I. INTRODUCTION

This present work is performed by grade in Textiles "Vinardi" which is a small business that manufactures woven that to improve quality in the presentation of the finished product has required the construction of a bending machine.

To develop this process of knowledge needed in the areas of textile, electrical, and mechanical design that is divided into six chapters. The first three chapters on the theoretical and the fourth to the sixth to the practice.
In the first chapter reviews the general plane of the tissue, its classification, weaving and quality systems in the tissue.

In the second chapter, refers to the bending machines, types, primary and secondary elements of the machine and its transmission system.
In the third chapter, explaining includes materials and equipment used in the construction of the machine.

In the fourth chapter, performed the design and construction of the machine, the engine power calculations and mechanical elements of the transmission system, types of solder used, mounting elements, fully armed, adjustments and calibrations.

In the fifth chapter explains the operation and maintenance of the machine, electrical and mechanical tests, the performance of the three systems, maintenance and lubrication of components and calculations of the weight and volume capacity of the machine.

In the sixth chapter discusses health and safety as well as some basic, protective equipment for workers and a brief analysis of the law in Ecuador on this topic.

And finally in the seventh explain the costs and payback, material costs, construction costs, processing costs and calculate the time of payback.

II. CONTENT DEVELOPMENT

1. WOVEN.

The fabric formation takes place in the loom as follows: warp cylinder or unwound from a beam, is driven by a wire guide, then are separated by rods, pass through grommets fitted in meshes fitted heald movement, its rise, decline and let rest be a drag on the inside of which passes the frame.

1.1. THE PLOT IN THE PROCESS OF WEAVING.

In weaving the plot is the essence of the process, as is the inclusion of this in the warping, the importance of this is that you must weave considering the article to be manufactured as considering the raw material, the title, the color Lot depends, not mescle each other to have an identical throughout the manufacturing process, one must also consider whether the preliminary storage is to be manufactured the same tissue in the same order not to vary its hue and texture.

1.2 WEAVING DOUBLE WIDE.

The advantage of this type is desired weaving with a lower cost of operation and in some cases where finishing operations allow double work piece of tissue, also a lower cost such processes.

However, these advantages are not always easy seem possible to obtain either because in a woven article there is no novelty order wide enough to allow two twin beams weave of appreciable length.

1.3. QUALITY FABRIC.

According to the ISO 8402 standard that says: Quality is the totality of features and characteristics of a product or service that will provide the ability to satisfy stated or implied needs of the customer. Among the weavers and garment manufacturers there is another common definition: Quality in a tissue is the absence of defects.

2. BENDING MACHINES.

This type of machines are characterized by reducing the width of the cloth from a flat loom; in half hence its name.

2.1. SYSTEM UNWINDING.

This system is the initial and in charge of the roll stand leaving weaving process as it is discharged as the loom with its initial width. This system is very simple and has no motion and motion of the system depends on the reel.

Fig. 1 Easels where you place the fabric roll to fold flat

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2.2. BENDER SYSTEM.

In this system the basic principle is the selvages together with one another and allow the width of the fabric to decrease to half of its length, this is achieved with the aid of a clamping device and a bending selvedge which is based on getting the fabric bars that help guide the fabric to get the system that makes an angle bender at the end of its travel the selvages are together forever.

Fig.2 Easels where you place the fabric roll to fold flat

2.3. WINDING SYSTEM.

Basically there are several principles of curl.

For bars Tablet, has been named as the finished product gets a tablet form, this system has direct contact with the tissue its movement unlike other dependent wound cylinders.

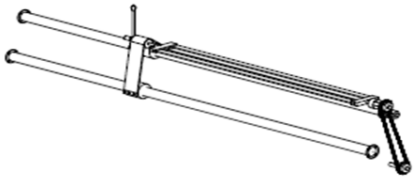

Fig.3The Tablet wraparound bar.

The bars are moved here form a single body wrapped fabric does not need the help of cylinders and its motion is direct and simple tissue.

3. CALCULATIONS OF ENGINE POWER.

To perform this type of calculation is taken into account the maximum velocity attained by the machine winder system especially when the roll of fabric reaches a weight of approximately 125metros meters that must be projected for its operation.

P = FxV
Where: P = Power
F = Force (Weight)
V = Speed

Whereas the force required to move a roll equals the same weight has been calculated with a mean roll on 125metros for determining the capacity of the machine when working with a roll end of these characteristics.

Other facts to consider**.**
1rollo of 125mts = average weight of 27.48 kg
1mts meters wide x 1.82 = 0.22 kg Fabric
Ø = diameter of the drive pinion basis development

speed
V = rpm x πxθ
V = 63x3.1416x420mm
V = 83126/1000
V = 83.126 m / min

power
P = F x V
P = 27.48 kg x83, 126 m / min x 1min/60seg
P = 38.07 kg m / sec
Horsepower
Knowing that: 1HP = 76.0402 kg m / sec
P = (38.07 kg m / sec) / (76.0402 kg m / sec)
P = 0.5 HP

Whereas 0.75 Kw = 1HP
The engine power in kW is needed is:

0,75Kw ---------- 1HP

x ---------- 0,5HP

$$P = \frac{0,75Kwx0,5HP}{1HP}$$

$$P = 0,375Kw$$

4.DESIGN AND CALCULATION OF ELEMENTS.

Was chosen for the transmission system elements as a pinion, a sprocket and a chain to be the ideal for this type of work because movement is conveyed direct and clean, to be efficient and that nose wasted power motor.
Another reason to use this type of element is that the machine is designed to produce a pulling force on the tissue from unwinding until tableteador or furling system through various clamping rollers and doubler system, which allows the coil end is compact and uniform for all this this drive system is ideal conserve

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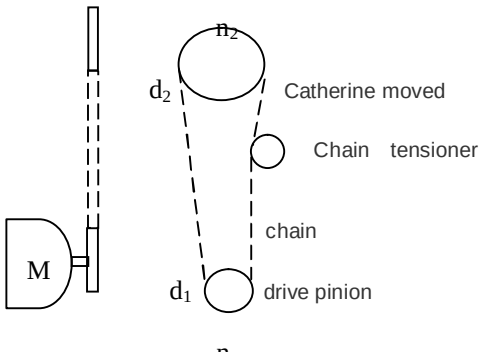
power 100Kw and with a minimum speed of 10m/min.

Movement System.



n1 (rpm drive) = 63

n2 (rpm moved) =?

D (diameter) =?

m (module) = 4

i (transmission ratio) = 0.636

z1 (# of teeth) = 14

z2 (# of teeth) =?

of (outside diameter) =?

do (pitch diameter)

Calculation of external diameters of the pinion and primitive.

$$de_1 = m(z_1 + 2)$$

$$de_1 = 4(14 + 2)$$

$$de_1 = 64\text{mm}$$

$$do_1 = m\ x\ z_1$$

$$do_1 = 4\ x\ 14$$

$$do_1 = 56mm$$

Calculation of number of teeth of the sprocket

$$i = \frac{z_1}{z_2}$$

$$z_2 = \frac{z_1}{i}$$

$$z_2 = \frac{14}{0{,}636}$$

$$z_2 = 22\text{teeth}$$

Calculation of external diameters catalina primitive.

$$do_2 = m\ x\ z_2$$

$$do_2 = 4\ x\ 22$$

$$do_2 = 88mm$$

$$de_2 = m\ (\ z_2 + 2)$$

$$de_2 = 4(22 + 2)$$

$$de_2 = 96mm$$

Calculation of moves rpm.

$$n_2 = i\ x\ n_1$$

$$n_2 = 0{,}636\ x\ 63$$

$$n_2 = 40rpm$$

Step for all items.

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$$p = m\ x\ \pi$$

$$p = 4\ x\ 3{,}1416$$

$$p = 12{,}57$$

Calculation of number of chain links.

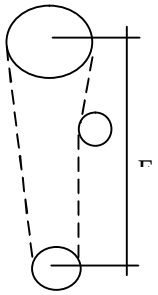
$$N = \frac{2\ x\ E}{p} + \frac{z_1 + z_2}{2} + \frac{p(z_1 + z_2)^2}{40\ x\ E}$$

$$N = \frac{2\ (500)}{12{,}57} + \frac{14 + 22}{2} + \frac{12{,}57(14 + 22)^2}{40\ x\ 500}$$

$$N = 79{,}55 + 18 + 0{,}81$$

$$N = 98{,}36 \cong 98 \text{ links}$$

Long chain calculation.



Used and calculated values:

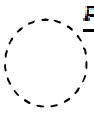
$$de_1 = 64$$

$$de_2 = 96mm$$

E (wheelbase) = 500mm

Calculation of half-perimeter of Catalina.

Pc/2=?



$$\frac{Perimeter}{2} = \frac{2\pi r_2}{2}$$

$$\frac{Pc}{2} = \pi r_2 \ \rightarrow\ r_2 = \frac{de_2}{2}$$

$$\frac{Pc}{2} = 3{,}1416\ x\ \frac{96mm}{2}$$

$$\frac{Pc}{2} = 150{,}79 \cong 151\text{mm}$$

Calculation of half-perimeter of the pinion.

Pp/2=?

$$\frac{Pp}{2} = \frac{2\pi r_1}{2} \ \rightarrow\ r_1 = \frac{de_1}{2}$$

$$\frac{Pp}{2} = 3{,}1416\ x\ \frac{64mm}{2}$$

$$\frac{Pp}{2} = 100{,}53 \cong 101\text{mm}$$

Minimum length of string.

$$L_T = 2E + \frac{Pc}{2} + \frac{Pp}{2}$$

$$L_T = 2(500mm) + 151\text{mm} + 101\text{mm}$$

$$L_T = 1252mm$$

$$L_T = 125{,}2cm$$

4.1. MECHANICAL DESIGN.

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The design is to launch a preliminary outline or sketch that meets the required needs, fulfilling the purpose for which it was raised, to reach the ultimate goal, correcting errors and overcoming difficulties. The design development has been facilitated by new technologies based on computer programs such as Autocad, compliant with the expressive and functional design.

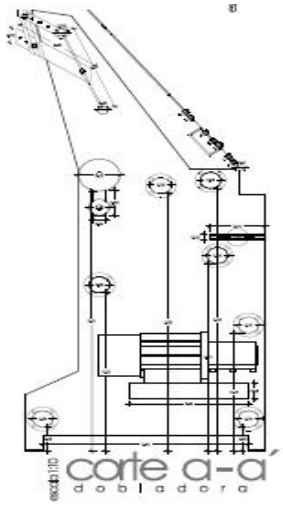

Fig.4 Side cut of the bender.

4.2. ELECTRICAL SYSTEM DESIGN.

The control circuit. - Is so named because the machine allows us to rule as it is directly associated with the use of contactors, switches, fuses, etc..

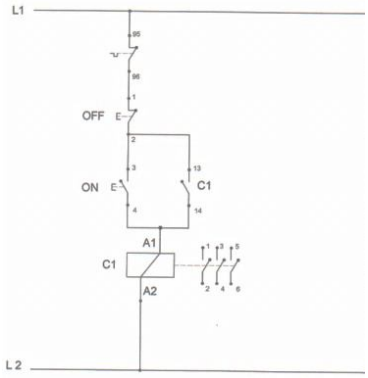

Fig.5 Control circuit.

The power circuit**.** - This drawing reflects all elements and conductors through which electric current flows feeding the control circuit.

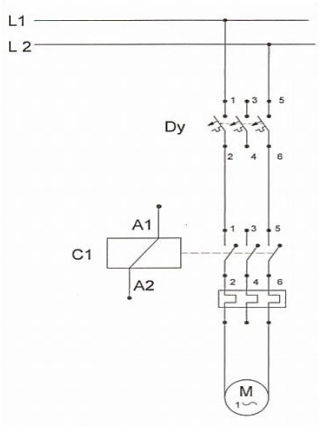

Fig.6 Strength Circuit.

5. MOUNT PARENT-CHILD.

First we proceed to arm the bed with his five crossbars along the walls thereof and forming the other two serve as auxiliary support for the upper, joined prior two sides or walls that form the bench for suitable drilling holes so you can maintain your exact horizontal alignment beams and cylinders.

Fig.7 Bed where all cylinders are placed and machine parts.

Once the bed armed proceeds to locate all the mechanical elements necessary for the operation of the bending machine this process should be done by building a logical sequence so that the set is efficient and accurate.

Some elements as indicated above are previously welded, others will form and joining with the aid of bolts and nuts.

He proceeds to mount the two stands on the back of the machine, this will serve as an unwinding system since these can be separated by work for different kinds of fabric because each is independent so it must pan and zoom to the width of fabric loom. -Bender system is almost entirely welded and bolted a few mates were in the bed this occupies the top half of it, is a structure slightly heavy and placed carefully tightening bolts holding with each of its parts.

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Fig.8 Doubler System is assembled and welded.

-The various cylinders is coupled to guide the fabric and which by its design also serve as tensioning tissue as one of these produces a compensating effect reciprocating distension occurs when winding the tissue. Each of the cylinders has been previously welded at their ends a shaft that it is accommodated in a respective bearing placed on the bench and then go to mount orderly distributed in the whole system as a whole.

This reel-mounted system in one of its ends on a support shaft and the other of its ends on a drive shaft and then welding the "T" and then bolting the parallel plates which are subject to its drive shaft, in the Moreover these same plates will trapped.

Fig.9 Furling system is bolted and weapon.

-Motor-reducer is placed on its base at the bottom right of the machine.

He mounts the catalina at the end of the drive shaft winder system, this catalina has 22 teeth.

-Place the pinion teeth 14 on the shaft of gear motor.

- Then he proceeds to set the chain and secure in their final position the chain tensioner, maintaining adequate voltage of the same.

-He checks that all these elements are subject to each of the both sides in the bedplate or is part of a system are coupled adequately therein.

6.TABLE OF RELATIONSHIP WITH RPM SPROCKET CHANGE.

For the preparation of Table 1 obtained rpm furling system, it was decided to choose the change to Catalina for ease of manufacturing and also to avoid the constant contact of the motor shaft gearbox.

		Element of Change			
Drive Pinion		***Catalina Move***		***Link (units)***	***Minimum length of string (cm)***
n1	***Z1***	***Z2***	***n2***		
63	***14***	***22***	***40***	***98***	***125,2***
63	***14***	***23***	***42,87***	***99***	***125,9***
63	***14***	***24***	***45,75***	***100***	***126,6***
63	***14***	***25***	***48,62***	***100***	***127,3***
63	***14***	***26***	***51,5***	***101***	***127,98***

Tab:1 rpm sprocket change

7. ANALYSIS OF THE OPERATION.

After learning how each one of the systems that make up the bending machine analyze all work together.

1. - Place the roll of tissue from the flat loom, we position the ends of the roll axis in the journals of the trestles that make up the system desenrrollador.

2. - We spent the tissue cylinder assembly guides, first by the crossbar, then the cylinder vai-ven, followed by the front cylinder, then move the fabric by the large diameter cylinder fabric here is a "S "reposante with roller.

3. - Extract the fabric of this pulling roller approximately 3 m in excess of this roller, then it reaches the upper bending element.

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4. - Place the fabric on top bender system.

5. - Hauled to central fabric bender system.

6. - We collected the ends of the selvedges.

7. - Spent inside of the platen which is sloped.
8. - Put inside the folded fabric rod-shaped curve "L" of stainless steel at the end where the selvages are not to get into a flow according folded tissue.

9. - Spent the guide rods tissue in a zig-zag.

10. - Fabric hauled up on the plates placed parallel furling system, leaving exceed about 30 cm with respect to these plates.

11. - Make a small double inclined at the two ends of the fabric to facilitate wrapping.

12. - Press the switch in the on position, allowing the engine turn.

13. - The movement is transmitted via a chain from the sprocket drive pinion to move, which is located at the end of the winding system drive shaft.

14. - The driving shaft and moves through the parallel plates of this system allows the shaft holder, which is mounted on the rails to move synchronously.

15. - The tissue begins to roll on the system uniformly.

16. - We go manually compensating inequality that forms at the junction of the selvages to the system output doubler, approximately the height of the meter counter.

17. - We review the account gradually dial meters to obtain the required footage.

18. - Retrieved desired roll with the meters, proceed to count the tissue.

19. - We subjected the roll and tied with the aid of a rope preferably extremity thereof.

20. - Unblocked parallel platens with the help of a lever, arranged in the shaft support, ensuring at the same time fasten the roll so as not to precipitate

21. - We take the scroll sliding of the plates.

22. - Place the plates in parallel trying to match the holes with the support shaft bolts and release the lever.

23. - To wind again repeat the process from the numeral 10.

8. MAINTENANCE AND LUBRICATION.

Maintenance. - All parts are important in the machine, cylinders, gears, belts, bearings, bearings, chains and other items should be cleaned and examined periodically. The intervals between such examinations are entirely dependent on the operating conditions. If you can monitor to do at work, for example listening to the sound of it running and measuring the temperature or examined lubricant is usually sufficient cleaning or a thorough inspection every six months or more frequently according the work period.

It should be cleaned with petroleum-based products such as diesel and immediately proceed to oiled or greased to prevent rusting.

Lubrication. - This should be done with suitable lubricants for the job and should be checked the manufacturers recommendations for each of the items that need to be lubricated and greased.

The numbering of the oils is very important as we work indicates the viscosity of both cold and hot. Inadequate lubrication and use of incorrect lubricant can cause vibration problems and therefore wear part or element, to be dry this causes excessive friction, called "dry whip" or dry whip, like passing a wet finger on dry glass.

9. MACHINE CAPACITY BY WEIGHT.

To estimate the maximum weight in the bending machine has done several tests that verify the capacity with which you can work without any mechanical defects in functionality or the processed product.

It has been taken as a reference and have to process canvas fabric which has the characteristics of 1.82 m. wide with 0.22 kg per meter length.

1. - The first test has worked 50mts roll weighing approximately 11kg exceeds all expectations.

2. - The second test with a final roll 100m and weighing approximately 22 Kg also passes the test.

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3. - The Third Test with a roll of 150 meters and a weight of 33kg the machine starts making trouble in the drag force and sinkers furling system starts producing a minimum curvature strapping but is a sign that is at capacity weight and work that does not meet its full functionality.

To end this data has been collected based on the evidence of work performed:

Number of Test	*Meters*	*Weight in Kg*	*Regulation*
First	*50*	*11*	*1*
Second	*100*	*22*	*1*
Third	*150*	*33*	*2*

Tab:2 Evidence performed

We conclude that the processing capacity is 33 kg roll aproxidamente independently of tissue characteristics, such as its width or type of material.

10. MACHINE CAPACITY IN VOLUME

For this we have taken the physical characteristics of that particular bending machine has limits regulations having the winder for this system has developed a table reference.

Regulation Number	*Distance in cm*
1	*9,0*
2	*11,5*
3	*14,0*

Tab: 3Regulatión capacity in volume

With this information we conclude that the maximum volume that can be processed in the machine 14cm thickness is measured from the surface plates to the roll and this is obtained by positioning the plates in the third regulation.

11. ADVANTAGES OF THE MACHINE.

Since its conception in the design was based on the benefits to be obtained on larger machines or manual processes, as working in "Textiles Vinardi" exposed here has been observed with the use of machine woven processing .

- Reduced physical space of 5.12 m2 approximately.
- Low vibration work.
- Power consumption of 0.375 kW Jan monthly cost is 6.66 USD / month.
- Low noise emission.
- Versatility in changing speeds.
- Compact and rigid.
- Easy to carry.
- Almost completely disassembled.

-Time 8min processing roll with downtime.
- Adaptability to any folder of Loom plane.
-Lightweight and lightweight.
-Easy to operate.
- Quality in the processed product.

Of all these advantages and benefits in the use of the bending machine, I have taken into account the short processing time per roll and the monthly production capacity, considering that the recovery of the costs incurred is less time than analyzed in the Investment Recovery chapter, for all the above.

12. HEALTH AND SAFETY.

Health is the prevention and monitoring of occupational diseases, studying, evaluating and monitoring the conditions that cause them.

Security is understood by the medical technique whose purpose is focused on the fight against industrial accidents by preventing and controlling its consequences. It is their aim the fight against occupational accidents, which distinguishes the safety of other nonmedical prevention techniques, such as hygiene and ergonomics.

The scope of the Industrial Safety is very broad, because it covers all production activities within or outside a company or industry, as in any of them generate risks that threaten the physical integrity of the staff and equipment, machinery and facilities that are in the workplace or the next has thus the family finds a full backup that will help promote unity among its members not only improving the socio-economic situation of the family but also of business, community and country.

13. PROCESSING COSTS.

For this calculation I have taken into consideration the machine to work 8 hours a day for 22 days a month for 12 months.

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Energy consumed.

1 motor 1/2 HP consumes

=0,375 KW

0,375 KW/h x 8h/ day

=3 KW/day

3 KW/día x 22 días/ month

=66 KW/ month

66 KW/mes x 0,101 usd

=6,66 usd/ month

Manpower.

The compensation that a worker earns an estimated monthly is 294 usd
Total Process Cost per month

Energy consumed ---------- *6,66 usd*

Manpower ---------- *294 usd*

Total 300,66 usd

14. RETURN ON INVESTMENT.

Roll length	***50m***
Working speed motor	***83.126 m / min***
Time it takes to bend a roll	***8min with downtime***
Rolls of fabric in 1 hour worked	***7.5 rolls / h***
7.5 rolls / hx 8h/diarias = 60 rolls / day x 22 days	***1320 rolls / month***
300.66 usd / month ÷ 1320 rolls / month	***23centavos dollar / roll***

The cost of a roll bending is 28 cents

Then:
0.28 usd / roll x 1320 roll / month = 369.60 usd / month
369.60 usd / month - 300.66 usd / month
= 68.94 usd / month x month recovery
68.94 usd / month x 12months
= 827.28 usd / year x year recovery

Recovery time.

Cost of materials + Construction Cost = Total Cost
1439.05 + 592 = 2031.05
÷ 2031.05 827.28 usd usd / year
= 2.455 years 2 years
0.455 years x 12 months = 5.46 months
0.46 months x 30 days = 13.8 days

This means that the money spent on design and construction of the bending machine will be recovering over the course of two years, five months and 13 days of work.

III CONCLUSIONS.

• The design of the fabric folding machine satisfactorily meets requirements Vinardi Textiles, based on a complete and detailed process.

• The development and implementation of this project has been implemented various technical, mechanical, computer and design acquired during the years of study of the School of Textile Eng.

• The bending machine is easy to operate and can be handled by one person, without any difficulty.

• In order to bend width different tissue types, has been placed independent trestle, adaptable to any loom beam.

• The design of the machine allowing bending develop a unidirectional system, since in the same direction as the fabric enters, leaves the roll processing.

• The machine is compact in design and easy to carry as most parts are removable.

• The bending machine consists of a motor 1/2 HP and of 0.375 KW which makes it an affordable and this is verified in its low power consumption.

• The materials used are easy to access, easy to work both in mechanical and electrical as this has allowed a better understanding of the design and construction of the machine.

• The furling system has a 3-position control, in this way we can work with compact or bulky fabrics, though always checking to not exceed the weight capacity of machine.

• After performing the necessary research to get the bender emits approximately 75 dB noise level so you do not need the mandatory use of protection earmuffs

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IV RECOMMENDATIONS.

• For safety must be the bending machine with anchors subject to a flat, level surface to keep the mechanical elements, as it may cause misalignment and bearing wear, deterioration bocines, wear axes among others.

• As a precaution you should check periodically adjusting bolts because vibration of work that occurs, can cause it to loosen.

• When replacing the chain, you must make a correct alignment with the pinion and sprocket to cause no mincing teeth working at the time of the machine.

• In the flats of the winding system as they are on the move at the time to get the roll processed, wear occurs in destaje of its edges, it is recommended to fill in and keep the destaje original.

• Step must be performed to correct the tissue cylinders guides, in order to obtain a compact roll, and even in the dyeing process pillín not occur, by the friction between the fabric circulate when said cylinders.

• It must implement an alternative braking on the roll of cloth from the loom in the unwinding system as it can cause variations.

• Check at least twice a year the state of the various elements of the bending machine, to thereby prevent damage during operation and if necessary replace them in time.

• It is recommended that when making use of this type of machine to use mask and goggles because the cotton lint and dust that removes 100% cotton fabric that wraps, as well as the use of a back brace due to that force is necessary when placing the cloth beam in bending and in rolls that come out of the machine.

• For people who make use of this research, we can make some improvements such as: adapting lights inside the doubler system, making it one revisadora, or increase the width of the plates furling system and passed the tissue guides for cylinders without passing through the doubler thereby making a winder, the theme is open to creativity and need for each person using it.

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