© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716189

Chain Link Wire Mesh Making Machine

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Abstract- ***Fences can be defined as arrangement that provides an obstruction, enclosure, or a boundary, made up of posts or stakes linked together by boards, wire, or rails. The chains run vertically and are bent into a zig zag pattern so that each "zig" hooks with the wire immediately on one side and each "zag" with the wire immediately on the other. The manufacturing of chain-link fencing is called weaving. Preparing zigzag shape wire is a quite challenging task and cannot be done using basic mechanisms. So here we design a smart mechanism to automatically bend wires in order to get zigzag shaped wire for mesh. These wires can then be linked together to create chain link or meshes. For this system we make use of a wire bobbin to supply raw wire to the system, a DC motor with shaft connected to a unique mechanism that achieves our bending requirements. The system is a small yet complex system that achieves the task with ease.***

I. 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 clothweaving machine. The complete understanding of basic manufacturing processes and workshop technology is highly difficult for anyone to claim expertise over it. The study deals with several aspects of workshops practices also for imparting the basic working knowledge of the different engineering materials, tools, equipment’s, manufacturing processes, basic concepts of electro-mechanical controls of machine tools, production criteria’s, characteristics and uses of various testing instruments and measuring or inspecting devices for checking components or products manufactured in various manufacturing shops in an industrial environment. It also describes and demonstrates the use of different hand tools (measuring, marking, holding and supporting tools, cutting etc.), equipment’s, machinery and various methods of manufacturing that facilitate shaping or forming the different existing raw materials into suitable usable forms. It deals with the study of industrial environment which involves the practical knowledge in the area of ferrous and nonferrous materials, their properties and uses.

It should provide the knowledge of basic workshop processes namely bench work and fitting, sheet metal, carpentry, pattern making, mould making, foundry, smithy, forging, metal working and heat treatment, welding, fastening, machine shop, surface finishing and coatings, assembling inspection and quality control. It emphasizes on basic knowledge regarding composition, properties and uses of different raw materials, various production processes, replacement of or improvement over a large number of old processes, new and compact designs, better accuracy in dimensions, quicker methods of production, better surface finishes, more alternatives to the existing materials and tooling systems, automatic and numerical control systems, higher mechanization and greater output. The study deals with several aspects of workshops practices also for imparting the basic working knowledge of the different engineering materials, tools, equipment’s, manufacturing processes, basic concepts of electro-mechanical controls of machine tools, production criteria’s, characteristics and uses of various testing instruments and measuring or inspecting devices for checking components or products manufactured in various manufacturing shops in an industrial environment. It also describes and demonstrates the use of different hand tools

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Project design may be defined as the iterative decision making activity to create a plan or plans by which the available resources are converted, preferably optimally, into systems, processes or devices to perform the desired functions and to meet human needs. In fact project design has been defined in many ways but the simplest ways to define project design as 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 accidents on track and destroy fencing. Marshals need to repair the fencings immediately.
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.

In simple terms, a chain link wire mesh making machine automates the process of weaving wire into a mesh structure. Traditionally, wire weaving was done manually, which required significant labor and time. However, with technological advancements, modern machines are capable of producing large volumes of mesh in a short period with high precision and consistency. The machine operates by feeding a continuous wire from a spool, straightening it, and then bending it into a zigzag pattern. These zigzag wires are then interlocked with each other to form a continuous diamond-shaped mesh. The finished mesh is either rolled into coils or cut into sheets depending on the application requirements.

II. OBJECTIVES OF THE PROJECT

- To understand the basic principal of the our project
- Describe the construction and working of various parts of our project
- Development of the working model of the our project
- To reduce time spent on this activity.
- To analyse the technology according to needs and capabilities.
- a chain link wire mesh making machine project are to automate the production of diamond- pattern fencing to reduce manual labour , increase production speed, and ensure consistent, high-quality output.
- Key goals include creating cost- effective machinery for small- scale manufacturers, enabling wire customization (diameter/mesh size), and improving overall efficiency.

1.1 Problem Definition

- In the Hand operated chain link fencing machine is more time consuming and more labour is required due to cost of process increase.
- Using the Hand operated chain link fencing machine more fatigue of workers.
- The problem involves automating the labour - intensive, slow, and inaccurate manual weaving of wire into zig- zag patterns for chain link fences.

1.2 Scope of Project

- To cut down the cost employed using motorized operation.
- Decreasing the operational cost by further introducing new solar power chain link fencing mechanisms.
- To decrease labour costs by advancing the motorized operation of machine.
- To consume low electricity solar power.
- A chain link wire mesh making machine project includes designing, fabricating, or operating a motorized unit to produce diamond-pattern fencing from galvanized or PVC-coated wire, typically serving the construction, agricultural, and security sectors.

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III. LITERATURE REVIEW

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.

A fence is arrangement that encircles a space, typically exterior, and is usually created from posts that are connected by panels, wire, railings or mesh. A fence varies from a wall is not having a rock solid foundation along its entire span. A chain-link fences usually made from galvanized steel wire. The manufacturing of chain-link fencing is called weaving. A metal wire frequently galvanized to reduce corrosion, is pulled along a rotating long and flat blade, thus making a somewhat flattened spiral. The spiral continuously rotate passing the blade and winds it through the previous spiral that is part of the produced fence. When the spiral reaches the distant end of the fence, the spiral is cut near the blade. Then the spiral is pressed flat and the whole fence is moved up and ready for the next cycle. The end of each second spiral joins the end of each first spiral. The machine clamps both ends and gives them a few twists. This makes the links permanent. An enhanced version of the weaving machine winds two wires around the blade at once, thus creating a double helix. One of the spirals is woven through the last spiral that is part of the already produced fence. This progress allows the process to advance twice as fast. Fences can be defined as structures serving as an enclosure, a barrier, or a boundary, usually made of posts or stakes joined together by boards, wire, or rails. In contrast, a “virtual fence” can also serve as an enclosure, a barrier, or a boundary, but that relies on other than physical objects on the landscape to alter an animals’ behaviour.

The concept of virtual fencing occurs increasingly in discussions of those whose job it is to manage Free-ranging animals; this includes stockpersons, scientists and nature conservationists. Therefore, a patent and literature search was conducted to investigate the topic of virtual fencing. The term virtual fence seems to be used in a very broad sense and different concepts of its application exist. However, they all have in common the fact that the system uses no physical barrier on the landscape. Therefore, a virtual fence can be defined as a structure serving as an enclosure, a barrier, or a boundary without a physical barrier. Knotted wire fences are used throughout the world for retention of livestock. Other types of wire fencing include single strands, diamond (chain link), welded mesh and hexagonal mesh (chicken mesh). However the subject of the present paper is only rectangular knotted mesh, with a particular emphasis on the production thereof.

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As an agricultural product, the primary body of knowledge on fencing has historically resided in national standards, e.g., with a particular focus on the geometric parameters of the fence and the coatings. The corrosion resistance of wire fences in exposed environments has been of interest for many years and still continues to be an area of research as material science has made newer coatings available.

IV. METHODOLOGY

Many products observed in day- to-day life, are commonly made by putting many parts together may be in subassembly. For example, the ball pen consists of a body, refill, barrel, cap, and refill operating mechanism. All these parts are put together to form the product as a pen.

More than 800 parts are put together to make various subassemblies and final assembly of car or aero-plane. A complete machine tool may also require to assemble more than 100 parts in various sub assemble or final assembly. The process of putting the parts together to form the product, which performs the desired function, is called assembly. An assemblage of parts may require some parts to be joined together using various joining processes. But assembly should not be confused with the joining process. Most of the products cannot be manufactured as single unit they are manufactured as different components using one or more of the above manufacturing processes, and these components are assembled to get the desired product.

Joining processes are widely used in fabrication and assembly work. In these process two or more pieces of metal parts are joined together to produce desired shape and size of the product. The joining processes are carried out by fusing, pressing, rubbing, riveting, screwing or any other means of assembling. The process of putting the parts together to form the product, which performs the desired function, is called assembly. An assemblage of parts may require some parts to be joined together using various joining processes. But assembly should not be confused with the joining process. Most of the products cannot be manufactured as single unit they are manufactured as different components using one or more of the above manufacturing processes, and these components are assembled to get the desired product.

These processes are used for assembling metal parts and in general fabrication work. Such requirements usually occur when several pieces are to be joined together to fabricate a desired structure of products. These processes are used developing steam or water-tight joints. Temporary, semi- permanent or permanent type of fastening to make a good joint is generally created by these processes. The joining processes are carried out by fusing, pressing, rubbing, riveting, screwing or any other means of assembling. These processes are used for assembling metal parts and in general fabrication work.

Temporary joining of components can be achieved by use of nuts, screws and bolts. Adhesives are also used to make temporary joints. Some of the important and common joining processes are:

(1) Welding (plastic or fusion),
(2) Brazing, (3) Soldering, (4) Riveting,
(5) Screwing, (6) Press fitting, (7)
Sintering, (8) Adhesive bonding, (9) Shrink fitting, (10) Explosive welding,
(11) Diffusion welding, (12) Keys and
cotters joints, (13) Coupling and (14) Nut and bolt joints.

4. Surface Finishing Processes

Surface finishing processes are utilized for imparting intended surface finish on the surface of a job. By imparting a surface finishing process, dimension of part is not changed functionally; a very negligible amount of material is removed from the certain material is added to the surface of the job. These processes should not be misunderstood as metal removing processes in any case as they are primarily intended to provide a good surface finish or a decorative or protective coating on to the metal surface. Surface cleaning process also called as a surface finishing process. Some of the commonly used surface finishing processes are:

(1) Honing, (2) Lapping, (3) Super finishing,(4) Belt grinding, (5) Polishing, (6) Tumbling, (7) Organic

finishes, (8) Sanding, (9) Debarring, (10) Electroplating, (11) Buffing, (12) Metal spraying, (13) Painting, (14) Inorganic coating, (15) Anodizing, (16) Sheradising, (17) Parkerizing, (18) Galvanizing, (19) Plastic coating, (20) Metallic coating, (21) Anodizing and (22) Sand blasting.

5.3. Product development process

A product development has to go through the following concepts of product engineering which are given as under.

- Product functions
- Product specifications
- Conceptual design
- Ergonomics and aesthetics
- Standards
- Detailed design
- Prototype development
- Testing
- Simulation
- Design for manufacture
- Design for assembly

5.4 Manufacturing process of the project

1. Measurement of the material required dimension:

Measurement is the foundation of scientific inquiry. In order to test our hypotheses, we must observe our theoretical concepts at the operational level. In simple words, we must measure what we have defined. But there are different levels of measurement, which provide differing amounts of information about the theoretical construct. There are also some basic issues about the adequacy of measurement which we must address.

The measurement of material and required dimensions is an important step in the design and fabrication of a chain link wire mesh making machine. Accurate measurement ensures that all components are manufactured with proper size, fit, and alignment, which is essential for smooth operation and high-quality output.

The process begins with identifying the required dimensions based on design specifications. This includes measurements such as length, width, thickness, diameter, and spacing of different components like shafts,

rollers, frame, and wire. For example, the diameter of the wire must be measured accurately to design the correct size of the wire bending die and to achieve the desired mesh size.Various measuring instruments are used for precision. A steel rule or measuring tape is used for general length measurements, while a vernier caliper is used for more accurate measurements of internal and external dimensions. A micrometer screw gauge is used to measure very small dimensions such as wire thickness with high precision. Marking tools like scribers and markers are used to indicate measurement points before cutting or machining.

Proper measurement helps in minimizing errors during fabrication and ensures that components fit together correctly during assembly. It also reduces material wastage and improves the efficiency of the manufacturing process. Any deviation in measurement can lead to improper functioning of the machine, affecting the quality of the mesh produced.

In conclusion, accurate measurement of material and dimensions is a critical step that ensures precision, quality, and reliability in the design and manufacturing of the machine.

2. Cutting operation as per dimension:

Cutting processes work by causing fracture of the material that is processed. Usually, the portion that is fractured away is in small sized pieces, called chips. Common cutting processes include sawing, shaping (or planning), broaching, drilling, grinding, turning and milling. Although the actual machines, tools and processes for cutting look very different from each other, the basic mechanism for causing the fracture can be understood by just a simple model called for orthogonal cutting.

V. SYSTEM DESIGN

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DOI: https://doi.org/10.64388/IREV9I10-1716189

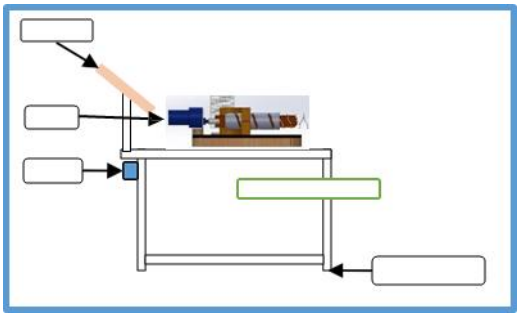

Figure.6.1. Flow Chart

- The system design of the Motor: A 12V 40W DC motor is a compact and efficient electric motor that operates on a 12-volt direct current supply and consumes 40 watts of power. It is commonly used in small machines, automation systems, and engineering projects due to its simple design and reliable performance. The motor works on the principle of electromagnetism, where electric current flowing through the armature generates a magnetic field that interacts with the stator field, causing the shaft to rotate. Typically, this type of motor draws around 3.3 amperes of current and can achieve speeds ranging from 1000 to 3000 RPM depending on its design and load conditions. It is widely preferred because it is lightweight, easy to control, and can be powered using batteries or DC power supplies. Applications of a 12V 40W DC motor include small industrial machines, chain link wire mesh making machines, conveyor systems, robotics, fans, and pumps. Due to its low cost, compact size, and efficient operation, it is an ideal choice for both educational projects and practical small-scale industrial uses.

- Advantages

A 12V 40W DC motor offers several benefits that make it suitable for small- scale applications. It is compact and lightweight, making it easy to install in limited spaces. The motor operates on low voltage (12V), which makes it safe and compatible with batteries and simple power supplies. It provides easy speed control, especially using PWM (Pulse Width Modulation), and delivers good starting torque, which is useful in machines that require initial force. Additionally, it is cost-effective and requires relatively simple maintenance, making it ideal for students and small industries.

- Disadvantages

Despite its advantages, the motor has some limitations. It has limited power output (40W), so it is not suitable for heavy-duty applications. Most 12V DC motors are brushed motors, which means brushes wear out over time and require maintenance or replacement.

- Applications

The 12V 40W DC motor is widely used in various small-scale and practical applications. It is commonly used in chain link wire mesh making machines, robotics projects, and DIY electronics. It is also used in conveyor belts, small pumps, cooling fans, and automotive devices like wipers or small actuators. In addition, it finds applications in home automation systems and educational engineering models, where low power and easy control are required.

VI. WORKING PRINCIPLE

3.1 Working of the project:

The chain link wire mesh making machine works on the principle of continuous wire bending and interlocking to produce a diamond- shaped mesh. The

entire process is automated or semi-automated, ensuring uniformity, speed, and efficiency in production. The working can be explained step-by-step as follows:

1. Wire Feeding

The process begins with the feeding of metal wire (usually galvanized or PVC-coated wire) from a spool or coil into the machine. The wire is supplied continuously to ensure uninterrupted production.

2. Wire Straightening

- Before bending, the wire passes through straightening rollers.
- These rollers remove any bends or irregularities in the wire
- Ensures smooth and accurate shaping in the next stage

3. Wire Bending (Zigzag Formation) The straight wire then enters the wire bending die section.

- The die bends the wire into a zigzag (spiral) pattern
- This zigzag shape forms the basic structure of the mesh
- The size of bends determines the mesh size

4. Weaving / Interlocking Process This is the most important step:

- Each zigzag wire is interlocked with the previous wire
- The machine twists or hooks the wire ends together
- This creates the diamond- shaped pattern of the chain link mesh

5. Continuous Mesh Formation

- The interlocking process continues automatically
- The mesh grows continuously in length
- The machine maintains uniform spacing and alignment

6. Edge Formation (Knuckling or Twisting)

- The edges of the mesh are finished by:
- Knuckling (bending ends) or
- Twisting (sharp ends twisted together)
- This ensures strength and safety of the fence edges

7. Cutting or Rolling

- The completed mesh is either:
- Cut into required lengths, or
- Rolled into coils for storage and transport

8. Motor and Drive System

- A motor (like 12V DC or AC motor) powers the machine
- Gear mechanisms control speed and movement
- Ensures smooth and synchronized operation of all parts

9. Control System

- In automatic machines, a control panel (PLC) is used
- Allows adjustment of:
- Mesh size
- Wire thickness
- Speed of production

10. Final Output

- The final product is a strong, flexible, diamond-shaped wire mesh
- Ready for use in fencing and other applications.

VII. RESULTSAND DISCUSSION

The robot was tested in controlled environments using small flame sources such as candles and paper fires.

8.1 Performance Parameters

- Fire detection range: up to 80– 90 cm
- Response time: 15–20 seconds
- Extinguishing efficiency: ~98%

8.2 Observations

- The robot successfully detected fire in most test cases
- Navigation was smooth with minimal collisions
- Obstacle avoidance worked effectively
- Water pump provided sufficient pressure to extinguish flames

8.3 Limitations Observed

- Performance decreases in very bright environments
- Limited effectiveness for large- scale fires
- Battery backup limits operation time

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VIII. ADVANTAGES

Advantages of the project

Advantages of the projects per following like as:

1) Reducing the cost of operation, due using motorized machine
2) There eco-friendly operations etc.
3) The maintenance machine is simple.
4) The improving of fence wire bending quality and reducing physical effort for the operator as compared to hand operated machine.
5) They are efficient, producing large quantities of mesh quickly.
6) They are also versatile, capable of making mesh with different wire gauges and mesh sizes.
7) The process is automated, reducing labour costs and ensuring consistent quality.
8) Furthermore, these machines are durable and can operate continuously with minimal maintenance.

IX. APPLICATIONS

Our project should use for following various applications like as:

- The wire mesh is used for compound in farms, home
- They are commonly used for fencing, providing security for residential, commercial, and industrial properties.
- They're also used in agriculture for animal enclosures and crop protection.
- Additionally, these machines produce mesh for sports fields, playgrounds, and various construction projects.
- Fencing, agriculture, sports fields, and construction are the main applications.

X. CONCLUSION

It is observed that, this model of solar chain link fencing machine is more cost effective and gives the effective results in meshing operation. As it runs on the non conventional energy source i.e. solar energy, it is widely available at free of cost. In now days where world is moving towards the finding the new ways for the energy requirement, it can be a better option, who economically challenged and facing electrical problem like load shading now days. Chain link wire mesh making machines have a solid future. Here's the breakdown:

- Growing Demand: Demand is increasing due to the need for fencing in construction, security, and agriculture.
- Infrastructure and Construction: As these sectors grow worldwide, so will the need for chain link mesh.
- Innovation: Advancements in materials and automation will boost the efficiency and scope of these machines.

In short, the future looks positive for chain link wire mesh making machines!

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