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DESIGN AND DEVELOPMENT FENCING MACHINE.

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Abstract - *The paper presents the review, analysis, study of concepts, innovation of machine producing chain link. The length of the fence produced is adjustable. The machine also has manually operated mechanism for situations like power cuts. The moto is to occupy less space at workplace and produce the fence as required on the spot.*

***Key Words*: Design of fencing machine, Chain link fencing, Fencing, Fencing machine, material selection.**

1. INTRODUCTION

For ages it has been a common practice to mark/designate one's property by fencing around it. As the time changed so did the techniques involved in fencing. In early age the fences used to be of stones. A century ago the fencing was dominated by use of steel and wood. In modern times though, there are many fencing techniques available which can be implied as per the requirement.

Of many such techniques a well-known and diversely implied one is the chain link fencing. Its implication can be found at borders, alongside the highways, in industrial production lines and for domestic purpose. It was the industrial revolution that influenced the production of chain link fencing machines, the inspiration was taken from cloth-weaving machine. For production of chain link fencing the manual, semi-automatic and automatic machines are used.

The machine under development is focuses on small scale business model and at places were instant fencing is required. 1) In areas with low power supplies and hard for transportation, like areas near LOC. The fencing are needed near LOC from time to time. The machine working on low power supply will help producing fence in difficult situations also. Since machine is also manually operated, in the situations without electricity, fences will be produced without any stoppage. 2) We often see chain link fences around sports grounds, especially in outdoor sports grounds, like cricket. Motorsports is one of the sports which needs chain link fences the most. It is most likely to have an accidents on track and destroy fencing. Marshals need to repair the fencings immediately. The machine is small in size and also consumes less power to operate so it can be placed in any corner of the building and operate. 3) Small scale businesses can also use the machine to produce fences and sell the product separately. The operating cost is very low as it consumes less electricity, also the maintenance is low which fulfils the purpose of the machine.

2. LITERATURE

2.1 WIRE QUALITY

There is a need to better understand how wire quality affects the manufacturing of fences because (1) to avoid wire strand breakage (2) to avoid subsequent field erection. For this a series tests of wire quality that can be conducted by fence producers for physical and metallurgical properties were administered, this six potential test were i) Tensile strength ii) Ductility iii)Three point bending iv)Impact energy v) Linear torsional conductivity vi) Micro-hardness. The various tests of GI were conducted the data then statistically examined and compared. It was found that linear torsional conductivity is the most sensitive and reliable indicator of wire quality.

Generally for fencing GI (galvanized iron) wire is used. It is a zinc coated iron wire used for applications that demand longevity zinc carbon should be uniform adherent, reasonably smooth and free from impurity. More recently the technology has increased in performance and functionality for a typical modern machine. Now they have a high degree of electrical- mechanical- electronic integration so wire strand breakage has reduced but the wire quality definitely affects the efficiency of machine and hence it affects the production of fencing. Another test conducted for the testing of wire quality is the wire wrap test, the existing wire wrap test simply involves wrapping the wire into a coil, and the LTD builds on this foundation. The innovative component in the LTD test is that the resulting wrap specimen is subsequently elongated in spring tension, e.g. In a tensile testing machine, whereas the plain wrap-test is single-direction application of plastic-ductility, the LTD test applies an additional torsion stress after the work hardening episode. Once a spring is formed, the test is easily conducted in any tensile testing system, or indeed in any system (e.g. hydraulic puller) that can stretch the coil. It is important to note that the test only measures the length of the specimen: the actual force is not required. So a laboratory tensile testing machine is unnecessary.

2.2 SHAFT DESIGN

Shaft design is the most important task in design of any mechanical system. Shaft is the most critical part and it must be designed with high accuracy for good reliability of any machine. It is the power transmitting element and carries the load of whole machine. It must be design to sustain the

stresses which are developed due to loads acting on it. There are many conventional methods to design the shaft. Fatigue is very common phenomenon which is responsible for failure of shaft during operation. Generally it is made up of cast iron. This shaft operably connected to the plate such that rotation of the shaft is imparted to the plate. The plate has wire engaging face, a tool engaging face(plate is connected to the drive shaft which provides rotation) and a port extended therethrough. This port has enough space that wire coming inside the shaft can take the desire angular bend. Hollow, solid and tapered are the basic types out of which we required hollow shaft here. Drive shaft is a mechanical component used to connect the drive chain components which are not connected due to distance between them. Drive shafts are used for transmitting torque and power which subjects to high torsional and shear stress. This drive shaft is joint with plate. From welded joint, bolted joint and riveting we have to decide which joint is best fit here. Welded joint is the joint in which two materials are joint at high temperature created by arc. It is permanent joint. Bolted joint is a temporary joint in which a threaded bolt is inserted in a hole. It is temporary joint and one can separate it whenever required. Because of extra vibration in bolted joint which can impact the twist angle we choose permanent joint. A rotating shaft subjected to a steady, transverse-bending load will experience a fully reversed stress state. Any one stress element on the shaft surface goes from tension to compression each cycle as the shaft turns. Thus, even for steady bending loads, a rotating shaft must be designed against fatigue failure If either or both torque and transverse load vary with time, the fatigue loading becomes more complex, but fatigue design principles remains the same. It is not necessary to evaluate the stresses in a shaft at every point; a few potentially critical locations will suffice. Critical locations will usually be on the outer surface, at axial locations where the bending moment is large, where the torque is present, and where stress concentrations exist.

2.3 THE CONTROL OF INDUCTION ELECTROMOTOR BY THE RESISTANCE CHANGE IN ROTOR CIRCUIT

Induction motors are the most widely used electrical motors due to their reliability, low cost and robustness. However, induction motors do not inherently have the capability of variable speed operation. Due to this reason, DC motors found applications in the electrical drives. But the recent developments in speed control methods of the induction motor have led to their large scale use in almost all electrical drives. The torque depends on motor resistance. Therefore, increasing the rotor resistance at a constant torque causes a proportionate increase in the motor slip with decrease in rotor speed. Thus, the speed for a given load torque may be varied by varying the rotor resistance. The function of this resistance is to introduce voltage at rotor frequency, which opposes the voltage induced in rotor winding. Conventionally, the rotor resistance is controlled manually and in discrete steps. The main demerit of this method of speed control is that energy is dissipated in rotor circuit resistance. Because of the waste-fullness of this method, it is used where speed change are needed for short duration only.

2.4 STUDY OF STATOR VOLTAGE CONTROL METHOD FOR INDUCTION MOTOR TORQUE CONTROL

This controlling method for an Induction motor speed control is used. Stator voltage control method is depending upon two basic planes, one of them torques control and another is flux control. The current is displaced from each other by 90 degree of induction motor easily controlled three phase current really applied to the motor. The voltage is generated by quadrature current and direct current. It is subjected to generating torque of motor. The stator voltages are phase with quadrature current, and direct current displaced to 90-degree angle. The motor inputs are actual voltages and the current produces in this system. Induction motor speed controlling is difficult than DC motor speed controlling. This technique used for a complex current construct quadrature element. First ones are usable for the flux maintaining of motor. The second basic concept is use for reference. The basic concept of that frame is change completely a specific frame [6-10]. The generated torque is controls in the motor. Basic concept of frame is to convert quantity in regular value of frame rotating for constant frequency. As the speed of motor reduces, the torque is also reduced. Torque applications are convenient for stator voltage control. This is reducing the speed of motor. The pump and fan drives are convenient for variable voltage and speed control is obtained using AC voltage controller.

2.5 SIMULATION OF SPEED CONTROL OF INDUCTION MOTOR USING V/F METHOD

In the present scenario of electric machines' applications, induction motors are the most preferable because of their strong, tough and sturdy construction without any commutators. The major applications of induction motors are in industries, lifts, hoists, lathe machines, textile etc. For efficiency, reliability, speed and torque, three phase induction motor comes into the picture. Speed control of such a machine is significant in variable load constant speed application.

The operation of induction motor using constant V/f method has been known for several decades. Because of frequent breakthroughs in power electronics, this method became more and more popular. Although the method of vector control or field-oriented control has been introduced by Blanche, there is intensive research still taking place in that area. In this model, simulation of speed control of induction motor is done using V/f method with the implementation of sinusoidal pulse width modulated signals fed to the inverter. The efficient and essential step to control the speed of an induction motor, is to control the frequency of the supply. In this manner, we will able to control the speed of induction motor. The output frequency of an inverter is determined by the gate pulses which are given to the semiconductor devices, which are switched on and off accordingly. One of

the best ways to generate these gate pulses is by using 'Sinusoidal Pulse Width Modulation' technique, where sine wave is taken as reference. As we are familiar with this following equation, "Nr=(1-s)*Ns" where "Ns=(120*f)/P", from these two equations, we can say that speed is directly proportional to frequency. The development of speed control system using variable frequency has been designed by combinations of SPWM control circuit and three arm inverter which makes the system simple, robust, cheap and compact.

2.6 MODELLING AND SYSTEM IDENTIFICATION OF A STIFF STAY WIRE FENCE MACHINE

C.E. Hann and E. Brouwers(2009) comes up with a Modelling and System Identification of a Stiff Stay Wire Fence Machine. This documentation is based on investigation of the gear backlash problem encountered in Stiff Stay Wire Fence Machine. Typically concentrated on the effect of backlash on ability to control a shaft. The problem was that the commanded torque were excessively large and threatened to damage the gearbox. Due to this problem they did the complete analysis of system dynamically, did mathematical modelling of machine, Identifying load on the shaft external as well as internal, torque analysis to overcome the problem of gear backlash. Overall, the measured and model responses show that significantly less motor torque than the given measured motor torque is required to adequately control the shaft position. In particular, only a change of 0.8 degrees is with an upper torque limit of 80 Nm as compared to the no torque limit. This change is well within the machine tolerances required for safety. Therefore, the maximum torque delivered by the motor could be made a lot less to minimize power consumption, and potentially, the motor could be downsized. However, it was noted in the machine, that the 80 Nm upper torque limit was not sufficient to bring the main shaft up to speed. The model was validated using several torque limiting experiments and gave an accurate prediction of the machine's major dynamics. The simulation tool developed provides the basis to predict the effect of different loads, wire types or motors on the machine for future designs minimizing the amount of experimentation on the machine.

BENJAMIN O. JOHNSON (1893) proposed a model of fence-building machine. Invention relates to an improvement in machines for building fences, and especially to that class of machines for constructing wire and picket fence, and the objective of the invention is to provide a machine of exceedingly simple and durable construction and capable of being readily transported from place to place and of being conveniently and expeditiously manipulated to separate wire strands to receive pickets, twist or close the strands around the pickets and hold them thereby firmly in the intended position. A further object of the invention to provide a machine in which the strands of wire adapted to support the pickets will be under Constant and uniform tension while the machine is in operation.

3. CONCLUSIONS

In the presented work, we have presented a comprehensive study covering all the key aspects that needs to be considered while deciding the function ability and sustainability of a fencing machine. The study involves inspection of wire quality, possible impacts on the shaft, various available driving mechanisms and their selection criteria. The study further involves the present and future advancements in the field. The result of the presented work shows the feasibility of the machine and various parameters that ought not be overlooked.

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