

Design of a Fabric Coating Machine for Laboratory Experiments

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Abstract

The current project is about a fabric coating machine for testing purposes. A polymeric layer is applied directly to one or both sides of the cloth during coating. Coating equipment that creates a stable coating on a flat sheet surface while also improving and expanding the spectrum of functional performance qualities. Coating the textiles is done in a variety of ways. The present study used the direct coating method for coating. In testing different factors such as coating surface homogeneity, fabric tension, and distortion or stretch. Different sorts of liquid solutions and different types of textiles might be utilised for coating in the current study, which would improve fabric finishing and extend its life in a simple and cost-effective manner.

Keywords: *Coating Machine, Textiles, Laboratory Experiments, Fabric tension*

INTRODUCTION

Over the last several years, continual research has been conducted on waterproof and porous materials that may meet the essential cost requirements. Many different brands of such textiles are now widely accessible in the market for diverse commercial and industrial applications. This embodiment's coating approach

allows for very precise coating from the start of the coating line.

Rubber has been employed in bigger scale in these sorts of meet to make water resistant porous fabric using cotton or rubber as a base fabric to provide good adhesive and mechanical qualities. The current project is about a fabric coating machine for testing purposes.

Different characteristics of the coated fabric must be tested, such as air tightness, water tightness, stress, and so on. The fabric that has to be tested in the lab is chopped into small pieces and coated on this specimen, as testing the fabric after coating the full lot size would be difficult and costly.

The specimen or test piece was traditionally produced by four employees holding the piece of cloth while the other worker applied the coat manually, as was the case in most businesses at the time. This early approach is inefficient and wastes a lot of time and effort. Understanding the situation, we proposed the idea of a fabric coating machine, which is used to make coated test pieces that are then put through various testing.

COATING TECHNOLOGY

A polymeric layer is applied directly to one or both sides of the cloth during coating. The polymer coating must cling to the fabric, and the thickness of the textiles is controlled by a blade or equivalent aperture. We built up the succeeding coating layers layer by layer, layer by layer; this layer is repeated 2-3 times. Finally, a thin layer may be placed as a top layer or to improve the coating's technical properties. Other applications, such as

clothing and rubber, may necessitate very light coating weights. Before any treatment procedure, such as deciding the fabric dimensions to coat, consider the chemical composition of the coating, the coating weight and thickness, the number of layers, the shape of the materials, and the nature. In recent years, advancements have expanded the coating method into a variety of future processes in a variety of fields.

Coating was formerly limited to woven technical textiles and fabrics, but with rising production needs, nonwoven fabrics must also be coated on the same line. The coating formulation's apparatus and technique of application must be adaptable, reducing stresses on the fabric that might cause distortion or stretch, and eliminating difficulties with knitted textiles such as curling selvages.

COATING METHOD

When we need to coat our textiles, the following will discuss some of the fabric coating procedures we may utilise.

Knife Coating or Direct Coating:

Floating knife is another name for it. This is one of the simplest methods, in which the materials are stretched flat to make an even uniform surface and scraped by a

knife moving forward. Knife Coating involves applying a liquid solution, such as solvent, to the cloth while creating tension with a floating knife blade. The thickness of the coating is regulated by the distance between the cloth and the knife blade. The blade may be controlled and tilted.

The blade can be adjusted and angled while consisting of multiple profiles, which impacts coverage. For this method to work, the liquid coating must be viscous enough to prevent it from penetrating the cloth. The coating is subsequently dried or cured after completion. The thickness of the applied coating determines the possibility for sticking out. The weaving structure must be exceedingly tight, and the fabric must be capable of being held in tension, for knife coating to be most effective.

Direct Roll Coating: The coating liquid is rolled onto the cloth with the assistance of a roller floating in the coating liquid solution in this method. To protect the roller from a coating, a certain type of blade is frequently placed next to it.

Calendar Coating: Cloth passes through a set of heated rollers during this procedure, which adds shine and

smoothness to the fabric. The coating is applied to both sides of the cloth simultaneously in this procedure, with the thickness of the coating defined by the width of the knife between the rollers. If a thinner coating is preferred, additional rollers should be utilised.

Hot Melt Extrusion Coating: Hot melt extrusion coating is applied in the same manner as Calendar Coating is done, with grains fed through heated rollers melting the coating and adhering it to the fabric. Unsupported films are created using Hot Melt Extrusion Coating, which is then applied directly to the fabric. Thermoplastic polymers such as Polyurethane, Polyolefin, and PVC, among others, require this type of coating procedure.

TYPES OF FABRICS

Fabrics such as Cotton Rubber Coated Fabric, Nylon, and Polyester are utilised in different ways.

Technical Specifications: 1) Rubber Coated Fabrics: A) Thickness: 0.2 mm to 6.0 mm, B) Width: upto 1300 mm, C) Rubber Polymer: Natural, Neoprene, etc. D) No. of Plies: upto 4 plies 2) Rubber Sheets: A) Thickness: 0.3 mm to 6.0 mm, B) Width: upto 1100 mm, C) Rubber

Polymer: Natural, Neoprene, Nitrile, Butyl, Silicon, etc.

CHARACTERIZATION

Coating viscosity: The coating viscosity was determined using a Brooke Field Viscometer. Torque is necessary to measure viscosity and rotate the spindle through various solutions, such as solvent solution.

Bending length: Shirley stiffness testers are used to determine the fabric's bending length. The test was conducted in accordance with industry norms.

Air electromagnetism: To measure, several sorts of textured instruments are utilised. The coated airelectro magnetic.

COMPONENT NAMES

1. FRAME
2. FABRIC
3. FIXTURE
4. KNIFE BLADE
5. GUIDING SHAFT
6. GUIDE WAYS
7. ADJUSTABLE SCREW
8. CARRIAGE
9. LEAD SCREW
10. HANDLE
11. BALL BEARING

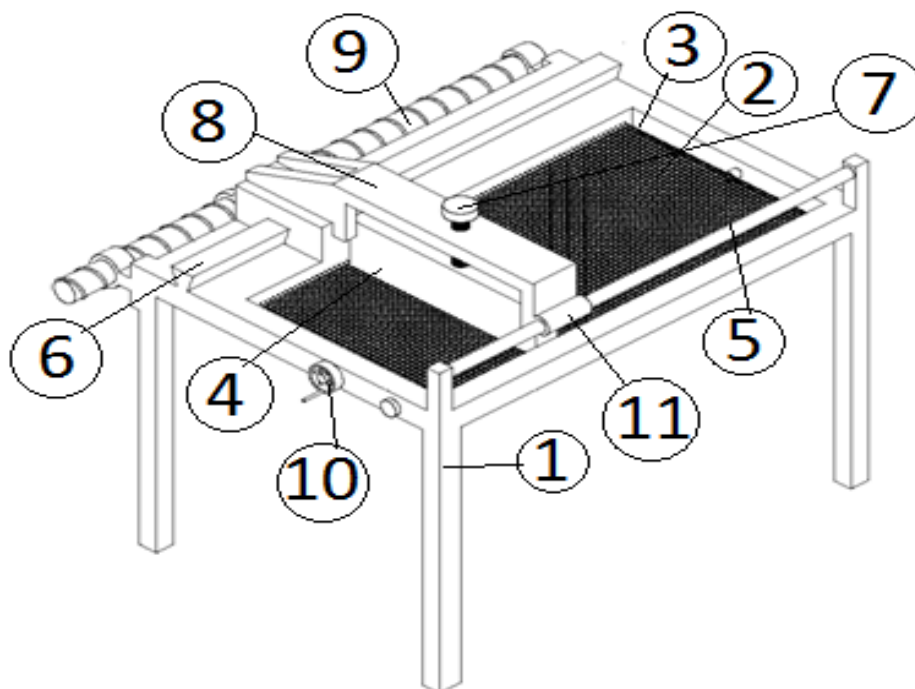


Figure:-1

Components

The following components are utilised:

Table: One sort of supportive member is this. It is used to keep the various components together. It is constructed of mild steel.

Frame : With the aid of a fixture, it is used to keep textiles in place. It is a particular sort of fixture.

Fabric : Fabric is made up of woven, non-woven, knitted, and netted textiles that are pin-tight in a primary frame. It's easily accessible.

Carriage : It is a one type of passage. The carriage is slides on the guide way which support the jig. It is travels the linear direction.

Guideways : A guide route is provided on one side of the frame, which is connected to the frame by welded joints. It is used to reverse the direction of a sliding knife blade.

Bearing : A rolling element bearing is a form of ball bearing. A ball bearing is used to withstand radial and axial loads while also reducing rotational friction. This is simply supported by ball bearings on the frame and supplied with a handle. The

supporting frames are held together by a locking nut.

Lead screw: It's also known as a translation screw or a power screw. This machine's most essential mechanism is the lead screw mechanism. A lead screw is a machine coupling that converts rotational motion into linear transfer motion. It is used to transmit power either manually or through a gear train. Lead screws are often square threaded.

Handle: Fabrics are linked to the machine's main frame. The textiles are turned when one side of the treatment has been completed.

CONSTRUCTION

The lab coating machine is made up of a primary frame on which all of the machine's other components are installed. A guiding route is given on one side of the frame, which has an inverted trapezoidal form. This is used to ensure that the jig on the guide path slides smoothly. The knife-edge is carried by the jig. The jig helps us to set the appropriate knife-edge location. A bolt is welded to the knife-edge and fitted to the jig to produce the necessary thickness of the coat layer. The jig has a hole drilled in it and threads are formed so that the bolt meshes with it. A linear scale

is connected between the jig's end and the knife's edge. The lead screw mechanism, which is the most significant mechanism of this machine, provides forward and reverse motion to the knife-edge. This is used to transform rotational motion into linear motion transfer. Ball bearings and ball bearing coupling are used to support this to the frame. These are located on the guideway's left side.

The carriage is coupled to a nut that transfers the motion, and the carriage glides on the guide path that supports the jig. The nut then transfers the power from the lead screw to the carriage. Nuts and bolts secure the lead screw and ball bearing assembly to the frame. There is a pulley on the extended end of the lead screw and a pulley on the other side with a handle, and the pulleys have a belt to supply rotating motion to the lead screw. On the front end and back end, there is a fixture assembly made up of mild steel strips, each of which is made up of two strips, and between which the fabric is fastened. An extra mechanism, namely a nut bolt attached to the back side strips, is supplied to assure appropriate fabric fitting. The pair of strips are welded to the small shaft that travels through the frame with the bush or ball bearing to spin the fabric to coat foam on both sides. A handle

is placed on the front strip shaft for turning the cloth. A locking pin is attached to the front strip to prevent cloth from being smashed during the operation.

WORKING

To begin, trim the cloth piece to the size of the fixture. The fixture assembly is made up of mild steel strips on the front and rear ends, each of which has two strips between which the fabric is held in place by bolts. To guarantee correct fabric fitting, change the thickness of the knife blade using the bolts that are installed to the jig according to the coating requirements. Then power the lead screw, and the nut takes the power from the lead screw and distributes it to the carriage.

The carriage slides on guide rails attached to the jig, and the pulleys have a belt to provide rotational motion to the lead screw. After that, the lead screw converts rotational motion into linear motion. The knife blade is pushed forward and backward in this linear action. When the fabric solvent liquid solution is sprayed manually, pour the solution into a fabric and slide the knifed blade 2-3 times forward to reverse direction. When one side of the coating is complete, verify the thickness of the coating with a linear scale. If the coating thickness is incorrect, the

cloth should be coated again. One side of the coated fabrics is rotated when it has been done. A handle is placed on the front strip shaft for turning the cloth. Then coat the other side of the cloth and use a linear scale to check the coat thickness. A locking pin is attached to the front strip to prevent cloth from being smashed during the operation. Fabrics are coated in this manner.

Advantages:

- It is a portable machine
- Reduce labor cost.
- Increase efficiency
- Easily maintained.
- Less maintenance cost.
- Good Reproducibility.
- High precision thin flame coating.
- Flexible organic substrates.
- Less expensive and no hazardous.

Disadvantages:

- It takes more time because doing a manually inspection
- Waste a material at the time of testing.

Features:

- A feature of present invention is to provide a coating on a substrate which reduces the mottle on the substrate without reduces the brightness unacceptably.

- Perform uniform coating across the whole thickness.
- Special arrangement to set a thickness

Application:

- It is used to test a various parameter of fabric coater like stress, strain, air tightening etc.
- It is use to check a uniform surface.
- This machine is also used in different types of fabric industry for testing the coating.

Future scope:

- In future used different types of fabrics and liquid solution for coat the fabrics.
- If we need to tested large size of fabrics. then making big size of machine.
- In a future if we required printed coating then changes in a machine component.
- For improving the finishing of coating we also add different mechanism.

CONCLUSION

It allows for homogenous film and changeable thicknesses to be applied to various materials for testing purposes. As a result, a significant amount of time, money, and human effort was previously required for coating a cloth for testing purposes.

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