DESIGN AND FABRICATION OF ROPE MAKING MACHINE

P.Veera Raju[1], N.V.S.R.Narasimha Naidu[2], Sree Dharmasastha.K [3], U.V.Kanaka Raju[4], M.Vamsi Krishna Reddy[5]

[1]Associate professor, [2345]U. G. Scholars, Department of Mechanical engineering
Godavari Institute of Engineering and Technology (Autonomous), Rajahmundry, Andhra Pradesh, India.

Abstract: A rope making machine is used for production of different types of wires such as accelerator wires, power transmission wires, etc. depending on applications and sizes of machines. In conventional machine, number of gears and space required is more .Also it is robust in construction.

In our modified machine, we use the synchronous AC motor to transmit power to frame, which is attached to the other end of synchronous motor. An epi-cyclic gear system is attached to the frame which provides rotation to the bevel gear system due to which spindle get rotated and winds the rope over it. Due to the rotation of frame wire get twisted .Because of simultaneous operation of twisting and winding of wires, the rope get produced.

Keywords **–Winding, wire rope, spur gears, load distribution, Epi-cyclic gear train.**

I. INTRODUCTION:

Our project work, rope making machine presents the work of making a rope from the four single strands which are twisted into a single rope and that rope is rotated onto a spool which is fixed as the head of the machine. Four strands were twisted together to make a rope. The strands were attached to the same hook. Three planetary gears which are induced in an internal gear are the ones that twists the single stranded spools and thus twisting the strands into a rope. The rope stayed together because the twists went in opposite directions. This machine will run by an AC motor which have a capacity of 0.25 Hp and has a 1460 rpm of speed. By making this machine the production of the rope will be more when compared to that of making of rope by human effort, which eventually saves time and labor cost and increases the production rate of the rope making.

The epi-cyclic gear worked winding machine winds a material, for example, metal wire, string or paper, onto a center, spool or bobbin. The paper manages the pedal worked winding machine. So we are exhibiting a creative technique for manual worked winding machine. This will eventually diminish cost and time. In any case, the fundamental favorable position is that we are proposing the strategy that is totally going to take out the high cost.

There are a couple of unmistakable sorts of turning machine from essential manual urge machine to complex PC numeric control (CNC) machines. A part of the more run of the mill utilizes for winding machines are twist winding, rope winding, and determined fiber winding. A curl winding machine is one of the kinds of winding machine that accessible in ventures today.

The loop winding machine can be arranged by their speed levels and limit. The regular utilization of curl winding machine is to twist loop for a transformer pointer engines and gags. Numerous ventures utilize this gadget including material, hardware, and wire businesses. A manual winding machine ordinarily has an inside on hub and the customer energizes wire, rope or other material onto the middle.

The customer controls the pivot speed and supports the material through client hands, overseeing it to control the weight and load plan. These essential machines may be of a seat top size or tremendous stay singular winder. In this project we are going to design and fabricate a rope making machine. The main work that is done on this machine is that it will take four single threads and by twisting them, they will turned out into a rope. This machine will run by an AC motor which have a speed of 1460 rpm (0.25 Hp)

2. HARDWARE USED

AC Motor:

Fig-1: AC Motor

Induction Motors are the most commonly used motors in many applications. These are also called as Asynchronous Motors, because an induction motor always runs at a speed lower than synchronous speed. Synchronous speed means the speed of the rotating magnetic field in the stator.

There basically 2 types of induction motor depending upon the type of input supply

(i) Single phase induction motor and

(ii) Three phase induction motor.

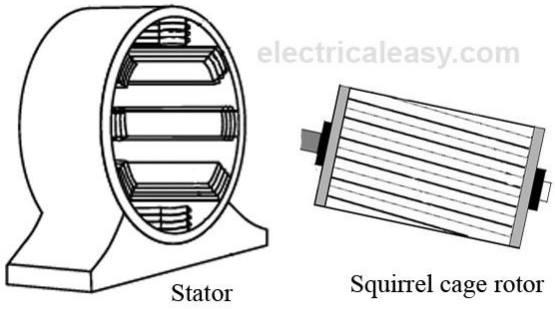

Fig: 2

Basic Working Principle of an Induction Motor:

In a DC motor, supply is needed to be given for the stator winding as well as the rotor winding. But in an induction motor only the stator winding is fed with an AC supply.

Alternating flux is produced around the stator winding due to AC supply. This alternating flux revolves with synchronous speed. The revolving flux is called as "Rotating Magnetic Field" (RMF).

The relative speed between stator RMF and rotor conductors causes an induced emf in the rotor conductors, according to the Faraday's law of electromagnetic induction. The rotor conductors are short circuited, and hence rotor current is produced due to induced emf. That is why such motors are called as induction motors.

(This action is same as that occurs in transformers, hence induction motors can be called as rotating transformers.)

Now, induced current in rotor will also produce alternating flux around it. This rotor flux lags behind the stator flux. The direction of induced rotor current, according to Lenz's law, is such that it will tend to oppose the cause of its production.

As the cause of production of rotor current is the relative velocity between rotating stator flux and the rotor, the rotor will try to catch up with the stator RMF. Thus the rotor rotates in the same direction as that of stator flux to minimize the relative velocity. However, the rotor never succeeds in catching up the synchronous speed. This is the basic working principle of induction motor of either type, single phase of 3 phase.

Gear:

Gears are machine elements, which are required to transmit power between shafts rotating at different rotational speeds. By adding teeth of the proper shape on disk, power can be transmitted without slip at uniform rate. These types of geometrics are known as external gears. Internal gears are generally more efficient since the sliding velocity along the profile is lower than equivalent external gears. It operates at closer centre distance with its mating pinion than external gears of the same size, which often permits a more compact design. The internal gears eliminates the use of an idler gear, where it is necessary to have two parallel shafts rotate in the same direction. In manufacturing point of view also, external gears are simpler than internal gears.

Fig 3: Internal & External gearing

Spur Gear:
Spur gears have their teeth parallel to the axis and are used for transmitting power between two parallel shafts. They are simple in construction, easy to manufacture and cost less. They have highest efficiency and excellent precision rating. They are used in high speed and high load application in all types of trains and a wide range of velocity ratios. Hence, they find wide applications right from clocks, household gadgets, motor cycles, automobiles, and railways to aircrafts.

Fig-4: Spur Gear

Epi-Cyclic Gear:
In our project an epi-cyclic gear train (also known as planetary gear) consists of two gears mounted so that the center of one gear revolves around the center of the other. A carrier connects the centers of the two gears and rotates to carry one gear, called the planet gear, around the other, called the sun gear. The planet and sun gears mesh so that their pitch circles roll without slip. A point on the pitch circle of the planet gear traces an epicycloid curve. In this simplified case, the sun gear is fixed and the planetary gear(s) roll around the sun gear. An epi-cyclic gear train can be assembled so the planet gear rolls on the inside of the pitch circle of a fixed, outer gear ring, or ring gear, sometimes called an annular gear which is used in our project.

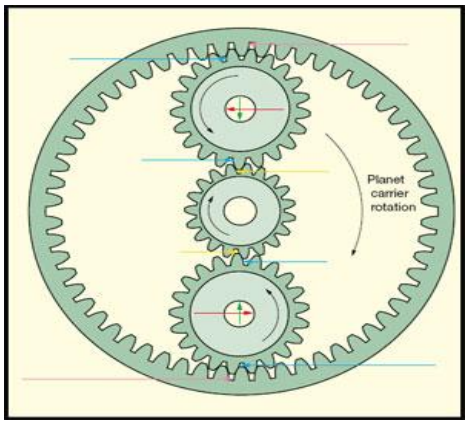

Fig-5: Epi-Cyclic Gear

WORKING PRINCIPLE:

An epicyclic gear train consists of two gears mounted so that the centre of one gear revolves around the centre of the other. A carrier connects the centres of the two gears and rotates to carry one gear, called the planet gear, around the other, called the sun gear. The planet and sun gears mesh so that their pitch circles roll without slip. A point on the pitch circle of the planet gear traces an epicycloid curve. In this simplified case, the sun gear is fixed and the planetary gear(s) roll around the sun gear. 2. An epicyclic gear train can be assembled so the planet gear rolls on the inside of the pitch circle of a fixed, outer gear ring, which is called as annulus gear. In this case, the curve traced by a point on the pitch circle of the planet is a hypocycloid.Epicyclic gear

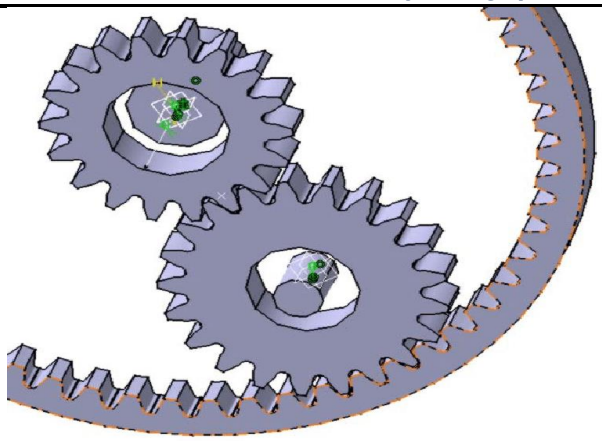

Fig-6: Epi-Cyclic Gear

V-Belt Drives:

Among flexible machine elements, perhaps V-belt drives have widest industrial application. These belts have trapezoidal cross section and do not have any joints. Therefore, these belts are manufactured only for certain standard lengths. To accommodate these belts the pulleys have V shaped grooves which makes them relatively costlier. Multiple groove pulleys are available to accommodate number of belts, when large power transmission is required. V-belt drives are most recommended for shorter centre distances. In comparison to flat belt drives, these drives are slightly less efficient. V belt can have transmission ratio up to 1:15 and belt

Fig-6: V-Belt drive

Fly Wheel:

Flywheels have been used for a long time as mechanical energy storage devices. The earliest form of a flywheel is a potter's wheel that uses stored energy to aid in shaping earthen vessels. The wheel is a disc made of wood, stone or clay. It rests on a fixed pivot and can be rotated around its center. The energy stored in a potter's flywheel is about 500J, which is by no means negligible. The main disadvantages are friction and material integrity. Most of energy is lost in overcoming frictional losses. The word 'flywheel' appeared first during the start of industrial revolution.

During this period, there were two important developments: one is the use of flywheels in steam engines and the other is widespread use of iron. Iron flywheels have greater material integrity than flywheels made up of wood, stone or clay. They can be built in a single piece and can accommodate more mass and moment of inertia in the same volume. These flywheels were used mostly for smoothing torque pulses in steam engines.

The amount of energy 'E' stored in a flywheel varies linearly with moment of inertia 'I' and with the square of the angular velocity 'ω'.

$$E = \frac{1}{2} \cdot I \cdot \omega^2$$

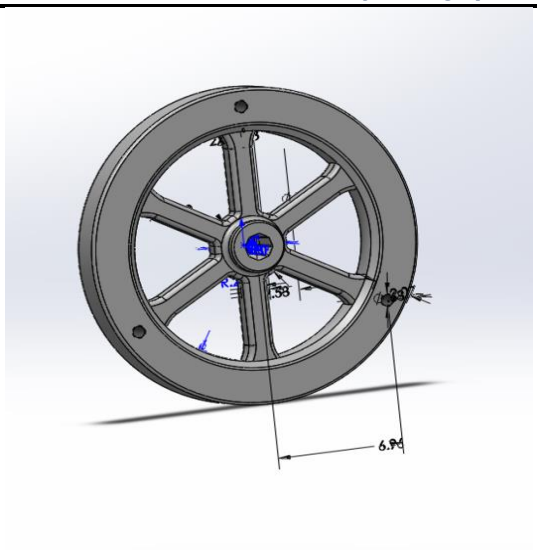

Fig: 4.1

Pulley:

A pulley is a simple mechanical machine and consists of a wheel that turns readily on an axle. The wheel is usually grooved for a rope or a wire cable. Idler pulleys in the accessory drive of internal combustion engines contribute to improvements in their performance capacity and noise behavior. In the accessory drive, idler pulleys are normally subjected to a demanding combination of high loads, exposure to dust and mud as well as high temperatures.

Fig: 7 Idler Pulley

II. RESULTS AND DISCUSSION

When the rope making machine is turned on, you can combine the four single strands to the hook provided and control the winding by attaching the initial end of the rope to the spool. In our project epi-cyclic gear will rotate the four single strand spools into a single rope. It has more efficiency and the production rate is higher when compared to the handmade rope production.

Fig-9: Side view of rope making machine

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V. CONCLUSION AND FUTURE WORK

This research facilitates efficient rope making. This proposed work will save time, labor cost. These can be used in a small scale industries for efficient production.

The additional features that may be added in this rope making machine is that by increasing the planetary gears we can increase the diameter of the rope as we can increase the no of strand spools. We can use chains instead of belts pulley mechanism.

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REFERENCES

[1] Charles C. Sunderland, Trenton, N.J., assignor to John A. Roebling's Sons Company, Trenton, N. J., a corporation of New Jersey Application August3,[1927].

[2] International J. of Engg. Research & Indu. Appls. (IJERIA).ISSN 0974-1518, Vol.3, No.IV (November 2010) pp. 193-216.