

FLAT NEEDLE KNITTING MACHINES: STRUCTURE, OPERATING PRINCIPLE AND FIELDS OF USE

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Abstract

This article provides a comprehensive analysis of flat needle knitting machines, detailing their structural components, operating principles, and various application areas. It examines the fundamental mechanisms that govern their functionality, including needle movement, yarn-feeding systems, and fabric formation techniques. Additionally, the study highlights modern advancements in knitting technology, such as automation, digital control systems, and material innovations that enhance production efficiency and fabric quality. The article also explores the significance of flat needle knitting machines in the textile industry, their role in producing diverse knitted fabrics, and their impact on sustainability through resource-efficient manufacturing processes.

Keywords: Flat knitting, design, knitting, weaving, Automatic, semi-automatic, efficiency, flexibility, pullover, sweater.

Introduction

Flat needle knitting machines play a crucial role in the textile industry, enabling the production of high-quality knitted fabrics with precision and efficiency. These machines are widely used in manufacturing various textile products, including garments, technical textiles, and customized knitwear. Their advanced design and operational capabilities allow for the creation of intricate patterns, seamless structures, and diverse fabric textures [1].

The working principle of flat needle knitting machines is based on the coordinated movement of needles, yarn feeding systems, and loop formation mechanisms, which collectively contribute to the production of uniform and durable knitted fabrics. With the rapid advancements in knitting technology, modern flat needle machines incorporate automation, computerized control systems, and energy-efficient solutions to enhance productivity and reduce material waste [2].

This article aims to provide an in-depth understanding of flat needle knitting machines by exploring their structural components, operating principles, and practical applications.

Furthermore, it highlights recent innovations and discusses their impact on the efficiency and sustainability of the textile manufacturing process [3].

Materials and methods

Flat knitting machines are widely used in the modern textile industry and are mainly designed for the production of flat and elastic knitted fabrics. This article provides detailed information on the working principle, basic structure, types, advantages and disadvantages of this technology, as well as areas of application.

1. Basic Structure of Flat Needle Loom Machines

The basic structure of flat needle looms consists of elements such as a needle bar, yarn feeding and tension control systems, needle movement control units, and a programming unit. Each needle is controlled individually, which allows for a wide variety of designs to be created. These machines are manufactured in both manual and automated versions, with automated machines often controlling the weaving process through programming using computer technology [1].



1-Fig. Flat needle knitting loom

2. Working Principle

Flat-needle knitting machines use needles in sequence. The yarn is drawn onto the needles and each needle moves back and forth, creating a row of stitches. These machines can use a variety of knitting techniques, including plain knitting, pattern knitting, and double-layer knitting. Each movement of the needles is controlled with high precision, ensuring consistent quality and consistency.



3. Types of flat needle machines

Manual flat needle machines: These types of machines are used for small-scale production and are relatively inexpensive. They are usually used to create special designs.

Automated flatbed machines: These machines are programmed using high-tech computers and are widely used by large manufacturing companies. They are capable of very fast operation and are adapted to produce large quantities of products.[2]



Figure 2. Needle structure of a flat needle knitting machine

4. Advantages of flat needle looms

One of the main advantages of flat knitting machines is their high efficiency and ability to produce quality products. These machines allow the textile industry to create quality, soft and flexible products. Computer control makes it easy to create complex patterns and designs, which gives manufacturers a wide range of design options. At the same time, the machine is quickly adjusted and can use different yarns, which expands the range of products. Below we will consider the capabilities of flat knitting machines.[1]

a) Ability to create complex designs

One of the main advantages of flat needle looms is the ability to create complex patterns and unique designs. These machines allow for very fine details and patterns due to the individual control of the needles. Computer-controlled versions further expand the possibilities of pattern creation and help to produce complex designs quickly and with high quality.

b) Flexibility and working with different materials

Flat needle machines can handle a variety of yarns. They can knit with materials such as cotton, wool, silk, and synthetic fibres, which helps manufacturers expand their product range. They also allow for machine size changes and the use of different knit textures.

c) High Speed and Efficiency

Automated flat needle looms increase production speed. They are capable of producing large volumes of fabric per hour, much more efficiently than human hands. This allows for the production of large volumes of products in a short time.



d) Manufacturing accuracy and precision

Flat needle looms ensure consistent product quality because they operate at high precision. Computer programs control the pattern and weaving process, providing a level of precision and consistency that is difficult to achieve by hand. Since the error rate is very low, production defects are minimal and product quality is high.

e) Automated Control and Technology News

Modern flat needle looms are controlled by computer programs, which provides great convenience for operators. By pre-programming the pattern and weaving process, the product can be produced automatically. In addition, the machine can be enriched with new capabilities by updating the software, which allows for the continuous creation of new designs.

f) Energy Saving

Many modern flat needle looms are energy efficient, which reduces production costs. These machines are designed to last a long time and keep energy consumption to a minimum, which helps reduce energy costs for businesses.

g) Less Environmental Impact

Products made with flat needle looms are often created with minimal waste, as they are woven directly into the desired shape and do not require cutting or the use of additional materials. This reduces waste during the production process and minimizes the negative impact on the environment. Therefore, these machines are especially valuable for companies aiming for environmentally friendly production.

h) High product quality and long-term use

Products produced on flat-needle looms are of high quality and can last a long time. Garments and other products woven on these machines are strong and elastic.[3]

5. Disadvantages

Flat needle machines also have disadvantages. First of all, these machines require high maintenance and good care. Such machines are relatively expensive and require a large investment for small enterprises. Also, for high-precision control, constant technical supervision and the work of experienced specialists are necessary.

Conclusions

Flat-needle knitting machines have become an integral part of the modern textile industry. Flat needle knitting machines allow for high-speed, high-volume, and high-quality production, which increases efficiency for enterprises. By working in integration with computer programs, it is now possible to easily create complex patterns that are difficult to implement manually during the production process. Such machines reduce waste in production and are characterized by energy efficiency, which causes less harm to the environment. Among the advantages of this technology are its high-precision control capabilities, durability and long service life, stable



product quality, and the ability to work with various types of fabrics. These machines are also seen as an environmentally friendly solution, creating the basis for large-scale positive changes in the global textile industry.

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