

## “Manufacturing of Wire Conductor by Using Multistrand and Wire Drawing Machine.”

Sibabrata Mohanty\*, Itishree Badtia\*\*, Sonali Singh\*\*\*, Bina Choudhury\*\*\*\*, Kumari Akriti\*\*\*\*\*, Susmita Dalai\*\*\*\*\*, Nagma Khatun\*\*\*\*\*, Sipra Nayak\*\*\*\*\*

\*Assistant Professor, Department of Mechanical Engineering, Gandhi Institute of Engineering and Technology, Gunupur, Rayagada Odisha,

\*\*\*\*\*,\*\*\*\*\*,\*\*\*\*\*,\*\*\*\*\*,\*\*\*\*\*,&\*\*\*\*\*, B.Tech Mechanical Students, Gandhi Institute of Engineering and Technology, Gunupur, Rayagada Odisha

### ABSTRACT

The aim of the paper enables prior to the adoption of continuous drawing practices, little attention was given to understanding wiredrawing theory. This can be largely attributed to the fact that, until the introduction of steam power, the single, largest problem facing wiredrawers was obtaining the necessary motive force required for the drawing process. As developments and improvements in mechanization developed during the Industrial Revolution, little emphasis was placed on understanding the physical process, as satisfactory results were generally obtainable with the moderate drawing speeds and drafting that were used.

**Keywords:** Wire drawing machine, Multi-strand machine, Drawing Dies

### 1. WIRE DRAWING CONCEPT:-

The wire drawing process is quite simple in concept. The wire is prepared by shrinking the beginning of it, by hammering, filing, rolling or swaging, so that it will fit through the die; the wire is then pulled through the die. As the wire is pulled through the die, its volume remains the same, so as the diameter decreases, the length increases. Usually the wire will require more than one draw, through successively smaller dies, to reach the desired size. The process of wire drawing changes material properties due to cold working. The area reduction in small wires is generally 15–25% and in larger wires is 20–45%.The exact die sequence for a particular job is a function of area reduction, input wire size and output wire size. As the area reduction changes, so does the die sequence.

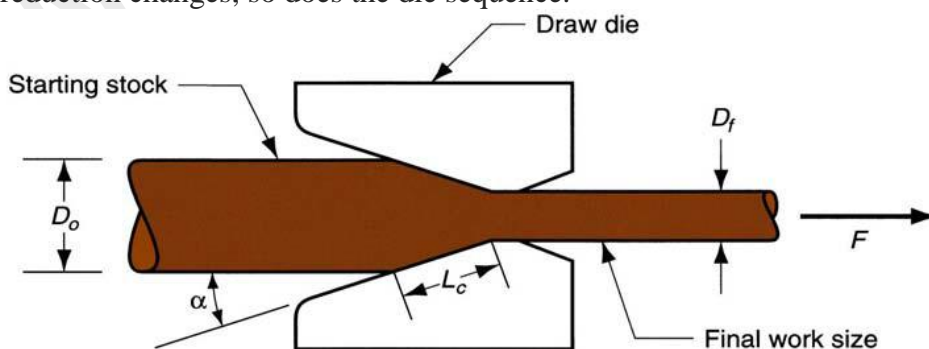


Figure.1-Drawing Of Bar, Rod, Or Wire

## 1.1 WIRE DRAWING PROCESS

Wire drawing is an operation done to produce wires of various sizes within certain specific tolerances. The process involves reducing the diameter of rods or wires by passing them through a series of wire drawing dies with each successive die having a smaller bore diameter than the one preceding it. The final wire size is reached as the wire passes through the last die in the series. Wire drawing can also be defined as a process that pulls the rod manufactured in the groove rolling process through a die with a hole by means of a tensile force applied to the exit side of the die.

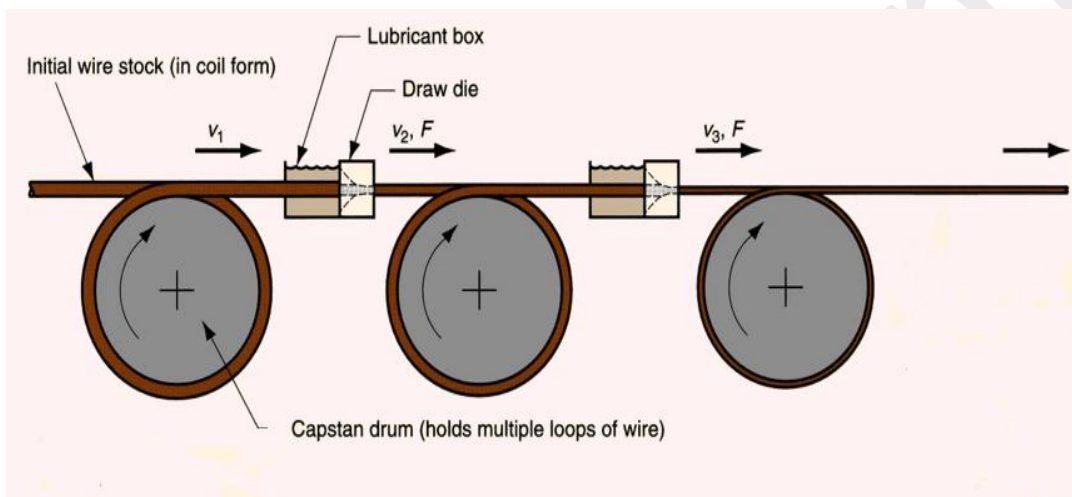


Figure.2 -Wire Drawing Process

## 2. LITERATURE REVIEW:-

- **Sun Kwang Hwang, et al.[1]** in 2015 published an article entitled “**THE EFFECT OF A NON-CIRCULAR DRAWING SEQUENCE ON SPHEROIDIZATION OF MEDIUM CARBON STEEL WIRES**”. After conducting experiment they concluded that; the non-circular drawing sequence might be efficient in manufacturing medium carbon steel wires with improved spheroidization and cold workability by subcritical annealing.
- **Mihaela Iordachescu, et al.[2]** in 2015 published an article entitled “**EFFECT OF COLD-DRAWN INDUCED ANISOTROPY ON THE FAILURE OF HIGH STRENGTH EUTECTOID AND DUPLEX STEEL WIRES**”. They concluded that;
  - The absence of strain-induced martensite in the duplex wires and presence of fine pearlite colonies axially oriented in the eutectoid wires are plausible explanations of detected differences in damage tolerance.
  - The damage tolerance exhibited by the duplex cracked wires agrees with the load upper bound given by the plastic collapse of the resistant ligament in simple tension.
  - The damage tolerance exhibited by the eutectoid wires deviates from this upper bound, the failure mainly occurring under combined tension and bending plastic collapse.

### 3. EXPERIMENTAL PROCEDURE:-

#### 3.1. PREPARATION OF ROD:-

The sample of aluminium rod was manufactured by the die casting method in form of rods. The die casting technique is the method of casting a molten alloy ingot into water cold copper mould under protective gas pressure. Injection pressure of molten alloy in to mold is adjustable between 0.2 and 0.5 MPa and depending on the quantity of material cast. The aluminum ingot is pre-heated in 400-500°C, after preheating we put the ingot into the furnace and thermocouple is enters into the furnace to know the temperature of furnace. The thermocouple is used to measure the temperature of molten aluminum metal, because the aluminum metal is melt at 715°C. The molten metal, which is maintained at a set temperature in the furnace, is next transferred into a chamber where it can be injected into the die. The method of transferring the molten metal is dependent upon the type of die casting machine, whether a hot chamber or cold chamber machine is being used. Once transferred, the molten metal is injected at high pressures into the die.

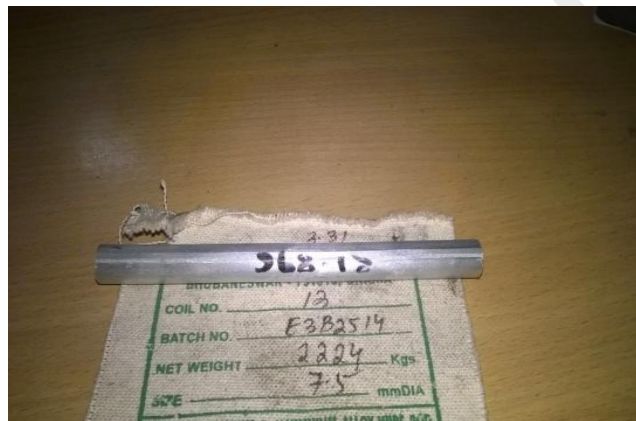


Figure.3-7.50mm Aluminium Rod

#### 3.2 PREPARATION OF WIRE FROM ROD:-

In a wire drawing machine a wire was drawn to a rod which is made in die casting process. After that from the wire which is having 7.50 mm diameter is reduced to diameter of 3.50 mm. The wire which is drawn, in order to ensure uniform wounding of wire on the bobbin a slider is used. Similarly the wires are wounded on all the bobbins.



Figure.4-A Take Off Roller Of The Wire Drawing

### 3.3 OPERATION OF WIRE DRAWING:-

The wire drawing process is quite simple in concept. It is one of the most common plastic deformation processes. The wire is prepared by shrinking the beginning of it, by hammering, filing, rolling or swaging, so that it will fit through the die; the wire is then pulled through the die. The major variables in the drawing process are the reduction ratio, die angle, friction at the interface of wire and die, and drawing velocity. As the wire is pulled through the die, its volume remains the same, so as the diameter decreases, the length increases. Usually the wire will require more than one draw, through successively smaller dies, to reach the desired size. The process of wire drawing changes material properties due to cold working. In general, drawing is known as a process performed at room temperature. Drawing of low-carbon-content steel wires is generally conducted at room temperature employing a number of passes or reductions through several dies. Sometimes it may be performed at elevated temperatures for large wires to reduce drawing forces. The area reduction in small wires is generally 15–25% and in larger wires is 20–45%. The exact die sequence for a particular job is a function of area reduction, input wire size and output wire size.

### 3.4 OPERATION OF MULTISTRAND:-

In an industry there are several no of bobbins are present on which aluminum wires are wounded. All the Bobbins are collected in a multi-strand. A multi-strand is a machine which is containing minimum 12 no of bobbins. Once the heating operation in the oven is completed, the prepared wire is sent to multi-strand. The figure below shows a typical multi-strand used in the wire drawing industry.



Figure.5-Multi Strand



Figure.6-Final Conductor

### 4. CONCLUSION:

- In the above experiments, it has been found that the diameter of the wire is lying between the maximum and minimum values, which are accepted by ISO standard.
- It has also been concluded from the experiments that when the conductor is prepared by combining several smaller diameter wires, the properties of the final conductor prepared remains unchanged.

---

**5. REFERENCES:**

- i. Ho SeonJoo, Sun Kwang Hwang, Hyun Moo Baek, Yong-TaekIm, Il-Heon Son, Chul Min Bae “THE EFFECT OF A NON-CIRCULAR DRAWING SEQUENCE ON SPHEROIDIZATION OF MEDIUM CARBON STEEL WIRES”, in 2015.
- ii. Mihaela Iordachescu, Maricely de Abreu, Andrés Valiente “EFFECT OF COLD-DRAWN INDUCED ANISOTROPY ON THE FAILURE OF HIGH STRENGTH EUTECTOID AND DUPLEX STEEL WIRES”, in 2015.
- iii. T.S. Cao, C. Vachey, P. Montmitonnet, P.O. Bouchard “COMPARISON OF REDUCTION ABILITY BETWEEN MULTI-STAGE COLD DRAWING AND ROLLING OF STAINLESS STEEL WIRE – EXPERIMENTAL AND NUMERICAL INVESTIGATIONS OF DAMAGE”, in 2015.
- iv. Kesavulu.P, G.RavindraReddy, N.Sreedhar “FINITE ELEMENT ANALYSIS OF CONCAVE AND CONVEX DIE CONTOURS IN WIRE DRAWING PROCESS”; in 2014.
- v. Sun Kwang Hwang, Hyun Moo Baek, Jung Wan Lee, Il-Heon Son, Yong-TaekIm, Chul Min Bae “THE EFFECT OF MICROSTRUCTURE AND TEXTURE EVOLUTION ON MECHANICAL PROPERTIES OF LOW CARBON STEEL IN A NON-CIRCULAR DRAWING SEQUENCE”; in February 2014.