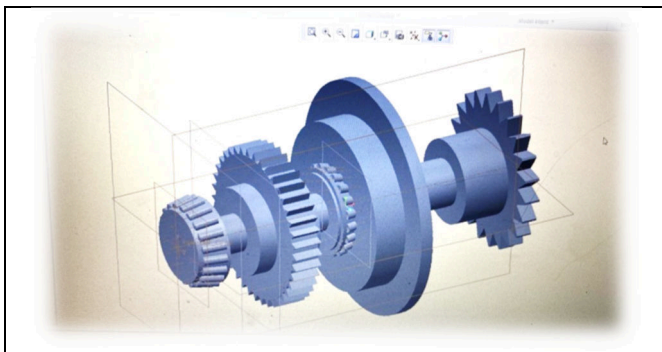


Fig. 7 3D view of gear assembly

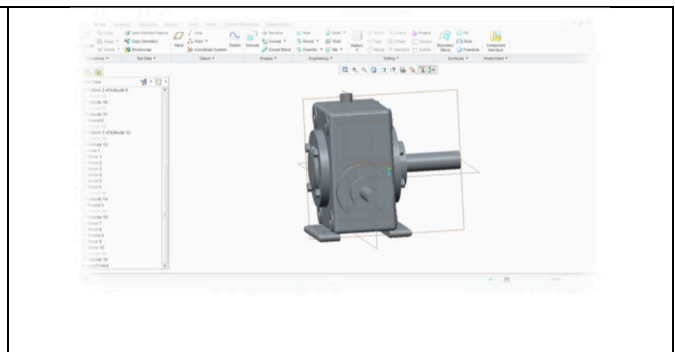


Fig. 8 CAD Model Gear Box

1. With a simple motor in place, motorised shutters are easy to use with the help of a remote.
2. In case of a fire or an earthquake, evacuation will be much easier with automatic shutters, as they would be able to open and close faster and wouldn't require human operation.
3. Fully automatic shutters will provide you with complete privacy, whether installed in your home or business facility.

RESULT AND CONCLUSION

- We have learnt how to apply theoretical knowledge into practical work.
- Team spirit and team work qualities are developed.
- We have learnt how to do technical analysis on particular object.
- Our presentation skill and problem-solving capability enhanced.

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