

DESIGN AND DEVELOPMENT OF MANUAL HANK REELING MACHINE

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ABSTRACT

In today's Textile product processing, customers are demanding lower prices, the best quality product and service. An effective cost reduction and higher productivity with short processing time is the main objective for textile manufacturer to be a strong competitor by having high market share with profitability and to compete successfully in the world market by keeping benefits of stake holders including customers.

Now a day there is different manual and automatic hank reeling machine. Hank reeling machine used to reel cone yarn to hank yarn form. Automatic hank reeling machine works by use of electric power system and has motor for Hank reeling. This machine can wind a maximum number of hanks within one reeling cycle of machine. It's less time consuming, but expensive.

Hand hank reeling machine can wind single hank per reeling cycle and its time consuming than automatic reeling machine. Based on data analysis, the researcher designed and fabricated manual hank reeling machine which can be driven easily by using foot. This machine can wind up to 12 hanks within single hank reeling cycle.

Keywords: Yarn, Hank yarn, Manual Hank reeling, Automatic Hank Reeling

INTRODUCTION

The interest in producing textile product has increased significantly. The abundance in nature combined with the ease of Textile processing was an attractive feature, which makes it an important income for the development of a given country. Now a day's different latest textile machineries are developed by different manufacturers. In production of yarn the main input fiber is changed into yarn by passing through different textile machinery.

In the textile industry, a hank is a coiled or wrapped unit of yarn or twine (as opposed to both other objects like thread or rope as well as other forms such as in a ball, cone, bobbin, spool, etc). This is often the best form for use with hand looms, compared to the cone form needed for power looms. Hanks come in varying lengths depending on the type of material and the manufacturer. For instance, a hank of linen is often 300 yards (270 m), and a hank of cotton or silk is 840 yards (770 m). While hanks may differ by manufacturer and by product, a skein is usually considered 1/6th of a hank (either by weight or by length). One source identifies a skein of stranded cotton as being 8.25 yards (7.54 m), of tapestry wool as being 10 yards (9.1 m), and crewel wool as being 33 yards (30 m) [1-2].

In yarns for handcrafts such as knitting or crochet, hanks are not a fixed length but are sold in units by weight, most commonly 50 grams. Depending on the thickness of the strand as well as the inherent density of the material, hanks can range widely in yardage per 50 gram unit; for example, 440 yards for a lace weight mohair, to 60 yards for a chunky weight cotton. Special treatments to the materials that add cost, such as mercerisation or labor-intensive hand-painting of colors, can influence a manufacturer's desired length per unit as well. Knitters and crocheters rewind the hanks into balls or centre-pull skeins prior to use, in order to prevent the yarn from becoming tangled.

Hog casings are sold in "bundles" or "hanks." This unit of measure equals 100 yards (91 m) [2].

Hank reeling machine is used to change cone or cop packed yarn into a hank form by winding a yarn into a circular or round shaped reel. Hank yarn used to produce knitted and woven fabric [3-4].



Figure 1: Hank yarn

In Ethiopia, Textile product manufacturing is one of a key sector that identified by the government since 2010. The Ethiopia industrialization strategy has given top priority to textile product processing. The several opportunity and suitability of the general atmosphere for the

growth of textile industries in the country some local and foreign investors are investing their knowledge and capital in textile industry. In Ethiopia there are large number of small scale knitted and woven fabric producers. To produce these fabrics the main input they using is hank yarn [5-7].

Local knitted and woven fabric producers can purchase a cop packed yarn from market and they change into hank form by using small manual hand driven hank reeling machine. However, the amount of hank produced by manual reeling machine does not satisfy the need of small scale knitted and woven fabric producers and it leads the hank cost very high. Therefore, this problem was a notable hindrance limiting the industrial growth of the country. The Author concerned on fabricating of easily operated manual reeling machine with less manufacturing cost and which rotates by using foot and can wind more number of hanks per cycle.



Figure 2: Electrical and Hand driven Hank reeling machines

METHODOLOGY

Materials

The researcher used CHS pipe, RHS Tubular steel, Sheet Metal, Bearing, pulley, Worm Gear etc.

Methods

The Author gathered required data through observation, Interview and referring books. The project mainly concerned on designing and fabricating a manual hank reeling machine which winds more hank per reeling cycle, by changing some mechanism of hand reeling machine. In manual hank reeling the operator uses its hand to wind hank yarn and can wind single hank per

cycle. The Author changed the driving unit from hand to foot and extended the width of reel in order to wind up to 12 hanks per reeling cycle. This allows comfort for the operator, because the operator got a possibility to drive the reel by his foot like fabric sewing machine, by sitting on a chair.

Design of Manual Hank reeling machine parts

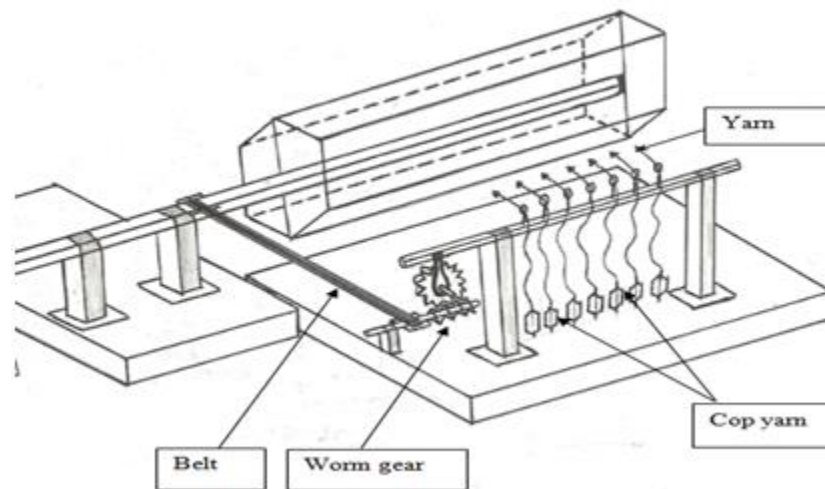


Figure 3: Manual Hank reeling Machine design

As indicated in Figure, The reeling part used to wind hank yarn and Worm gear and worm shafts are used to push yarn traverse rod. Yarn traverse used to distribute the yarn uniformly throughout the width of hank.

Table 1: Manual Hank reeling Machine specification

No.	Machine parts	Dimension	Material Type
1	Reel	Length 90cm, circumference 80 cm	10mm Round bar
2	Reel support	Length 50 cm	CHS pipe 50*2
3	Traverse support	Length 65 cm	CHS Pipe 25*1.25
4	Yarn Traverse	Length 110 cm	
5	Reel Frame	60cm*40cm	RHS Tubular steel
6	Feeding frame	110cm*60cm	RHS Tubular steel

7	Shaft	Length 160 cm	CHS pipe 25*1.25
8	Ball Bearing	25*52	-
9	Worm Gear	100 Teeth number	-
10	Sheet Metal	1.25mm Thickness	-

Manual Hank reeling Machine Description

The machine has a long shaft, on which the reel is welded. The shaft is supported by two bearing with their Bearing house. The one side shaft is connected with the driving unit by belt. When the driving unit rotates, the reel which is fixed on the shaft starts reeling the cone or cop yarn into the reel to form a hank.

This machine has a feeding unit to feed cone or cop packed yarn to the reeling unit. There is a yarn traverse rod used to distribute the yarn throughout the hank width. The machine has worm gear with 100 teeth number. The worm gear is connected with the shaft by belt. A small length rod is welded on the worm gear there is a small length rod. In yarn traverse rod a small key like tongue is connected. During reeling, when the shaft rotates one cycle, one of the worm gear teeth forward and a small rod on the worm gear pushes the key like tongue welded on yarn traverse rod. Yarn feed welded on yarn feed Yarn traverse distribute the hank yarn uniformly throughout the width of hank.

RESULT AND DISCUSSION

The new fabricated Manual hank reeling machine can reel 12 hanks within one reeling cycle. The machine can be driven easily by foot like fabric sewing machine. The cost to fabricate this machine is very compared to Automatic Electrical hank reeling machine. To fabricate this machine it costs around 530\$.

Table 2: Machine Description

S/N	Description	Description
1	Type of machine	Manual hank reeling machine
2	Number of hank produced per cycle	12
3	Working condition	Manual
4	Required Number of operator	Single

5	Spinning method	Winding
6	Material input	Cone or cop packed yarn
7	Material output	Hank yarn
8	Maintenance system used	Oiling and cleaning
9	Swift circumference	1.2meter
10	Length of machine	1.8 meter
11	Width of machine	1.1meter
12	Height of machine	1meter

Fabricated Manual Hank reeling Machine

As indicated in Figure 5, the fabricated manual hank reeling winds 12 hanks per reeling cycle. The produced hank yarn is distributed uniformly throughout the width of hank.



Figure 4: Fabricated manual hank reeling machine (Photo shoot by Author)

CONCLUSION

In Ethiopia Textile sector plays a very important role in the Economic growth of the Country. Different Local and foreign are investing their capital in the sector. In the country there are a large number of Small scale enterprises working in producing woven and knitted related fabrics.

Most of the enterprises use a hank yarn to produce a woven fabric. To convert Cone yarn to hank yarn, they use hand driven manual single hank reeling machine. This machine is tedious and less productive. The aim to design manual foot driven hank reeling winding machine is that to reduce the time for the reeling of hank. The job of reeling single hank is very tiresome. Also the time required for the reeling hank varies largely from worker to worker, thus making process is time unpredictable. This work lead to develop easily controlled manual hank reeling machine. This will make hank reeling process convenient for woven fabric production. The author planned to fabricate the hank reeling machine to distribute for small scale woven fabric producers in the area.

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REFERENCES

- [1] Marie C. The Ultimate A to Z Companion to 1,001 Needle craft Terms: Applique, Crochet, Embroidery, Knitting, Quilting, Sewing and More. St. Martin's. December 2007; p. 143. ISBN 978-0-312-37777-9.
- [2] Ratigan, Dorothy T.; Durant, Judith. Knitting know-how (1st ed.). Cincinnati, Ohio: Krause Publications 2012; p. 11. ISBN 9781440218194. OCLC 748334224.
- [3] K. P. Chellamani & D. Chattopadhyay. "Yarn quality improvement with an air jet attachment in cone winding", Indian journal of fiber & textile research vol.25 December 2000, PP.289-294
- [4] V. B. Bhandari; Tata McGraw-Hill. Design of Machine Elements; Edition II 2007.
- [3] Kalaikathir A. Design Data Book", PSG College of Technology; Edition III May 2013.
- [5] Henze, Martha. Tablet-Woven Curtains from Ethiopia: New Light on a Puzzling Group of Textiles. The Textile Museum Journal 38/39 (1999/2000): 85-100.
- [6] Itagaki, Jumpei. Gender-Based Textile-Weaving Techniques of the Amhara in Northern Ethiopia."In Gender-Based Knowledge and Techniques in Africa, edited by Morie Kaneko. Kyoto: Center for African Area Studies, Kyoto University, 2013.
- [7] Gervers, Michael. Cotton and Cotton Weaving in Meroitic Nubia and Medieval Ethiopia". Textile History 21 (1, 1990): 13-30.