# FABRICATION OF CHAIN LINK WIRE MESH MAKING MACHINE

A Thesis
By


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Assistant Professor & Exam Coordinator






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Dhaka, Bangladesh

JANUARY 2025

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Submitted to the
DEPARTMENT OF MECHANICAL ENGINEERING
SONARGAON UNIVERSITY (SU)
In partial fulfillment of the requirements for the award of the degree
of
Bachelor of Science in Mechanical Engineering

Sonargaon University (SU)
Dhaka, Bangladesh
JANUARY 2025

## ACKNOWLEDGEMENT

First, we started in the name of almighty Allah. This thesis is accomplished under the supervision of Md. Ahatashamul Haque Khan Shuvo**.** Department of Mechanical, Sonargaon University. It is a great pleasure to acknowledge our profound gratitude and respect to our supervisor for this consistent guidance, encouragement, helpful suggestion, constructive criticism and endless patience through the progress of this work. The successful completion of this thesis would not have been possible without his persistent motivation and continuous guidance.

The authors are also grateful to **Md. Mostofa Hossain,** Head of the Department and Md**.** Ahatashamul Haque Khan Shuvo, Assistant Professor & Exam Coordinator and all respect teachers of the Mechanical Engineering Department for their co-operation and significant help for completing the thesis work successfully.

## ABSTARCT

The chain link wire mesh making machine is a highly efficient and automated system designed for the production of chain link fences used in various applications, including security fencing, agriculture, construction, and industrial enclosures. The machine operates by interweaving wires into a diamond-shaped mesh pattern, ensuring strength, flexibility, and uniformity. Key features include adjustable mesh size, wire thickness adaptability, and a user-friendly interface for precision control. The system incorporates advanced mechanisms for wire feeding, twisting, cutting, and edge folding, minimizing manual intervention and enhancing productivity. Equipped with durable components and energy-efficient motors, the machine ensures high-speed operation with minimal maintenance requirements.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background of the Project

A fence is a structure that encircles an area, typically outdoors, made from posts connected by panels, wire, railings, or mesh. Unlike walls, fences do not have a solid foundation along their entire length. Chain-link fences are usually made from galvanized steel wire, and their production is known as weaving. The process involves pulling galvanized wire through a rotating blade to create a flattened spiral. This spiral hooks through the previous one, forming the fence. The wire is cut, pressed flat, and the ends are twisted to secure the links. When powered, an AC motor rotates a rectangular rod inside a hollow tube with a spiral-shaped cutout. The wire from a bobbin hooks onto the rod through the tube slot. As the motor runs, the wire spirals around the rod, creating a zigzag shape. This efficient system produces zigzag wires for chain link or mesh making. A chain-link fence is woven from galvanized steel wire into a mesh pattern, forming interlocking squares referred to as the "fabric" of the fence. It is secured to steel posts embedded in the ground and used to enclose areas such as schoolyards, parking lots, industrial properties, and residential yards. It also serves for dog runs, kennels, animal pens, and as temporary fencing at construction sites. Understanding wire quality in fence manufacturing is essential to avoid breakage and field erection issues. Tests for wire quality include tensile strength, ductility, three-point bending, impact energy, linear tensional conductivity, and micro-hardness. These tests ensure the wire meets required standards, with linear tensional conductivity being the most reliable quality indicator. Chain link fence manufacturing involves running two wires through a machine, wrapping them around a metal rod, pulling out the rod, and hooking the wire ends together to form the mesh. This process is repeated, building the chain-link fence incrementally

## 1.2 Objectives of the Project

- To design a chain link wire meshing machine
- To construct chain link wire meshing machine.

## 1.3 Problem Statement

Current market solutions for wire mesh machines are prohibitively expensive, limiting adoption by SMEs. This project intends to deliver a low-cost, high-efficiency alternative that maintains quality standards.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Related Research/ Works

1. **D. Pons, G. Bayley, R. Laurenson, M. Hunt, C. Tyree, D. Aitchison.** Wire Fencing: Determinants of Wire Quality. This study investigated knotted wire fences fabricated on specialized machines using galvanized steel wire. They identified wire strand breakages during fabrication and subsequent field erection.
2. **Dirk J. Pons, Gareth Bayley, Christopher Tyree, Matthew Hunt, Reuben Laurenson Aitchison.** Material Properties of Wire for the Fabrication of Knotted Fences. This research focused on the material properties of galvanized fencing wire, examining tensile strength, ductility, Young's modulus, three-point bending, and bending span.
3. **Sebastian Balos, Vencislav Grabulov, Leposava Sidjanin, Mladen Pantic.** Wire Fence as Appliqué Armoring. This study explored the behavior of wire fences made from commercial high-strength patented wire, supported by mild steel L-profile frames.
4. **Arshpreet Singh, Anupam Agrawal.** Comparison of Deforming Forces, Residual Stresses, and Geometrical Accuracy of Deformation Machining with Conventional Bending and Forming. This research compared deformation machining, which combines thin structure machining and single point incremental forming/bending, with conventional methods.
5. **Nurudeen A. Raji, Oluleke O. Oluwole.** Influence of Degree of Cold-Drawing on the Mechanical Properties of Low Carbon Steel. This study examined the effects of different degrees of cold drawing (20%, 25%, 40%, and 50%) on the mechanical properties of low carbon steel using tensile, impact, and hardness tests.
6. **Junichiro Tokutomia, Kenichi Hanazaki, Nobuhiro Tsuji, Jun Yanagimoto.** Change in Mechanical Properties of Fine Copper Wire Manufactured by Continuous Rotary Draw Bending Process. This research investigated the mechanical behaviors of Cu–Sn alloy wire processed by rotary draw bending, noting changes in Vickers hardness and the promotion of softening induced by plastic deformation. These references provide a comprehensive understanding of wire fencing, from material properties and manufacturing techniques to specific applications and mechanical behavior studies.

# CHAPTER 3

# METHODOLOGY

## 3.1 Components

1. AC Motor
2. Bearing
3. Shaft
4. Bearings Block
5. C.I Pulley
6. V-Belt
7. Nut bolt
8. Supporting Frame
9. Basic of wire mesh
10. Slotted pipe
11. M.S Flat bar

### 1) AC Motor

The basic idea behind how an electric AC motor operates is that when an electric current flows through a conductor that is generally positioned in a magnetic field, a force occurs on the conductor, causing it to move and producing mechanical energy.



Figure 3.1 : AC Motor

**2) Bearing**

Between the spinning shaft and the component supporting the rotation, friction will always arise. These two parts are connected by bearings. The purpose of the bearings is to provide smoother rotation by lowering friction. This reduces the quantity of energy used.



Figure 3.2 : Bearing

**3) Shaft**

The term shaft usually refers to a component of circular cross section that rotates and transmits power from a driving device, such as a motor or engine, through a machine. Shafts can carry gears, pulleys and motion and power via chains. sprockets to transmit rotary mating gears, belts and

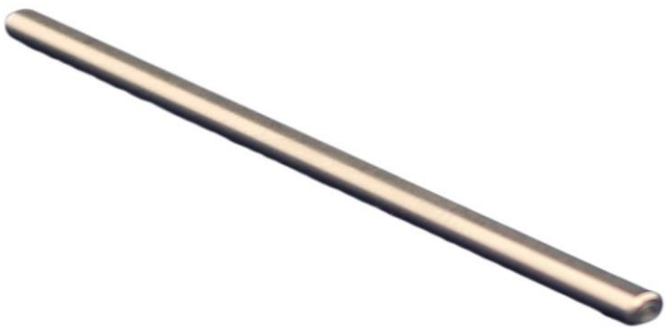


Figure 3.3 : Shaft

**4) Bearing Block**

A bearing block, also known as a pillow block or plummer block, is a mounting used to support a rotating shaft




Figure 3.4 : Bearing Block

**5) C.I Pulley**

A pulley is a simple machine that uses a wheel and a rope, chain, belt, cord, or cable to make work easier. Pulleys work by changing the direction of force, and can be used singly or in combination to transmit energy and motion.



Figure 3.5 : CI : Pulley

### 6) V-Belt

A v-belt is a flexible machine element used that transmits power between a set of grooved pulleys or sheaves. They are characterized by their trapezium cross-section. V-belts are used because of their ability to wedge tightly into the grooves of the pulley.




Figure 3.6 : V-Belt

### 7) Nut and Bolt

Nuts are almost always used in conjunction with a mating bolt to fasten multiple parts together. The two partners are kept together by a combination of their threads friction (with slight elastic deformation), a slight stretching of the bolt, and compression of the parts to be held together. Turning the bolt move the complementary against the inclined causes the threads to slot or nut upward plane.



Figure 3.7 : Nut and Bolt

**8) Supporting Frame**

It has a wood, And it is supporting a all parts of material.

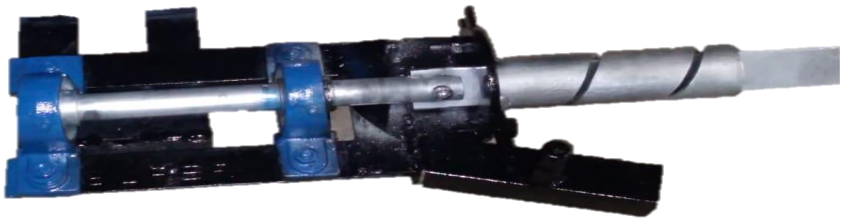


Figure 3.8 : Supporting Frame

**9) Basic of wire mesh**

Wire mesh is fabricated by the intertwining, weaving, or welding of wires of various thicknesses to create proportionally equal parallel rows and intersecting columns. Also known as wire fabric, wire cloth, or hardware mesh, the production of wire mesh involves the weaving of wire on industrial looms, leaving square or rectangular gaps between the wires. Welded wire mesh or fabric is manufactured using an electric welder that joins parallel longitudinal wires where the wires intersect.



Figure 3.9 : Basic of wire mesh

**10) Slotted pipe**

Slotted pipe are used for oil and gas wells. Steel casing pipes and tubing are applied to furnishing and installing cased tunnels, where they indicate to pass other utilities or obstructions without open excavation. Steel casing pipes and tube have smooth wall and a minimum yield strength of 35,000 psi. Corrosion-proofing water-based paint is applied on the outside pipe surface to protect against atmospheric corrosion during transportation and storage.



Figure 3.10 : Slotted pipe

**11) M.S Flat Bar**

Ms Flats bars are rectangular-shaped metal bars with a Ms flats surface and uniform thickness.



Figure 3.11 : M.S Flat Bar

## 3.2 Applications of Chain Link Wire Mesh

- Open lands and plots
- Characterizing Boundaries
- Providing Security
- Sports Fields
- High-Security Facilities
- Modern Buildings and Factories
- Schools and campus
- Farms
- Highways and motor ways
- Suitable for both residential and commercial properties, chain link fencing is versatile, cost-effective, and practical.
- Widely used in commercial markets where solid walls are impractical or unnecessary.
- Common in Western countries like Europe and the United States due to its functionality and cost-effectiveness.

## 3.3 Operations Involved

- Facing
- Drilling
- Welding
- Cutting
- Grinding
- Thread cutting

### 1) Facing

Machining the end of the work piece produce flat surface is called Due to this, the plate can get flat surface have done by facing operation.

### 2) Drilling

Drilling is operation of producing cylindrical hole in the work piece. It is done by rotating the cutting edge of the cutter known as drill bit. In our project the drilling is done on the supporting post for inserting the hinged eye bolt and nut.

### 3) Welding

The process of joining two similar or dissimilar metals is known as welding. It is done between the post and base.

### 4) Grinding

A grinding machine uses an abrasive product usually a rotating wheel to shape and finish a work piece by removing metal and generating a surface within a given tolerance. A grinding wheel is made with abrasive grains bonded together. Each grain acts as a cutting tool, removing tiny chips from the work piece.

### 5) Thread Cutting

Thread cutting is the operation of forming external thread of required diameter of rod by using a multipoint tool is called thread. This process is used in equalizer clamp to done on the rod, which is used for the movement of the clamp up and down.

## 3.4 Machine Layout and Structural Design

The design integrates key components, including the frame, wire feeding system, weaving head, and cutting unit, ensuring compactness and operational efficiency

## 3.5 Chain Link Fence For Privacy Purpose

One common misconception about chain-link fences is their perceived lack of privacy due to the open holes in the mesh. However, there are several effective ways to add privacy to these fences:

1. **Privacy Fence Screens**: Designed to withstand various weather elements, these screens can be easily attached to the fence, providing immediate privacy.
2. **Inserting Slats**: Privacy slats can be woven through the wire mesh either horizontally or vertically, significantly reducing visibility.

3. **Growing Vines**: Planting vines along the fence can offer a natural and aesthetic privacy solution. Depending on the plant species, the coverage can be partial or complete.
4. **Greenery Panels**: These garden decor panels offer an eco-friendly, low-maintenance privacy option that can be easily controlled and adjusted.

## 3.6 Installation Of The Chain Link Fence

To install chain-link security fencing around a property, follow these steps:

1. **Install Posts**: Use concrete, steel tubing, or timber posts planted into the ground for stability. Terminal posts, such as gate and corner posts, should be anchored or set in concrete footings to prevent leaning or falling under the tension of the stretched wire fence. Line posts, placed between terminal posts, should be spaced no more than three meters apart.

2. **Wire Bending**: Figure 1 demonstrates the wire bending process.

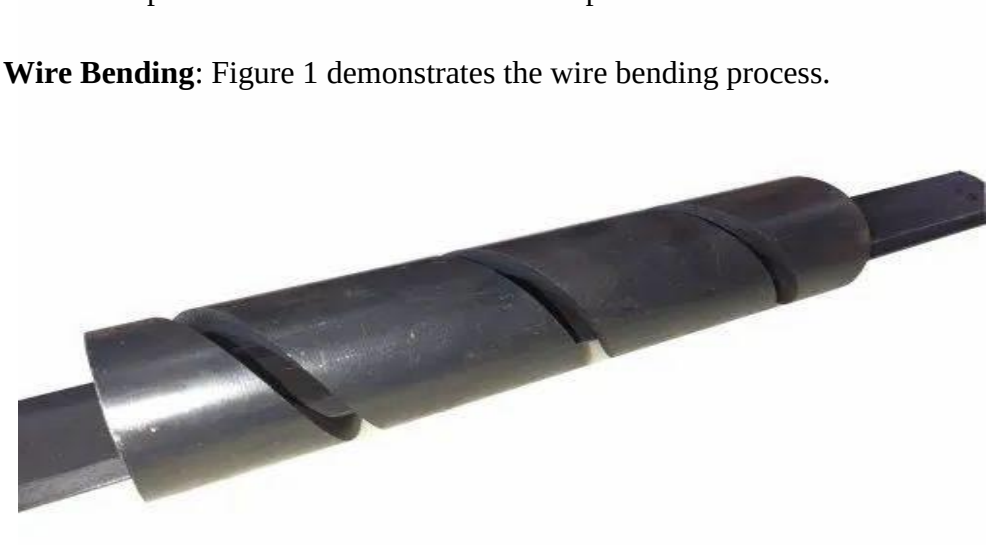


Figure 3.12 : Wire Bending Diagram

3. **Chain-Link Machine Operation**: Modern chain-link machines adopt automatic threading, saving manpower and providing stable mechanical performance. A servo motor and touch screen operating system ensure precise control. By setting the speed and thread values on the touch screen, accurate grid width and smooth mesh surfaces are achieved, reducing material waste and increasing efficiency by 1.8-4 times. The machine features automatic locking in Knuckled and Twisted forms, allowing for mechanized and automated production

4. **Wire Mesh Fabrication**: Wire mesh is created by intertwining, weaving, or welding wires of various thicknesses to form equal parallel rows and intersecting columns. Wire mesh, also known as wire fabric or hardware mesh,

is produced on industrial looms. Welded wire mesh is made using an electric welder to join longitudinal wires at their intersections.

5. **Galvanized Wire Mesh**: Made from plain or carbon steel wire, galvanized wire mesh involves applying a zinc coating to protect against rust and corrosion. It can be welded or woven using galvanized wire or plain steel wire galvanized post-production. Galvanized wire mesh is cost-effective and ideal for fencing in agriculture, gardening, greenhouses, architecture, construction, security, window guards, and infill panels.
   This setup ensures a durable and efficient chain-link fence, suitable for various applications and providing enhanced security.

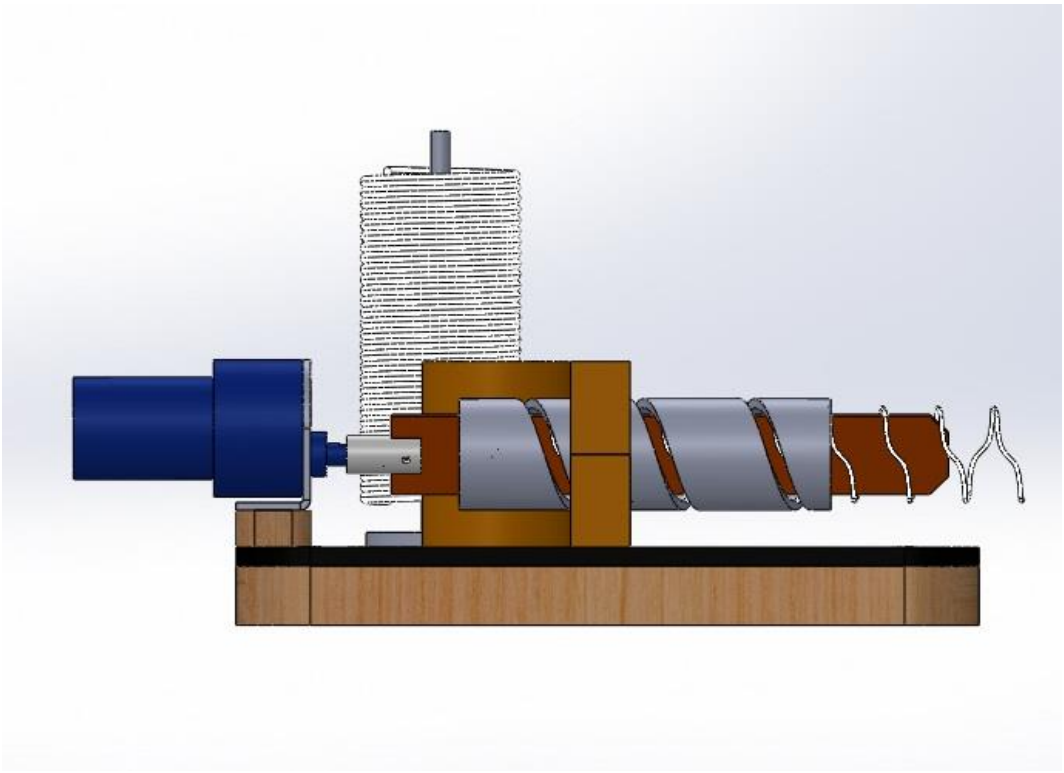


Figure 3.13: Block Diagram of the project

## 3.7 Diamond Mesh Chain Link Fencing Production Mechanism

### 1. Wire Preparation:

- The wire is retrieved from the payoff stand and moved through dies, creating a zigzag wire pattern.

- The cutting machine, equipped with sensors for 100% accuracy, cuts the wire to the correct length.

2. **Weaving:**

- Two zigzag wires are woven together to form the diamond mesh chain link pattern.

3. **Locking:**

- The woven diamond mesh is locked at both ends using the locking mechanism.

4. **Rolling:**

- The completed diamond mesh chain link fence is rolled using the roller part of the machine

## 3.8 Summary

- **Galvanized Wires**: Best for durability in extreme environments, with regular and heavy-duty options.

- **Vinyl-Coated Wires**: Enhanced rust protection, ideal for coastal areas.

- **Green PVC Wires**: Blend into natural settings, perfect for gardens and lawns.

- **Black PVC Wires**: Offer a bold, high-end appeal or a transparent look depending on the setting.

Choosing the right type of wire for your chain link fence depends on the specific needs of your environment and your aesthetic preferences. Each type offers unique benefits that can help ensure your fence is both functional and visually appealing.

## 3.9 MANUFACTURING PROCESS

### 1. Wire Formation

- The wire runs through a machine that bends it into a zigzag pattern, forming the characteristic diamond shape.
- This wire is then cut to the required length and locked into place.

### 2. Fencing Machine

- Modern chain link fencing machines automate the threading, weaving, locking, and rolling processes.
- These machines can produce fences of various widths, typically between 2 to 6 meters.
- They also allow for different re-coiling options based on production needs.

### 3. Usage

- **Sports Fields**: Provides a secure and visible boundary.
- **River Banks**: Prevents erosion and unauthorized access.
- **Construction Sites**: Ensures safety and demarcation.
- **Residential Areas**: Offers security while maintaining visibility.
- **Animal Fencing**: Contains animals securely without obstructing the view.

### 4. Features

- The fence is highly durable, with a heavy galvanized coating ensuring a long lifespan.
- Suitable for enclosing lawns, roads, and other areas where a secure yet visible barrier is needed.



**Figure 3.14 : Wire Differences in Chain-Link Fences**

When considering chain link fencing, several types of wires can be used, each with its unique properties and applications. The most popular types are heavy galvanized wires, vinyl-coated wires, green PVC wires, and black PVC wires.

### 5. Galvanized Wires

**Process:**

- Galvanized wires are steel wires coated with zinc through a hot-dipping process at temperatures around 450°C.
- This galvanization process protects the wire from rust and corrosion.

**Uses:**

- Ideal for environments that require heavy-duty material to withstand extreme elements.
- Commonly used in most chain link fences:
- Regular hot-dip galvanized wires (2.5mm diameter) for general use.
- Heavy galvanized wires (3.15mm diameter) for commercial fencing.

6. **Vinyl-Coated Wires**

**Process:**

- Wires are coated with polyvinyl chloride (PVC) or vinyl.
- This additional coating enhances the wire's resistance to rust and corrosion.

**Uses:**

- Suitable for coastal areas where salty air can accelerate the breakdown of zinc coating in galvanized wires.
- Provides extended durability and longevity to the fence.

7. **Green PVC Wires**

**Characteristics:**

- Vinyl-coated in green to blend seamlessly into natural environments.
- Preferred for aesthetic reasons, especially in gardens and grass lawns.

**Uses:**

- Ideal for areas where the fence should blend into the background rather than stand out.

8. **Black PVC Wires**

**Characteristics:**

- Coated in black PVC for a bold, distinct look.
- When used with black metal rails and posts, it can mimic the appearance of wrought iron structures from a distance.

**Uses:**

- Popular for creating a striking profile against natural landscapes.
- Can also be used to create a "transparent" fence effect, depending on the background and landscape.

### 3.10 Our Final Project View

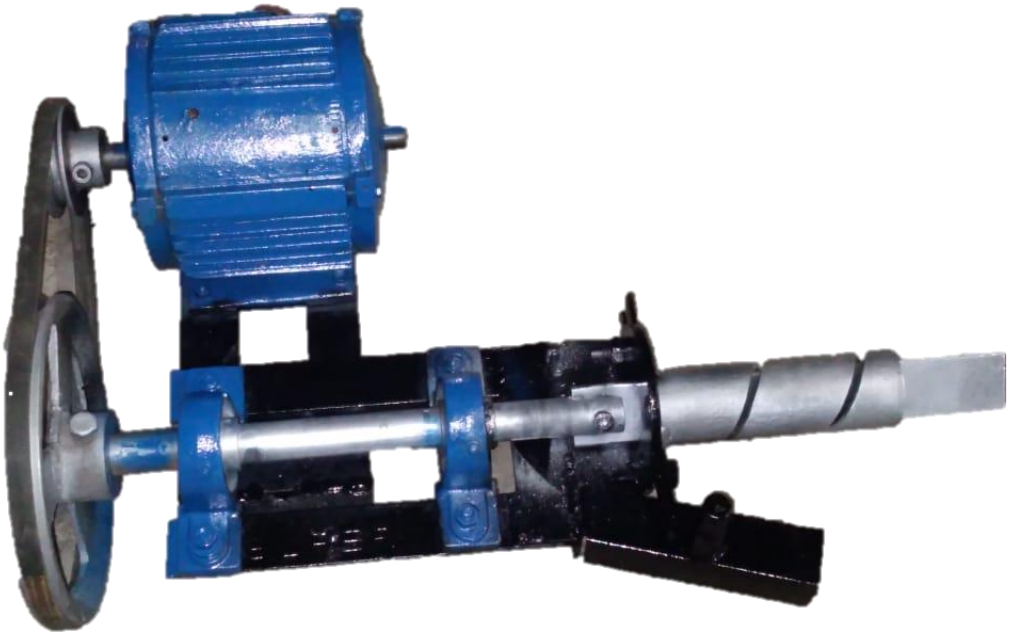


Figure 3.15 : Figure of the Project

# CHAPTER 4

# RESULTS AND DISCUSSION

## 4.1 Results

Motor RPM= 900,
Drive Pulley 70 mm
Driven Pulley= 200 mm
Votes = 220 v
Watt=1500 W
Now Calculate Driven Pulley RPM=?
Chain link length m/min ?

Gating value,

$N_1$=900 RPM
$D_1$= 70 mm
$D_2$=200 mm
$N_2$=?
L=?

We Know That

$N_1D_1=N_2D_2$

$$N_2 = \frac{N1D1}{D2}$$

$$N_2 = \frac{900X70}{200}$$

$N_2$ = 315 RPM

Now,

$L= \pi D_2 X N_2$ $D_2$=200 mm

L= 3.1416X0.02X315 $D_2$= 0.02 m

L= 19.79 m/min

- Output Speeds of the machine: 315 RPM
- Output Length of the machine: 19.79 m/min

Gating value,

V = 220 V

P = 1500 W

N = 900 RPM

We Know that,

Tork:-

P = Tw

$$T = \frac{P}{\frac{2\pi N}{60}}$$

$$T = \frac{1500}{\frac{2\pi N}{60}}$$

T = 15.91 N-m

Power Consumption:-

Current -

$$I = \frac{P}{V cos\Theta}$$

$$I = \frac{1500}{220X0.85}$$

I = 8.02 Amp

Power-

P = VXIcosϴ

P = 220X8.02X0.85

P = 1499.74 w

P = 1.5 Kw

- Power Consumption 1.5 Kw
- Current : 8.02 Amp
- Torque : 15.91 N-m

## 4.2 Discussion

The machine successfully produces chain link wire mesh with minimal human adjustments in mesh size. This enhances the potential for wider industrial applications, making the machine suitable for diverse fencing and construction needs. Feedback from trial runs indicates improved production efficiency and reduced material wastage.

## 4.3 Challenges and Solutions

- Wire Jamming: Implement automatic detection and reverse feed to prevent jamming.

- Mesh Deformation: Use high-precision rollers to maintain mesh shape.

- Maintenance: Design the machine with easily accessible parts for maintenance and repairs.

## 4.4 Advantages Of The Project

- **Easy Installation** — Wire mesh is flexible and pliable to easily insert or connect to a wall, railing, or flat surface.
- **Electronics Storage** — Computers, monitors, and other electronics have to be placed in well-ventilated storage areas. Wire mesh makes it possible for delicate and sensitive electronics to be held securely with limited access.
- **Convenienc**e — Wire mesh can be used as partitions to separate work positions but afford easy accessibility. It can be easily removed or rearranged to meet the needs of changing organizational dynamics.
- **Visibility** — In warehousing, wire mesh can be used to separate items but make them easily detectable and visible for retrieval. The use of wire mesh removes time- consuming searches and inventory checks.
- **Customer Area Partitions** — Wire mesh can be used to allow customer interaction while preventing them from entering the work area.
- **Strengthening and Support** — In the construction industry, wire mesh is added to a building to provide extra support and backing for walls and ceilings.
- **Cost-Effective** — Wire mesh is a cost-effective way to replace panels, shelves, and supports. It is easy to man ever and place. The superior strength of wire mesh makes it a positive Alternative to other forms of filtering and support materials.

## 4.5 Disadvantages Of The Project:

- This type machine various sizes wire mesh, various sizes wire bending die is required due to initial costing higher.

# CHAPTER 5

# CONCLUSION

## 5.1 Conclusion

The design and fabrication of the chain link wire mesh making machine demonstrate a practical, scalable solution for small to medium-sized businesses. This machine significantly reduces labor costs, enhances production efficiency, and offers a reliable means of producing high-quality chain link mesh, contributing to the growth of wire mesh manufacturing enterprises.

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