The New Making Equipment for Yarn Bulky Process

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Abstract- **A study has been carried out by means of designing and engineering tools (machine) maker of bulky yarn to produce a ready-made yarn for knitting process availability (Knitting) and weaving (Weaving). Raw materials which are processed on the machine results of design and engineering using two (2) types of raw materials, namely polyester and silk while the system processes threads bulky his created using three (3) a process model that includes system Gear Crimp, Friction Former crimp, and depending Twist. Besides the development of new tools in the trial , conducted four variations of the experiment the results of which can be selected which is best for each raw material .**

The purpose of this study was to obtain the appropriate technology that can be promoted nationwide for the processing and manufacture of bulky yarn up into threads that are ready for the next process, especially for knitting and weaving. Moreover appropriate technology produced by the Center for Textile expected to assist SMEs in the availability of bulky yarn material made in the country (homemade) with the use of machinery is relatively inexpensive and also in this case does not depend on outsiders.
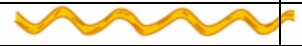
Results of the experiments and tests that are processed on the machine (tool) process bulky yarn BBT engineering results showed that the fibers were processed (the first variation) through the stages of the process model produces bulky yarns are quite stable form of "Crimp" and this is compared with another model / system. For two types of polyester and silk material 're suitable used with the 4th variation, and to the manufacturing process that uses bulky yarn of polyester , the ideal is to use the 1st variation.

*Index Terms—* **Crimp, Bulky, Friction Crimp Former, Twist**

I. INTRODUCTION

Bulky yarn is a kind of textured yarn, and this yarn can be obtained by various methods texturizing, either with simple equipment and modern machinery. Here are some examples of textured yarn which is widely used in the textile industry.

TABLE 1- TEXTURED YARN SAMPLE [1]

No	Tekstured Yarn	Explanation
1		*Bulky yarn*
2		*Stretch core yarn*
3		*Imparts crimp yarn*
4		*Curled yarn*
5		*Heated gear Yarn*
6		*Coiled yarn*
7		*Synfoam yarn (twist and untwist method)*

Basically, bulky yarn texturizing process aims to produce a yarn that has characteristics resembling wool thread characterized thick, fluffy and warm when used as clothing. The bulky yarn is a thread that irregular wave-like texture and is generally used to make warm clothing, such as scarves, sweaters, blazers, hats, socks, and other-elsewhere [2].
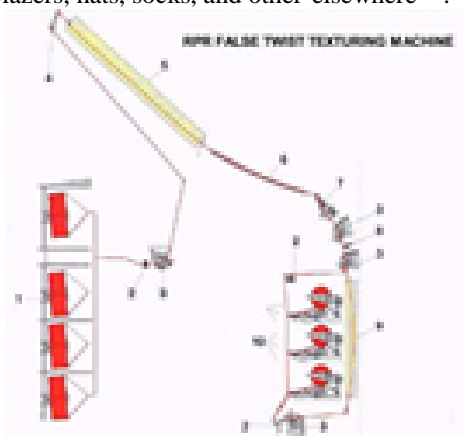
Figure 1. RPR False Twist Texturing Machine

Explanation in Fig. 1: 1) POY creel, 2) Knife (Cutter) dan Sensor, 3) Feed roller, 4) Threading device, 5) Cooling zone, 6) False twist spindle, 7) Interlacing jet, 8) Secondary heater, 9) Oiling device.
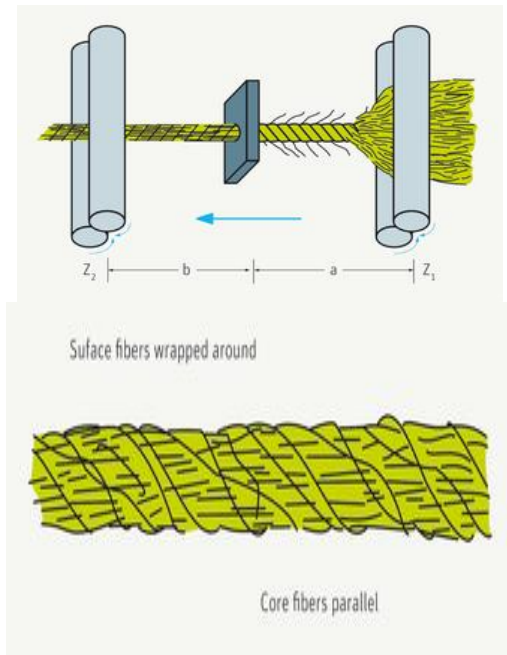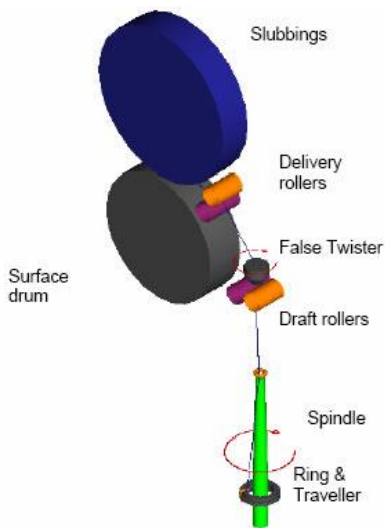

Figure 2. 1ˢᵗ Rieter System

Figure 2. 1st Rieter System
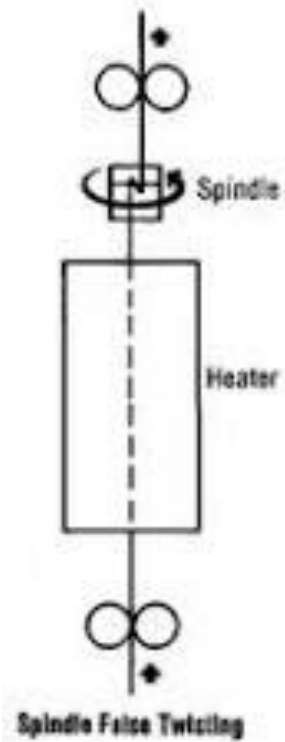

Figure 3. 2nd Rieter System
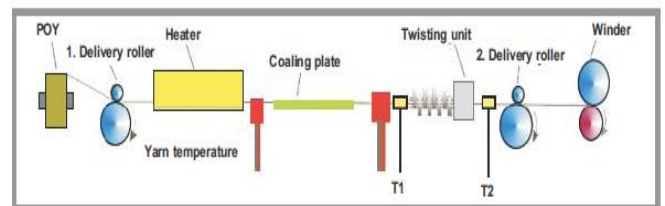

Figure 4. Simple English System

Figure 5. Heat & Twist-UnTwist System

Center for Textile (BBT) particularly PDDC (Product Design and Development Center) in fiscal year 2010 has brought knitting machines and weaving along with the accessories that aim to support R & D and technical services to the industry, particularly in the field of knitting and weaving. The machines are to be supported by the availability of other resources, particularly in the supply of raw material (yarn fancy, bulky, etc.) That enable product designs produced by knitting machines and weaving becomes more interesting (attractive). With this tool is expected to further support the further development of technology products and design of PDDC which is the result of innovation from research.

The purpose of this study was to obtain the appropriate technology that can be promoted for benefit of Indonesian Nation in processing and manufacture of bulky yarn so that a thread that is ready to be used in further processing, especially for knitting and weaving. Moreover appropriate technology produced by the Center for Textile (Balai Besar Tekstil) expected to assist SMEs in the availability of bulky yarn material made in the country (homemade) with the use of machinery is relatively inexpensive and can be reached also in this case does not depend on outsiders.

The scope of this study focuses on the manufacture of machinery to process bulky yarn, especially that can be used for yarns from natural and synthetic fibers. The yarn produced in this study is a single 30 denier silk yarn, silk and polyester

twisted yarn 75-200 Denier. While the concept of making tools to process bulky yarns include mechanical processes, the preparation by a chemical process, and a separate heating system. Particularly for manufacturing bulky yarns derived from natural fibers go through the process of chemical addition is made by a mechanical process (using hot air).

Some research on yarn bulky have never done such studies on the effect of fineness of yarn, shrinkage acrylic and degree of torsion on the various properties of mixed yarn of cotton and acrylic by using water treatment (boil water) [11], the influence of technology rotor to manufacture yarn bulky than cotton blend and acrylic [12], as well as the method in yarn spinning to produce a solo bulky cirofyl cotton [13]. As you know, that the bulky yarn manufacturing tools in this study using the methods and gear twist crimp to produce bulky more permanent nature.

II. METHODOLOGY

Raw material

Raw materials for manufacturing bulky yarns are 30 Denier silk yarn; polyester and silk 72-200 Denier; 30 Denier either single (Single) or duplicate and twisted yarn.

Sketch Design and Process Engineering

This research was conducted with an experimental method that examines the process of testing both the manufacture of tools and products from these tools. To sketch a design covering the front of the rack, middle and back, while the bulky yarn manufacturing process to the finished fabric through a phase of 1,2,3,4,5, and 6 [14,15,16,17]. Figure 6 below shows the display design engineering and planning stages of the new process making for bulky yarn.
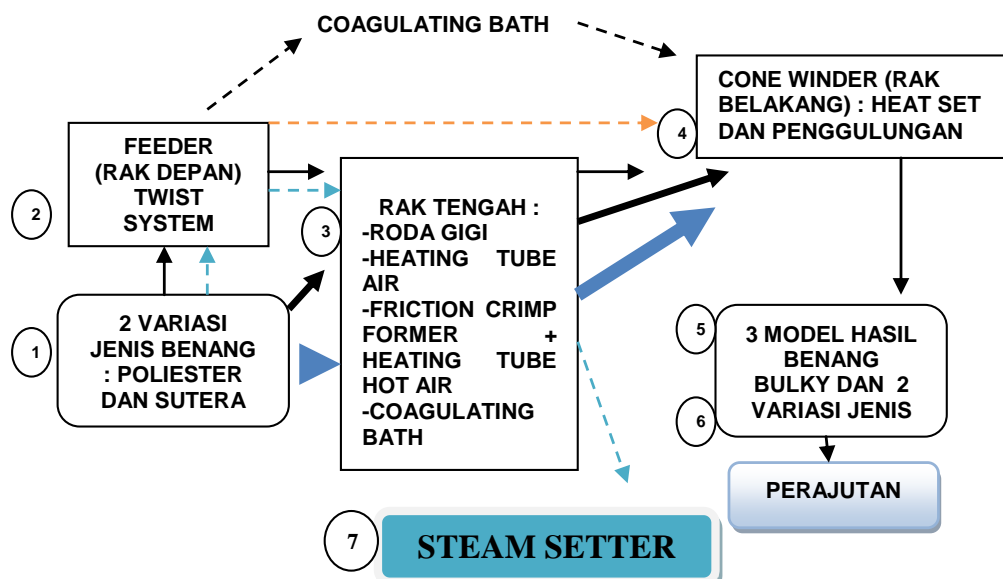

Figure 6. Sketch Design and Process Engineering

Explanation in Figure 6 can be explained as follows:

- Twist system : Yarn (1) in a twist (2) and into a coagulating bath (this special silk thread), then dried (4) and rolled.

- Gear crimp system: Yarn processed into gear crimp - heating water tube (3) is then passed through steam setter (7) and immediately rolled (4) without drying.

- Friction crimp former system: Yarn friction processed to crimp former - heating water tube (3), and then passed through steam setter (7) and immediately rolled (4) without drying.

III. PRESENTATION AND ANALYSIS OF RESULTS

Machines are made to process bulky yarn is carried out comprehensively from three systems were combined into a complete integrated suite of tools, and for more details can be seen in Figure 7 below [18].
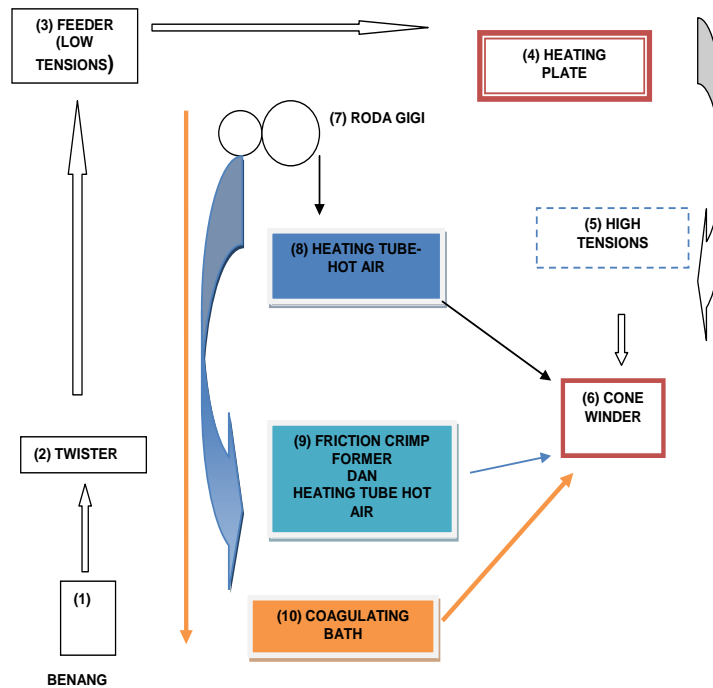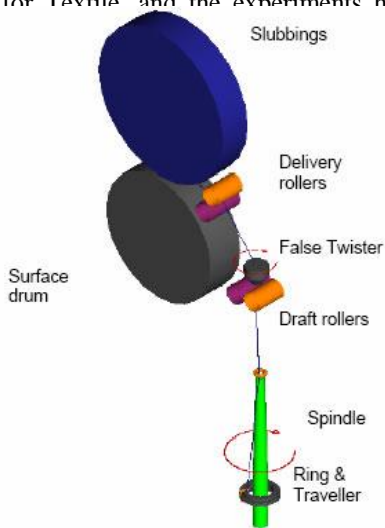
Figure 7. Plan and Process Machinery Yarn Bulky

The process of making a bulky yarn

Making the bulky yarn with a new tool that has created by the Center for Textile, and the experiments have done with some v...

- V ... rough the stage, l ... g.

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Thi ... into yarn made quite simple. The most important part in this Twister consists of a guide Yarn down / up, Ring, round rods (Rod roller) and the yarn fed (coarse and fine thread). Bulky yarn that will be created in addition to the wrapped rod is also inserted into the rod hole, so that when the rod and Ring spinning can produce a bulky yarn [19,20,21].

8.
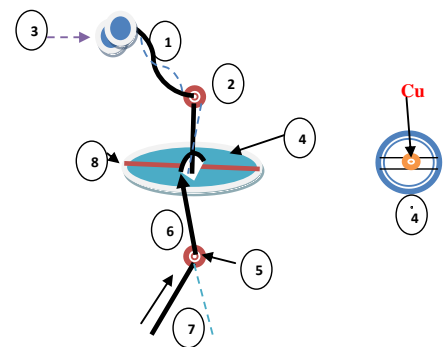
Figure Tools

Twister (Side View)

Explanation in figure 8 : 1) Twisted yarn, 2) Yarn guide above (expense), 3) Roll expenditures, 4) Ring rotatable direction S and Z, 5) Yarn guide below (bribery), 6) Yarn double, 7) Single yarn (number of coarse and fine), 8) Rod spherical shape (Rod shaft), 9) Cu (Central unit)

Figure 9. Twister Tool (Top View / Cross Section)

Gear Crimp

The use of gears to crimp this there are two (2) pieces (a pair), and aims to clamp threads through the gears. In this pair

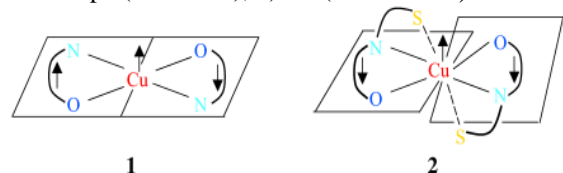of gears that do heating tube heating system with hot water. Heating imposed by using hot air, and aims to change the structure of the deadly nature of the thread that has been formed crimp yarn. The thread that is already formed or bulky yarn crimp is expected not to return to the form of yarn origin.

Friction Crimp Former

This tool is specifically to make more varied forms of crimp yarn and how it works with the system curve of friction on the field and assisted with the process of heating the tube of hot water, so the results are expected to be more stable threads

Coagulating batch

The use of special coagulating bath used when making bulky yarns derived from natural fibers. The results achieved have not been good enough, because the threads within a period of 100 hours no change, because in this case the chemical used is still not right. Therefore, research on the bulky, especially in the use of chemical substances should be investigated further.

Heating plate

Their heating plate making conditions more stable and bulky yarns made warming can be adjusted with the use of threads to be processed, because the tool is no thermostat to adjust the heat according degan desired.

Twister (High tensions)

Tensions high rollers are used to stabilize and to fix bulky yarn structure produced, also layer on a cone winder rolls more tidy and during the drawing back to the next process, as in the process of knitting and weaving.
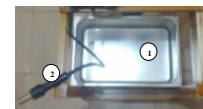
Making of machine components

The results of the manufacturing process tool rack bulky covers front, middle and rear shelf, and all of which can be displayed as in Figure below.

Figure 10. Front Rack (Feeder and Twisting)

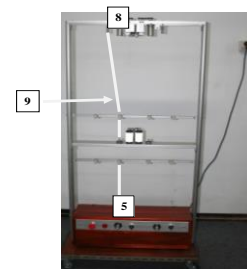**Figure 11. Back Rack (Cone Winder, Traverse Guide, dan Heating)**

Figure 12. Coagulation Bath , Heating Tube – Hot Air, dan Temperature Regulator For Heating
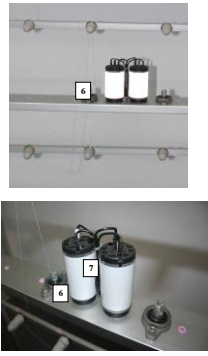
Explanation in figure 12 : 1) Coagulation Bath, 2) Heating Tube – Hot Air, 3) Temperature Regulator
Manufacturing Engineering (*Fabrication*)
The Front Creel
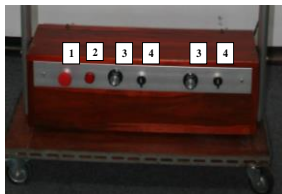

Figure 13. Schematic Course of Yarn

Figure 14. Yarn Feeding
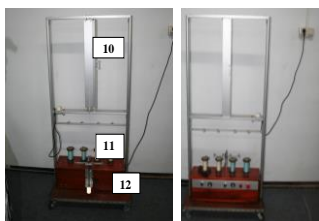
Figure 15. Twister Tool and Motor Drivers

Figure 16. Low Tensions

Figure 17. Panel Electrical Home

Key for Figure 13 - Figure 17:
1. The on / off
2. Control Lights
3. Regulatory motor speed twist
4. The on-off switch
5. Section bribery (Feeding)
6. Twister
7. Motor twist
8. Players low tensions
9. Yarn basic

Back Creel

Figure 18. View Rack (Front and Rear)

Figure 19. Rear Electrical Panel (from Home)
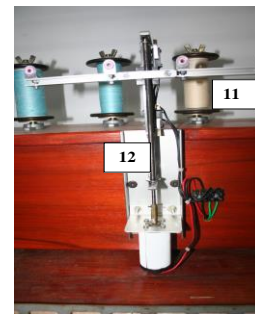
Figure 20. Traverse Guide
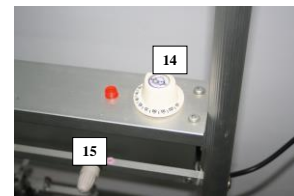
Figure 21. Heater (Heater)

Key for Figure 15- Figure 18:
10. Heater (Heater)
11. The results of bulky yarn
12. Traverse guide
13. The hot wire element
14. Regulatory Climate
15. The voltage regulator bulky yarns are rolled

The following picture is one example of the bulky yarn before and after the process bulky.
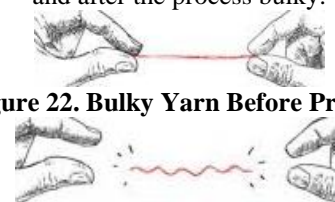
Figure 22. Bulky Yarn Before Process

Figure 23. After the yarn Bulky Process

Bulky Yarn Results

Due to the bulky yarn maker is still not perfect and is still in the trial and to be developed, then the example of the process of making bulky yarns made only a few examples. Here is an example of the results generated by the bulky yarn maker bulky yarn process.

Figure 24. Sample Result of Yarn Bulky

As the sample result from 4 (four) variations of experiment can be showed in figure 25 as followed :

a
Before Testing

b
After Testing

Figure 25. The sample result from 4 (four) Variations of Experiment (200/2 twisted polyester yarn)

a
Before Testing

b
After Testing

Figure 26. The sample result 30/10 Denier

a
Before Testing

b
After Testing

Figure 27. The sample result 30 Denier

a
Before Testing

b
After Testing

Figure 28. The sample result
(150D Polyester and 30D Silk)
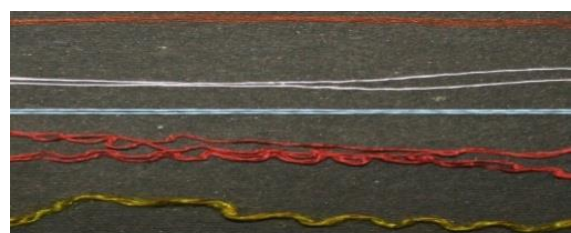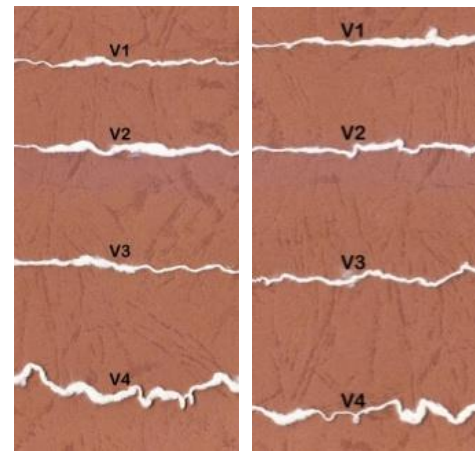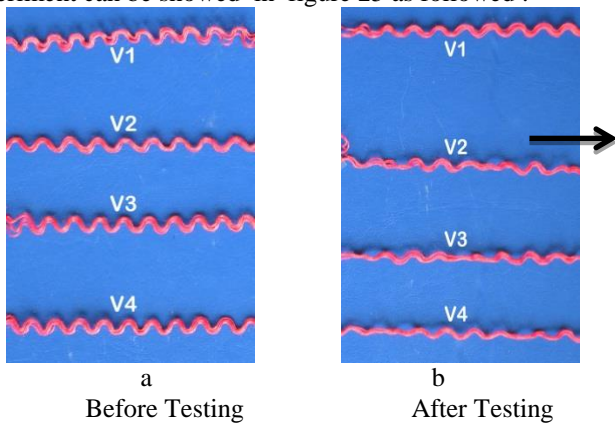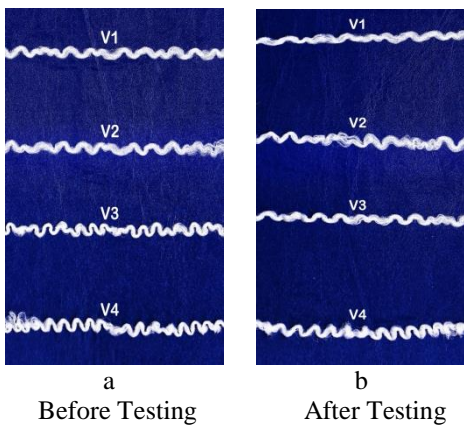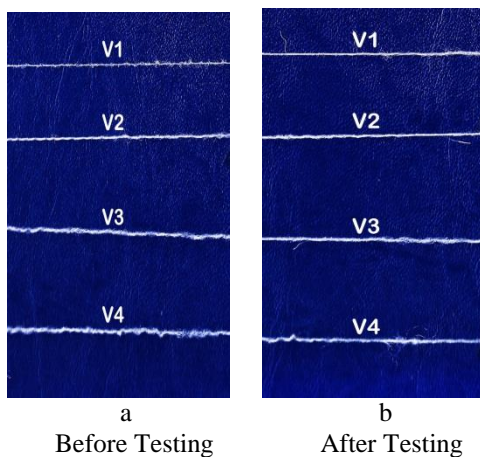
IV. DISCUSSION

Since the research is making the new tool for making bulky yarn and not varying types of threads then the discussion more emphasis to the tools or machine element alone and trials for making of products from polyester as well as blend of polyester and silk.

Note : The results of bulky yarn processed by the new machine (discovery research BBT in 2013) , in this case not all displayed . This is because research is still being developed and is still in the process of the invention patented in Indonesia .Crimp tested according to SNI 0619:2008, *Crimp test method for textured filament yarn.*

Trial Without Raw Materials

Road engine test without the raw materials needed to know the movements and engine vibrations that occur. In addition, in this trial was observed whether there are parts of machinery or equipment damaged, worn or less precise tuning (setting), so it can be identified and repaired or replaced. The trial is conducted for a period of seven times an hour the machine without the raw materials or the load.

Testing Machine With Raw Materials

Trials with the raw material was conducted to determine the performance of machines and processes. At the trial it was observed setting briber against cylindrical roller equipment, removal of raw materials by conveyor and material conditions in each stage of the process. Trials with the raw material is simply done by using raw materials of polyester and silk are limited and the materials tested are processed three (3) models of how to manufacture bulky yarns by means of research results. For the sample of experiment, in this cases we only performed 4 (four) variations and these're part of all experiments result.

Installation

As for the observation of some components of the equipment such as pallet holder and thread spools, place and position at the time of withdrawal of the yarn is no significant concern, and only here should stop motion mounted in machine tool. In a subsequent study planned development and

improvements to the perfection of the tool. In general, to make twisting used motors with large energy capacity, but the motor is used when the only research using some mini motor if you add up all of which are still below 500 watts (Note : 100 units of twister only need 500 watt). Electrical energy needs quite a bit, because here need only to rotate the hook rod that moved with slow rotation and to obtain a high twist just change the arrangement of wheels transmission only. In irotape motors (for low tensions), electrical energy is used to rotate the tool's low tensions are still under 50 watts, but a round to play irotape its own quite well and have so far never happened slip.

Traverse guide serves as an introduction and set the layer yarn bulky yarn on bobbins chakras. Traverse guide who made no use of drums and eccentric commonly used by the machine rollers (winding), but here's how it works up and down alternately controlled electronically (The new system and made by authors). With the use of a tool that allows the electronically controlled yarn-making process becomes better and flat. Shape rolling results yarn bulky using bobbins form of chakra, it is that the scrolls were collected on bobbins of the amount (magnitude) maximum, especially again for yarns derived from natural fibers such as silk yarn will not slip when retracted to the process of knitting or weaving , Besides the traverse guide that works up and down, resulting in a roll form rather use disc shape. So that a layer of rolls more neat and solid.

Product of Bulky Yarn

For The sample result from 4 (four) Variations of Experiment (200/2 twisted polyester yarn),1st variation results show good results after testing test . 200/2 polyester raw material process , the results show the stability of the form " Crimp " fixed and stable and it is because the twisting process by alt new twist warming also done very suitable for polyester raw material .

The sample result for 30/10 Denier an excellent fit with the experimental variation of the 4th , because here the process of stabilization and chemical processes by passing natural fiber material into a coagulation bath   (further stabilize the form of " Crimp " is happening) . As for the silk yarn 30 Denier , bulky process better suited to variation 3, this is because the process of Former Friction Crimp better in the formation Crimp shape for fine threads ; especially for natural fibers such as silk .

For blending of polyester and silk material is very compatible with the experiment with 4th variations, and it is because of the combination twist and immersion process (coagulation system with chemical) . Keep in mind also, that the research and testing is still ongoing and done. Hopefully after this article can be displayed again writing the results of further research.

IV. CONCLUSION

Results of the experiments and tests that are processed on the machine (tool) process bulky yarn BBT engineering results showed that the fibers were processed through the stages of the process model I (the first variation) produce bulky yarns are quite stable form of "Crimp" was and is compared with the other model/system. Research and engineering tools (machine) has a bulky yarn maker can produce ready-made yarns for the knitting process raw materials (Knitting) and weaving. Raw materials which are processed on the machine results of design and engineering using two (2) types of raw materials, namely polyester and silk while the system processes threads bulky his

created using the fourth variation (4) and the 3rd process model that includes friction   crimp former system. and to the manufacturing process that uses bulky yarn of polyester only, the ideal is to use the 1st variation.

This tool is expected to help SMEs in terms of availability of bulky yarn material made in the country (homemade) with the use of machinery that is relatively cheap and affordable also in this case does not depend on outsiders.

V. RECOMMENDATION

1. To obtain data on the performance of the process tool is still required bulky yarn trials with a longer period of time.
2. The maker of artificial bulky yarn (Product's BBT/Center for Textile) is still to be developed and improved further to make it more perfect performance of the engine.
3. Test the performance of this machine should be done in the field by placing machines in the spinning industry or SME silk yarn maker.
4. Yarn prepared process bulky yarn processing engine results should be tested further on automatic knitting machines and Jacquard weaving and with the aim to determine the level of quality and aesthetics of the product of the fabric.

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