An Automatic Machine for Decorative Stitching of Cricket Balls

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ABSTRACT

The cricket balls are generally manufactured by manual process for providing decorative stitching which is used to grip the ball for imparting desired bowling action. Conventionally two hemispherical cups are pre- punched circumferentially in two rows and then stitched with curved needle, which passes at about an angle of 15 degree through pre-punched holes. This manual operation actually takes stitching time of around 30 minutes for one hemispherical cup. As the quality of stitching mainly depends upon the skill of the operator, it is very difficult to get consistent quality of stitching and it varies from individual to individual. This paper presents an automatic machine for decorative stitching of cricket balls, which provides simultaneous decorative stitching of two parallel rows as per international standard on each hemispherical leather cup before they are put together and stitched for providing the assembled ball.

Key words: *Cricket ball, Decorative stitching, Automatic, Machine*

1. Introduction

Conventionally, cricket balls are manufactured completely by manual stitching process. For providing decorative stitching, the two hemispherical cups are punched on circumference in two rows and stitches are provided manually with a special curved needle. This manual operation usually takes stitching time of around 30 minutes for one hemispherical cup. The stitching quality mainly depends on operator's skill. International standards are laid down to specify the spacing of the rows of stitches and the total number of stitches on the circumference of each row. Though a skilled human hand may be suitable for a near perfect stitching operation, it is not ideal for performing continuous monotonous operation. Information from the Internet search (www.lexicon.netlplatypus/ process.html), shows that a machine being used for Kookaburra balls in Australia for double row of decorative stitching however, the details of the machine are closely guarded secret.

This paper describes a machine, developed by CMERI, which will be useful to provide two rows of decorative stitching simultaneously on each hemispherical cup of a cricket ball prior to the ball being stitched together. Figure 4 depicts the type of stitches to be given on a complete cricket ball, out of these trhe machine in consideration facilitate decoratige stitching only on the cricket ball. This decorative stitching does not serve any structural prupose, but influences the way the ball is bowled. This machine is provided with reprogramming ability that can perform different tasks according to desired output i.e. different number of stitches on periphery of the ball. Automation with sensor capability greatly enhances the perfectness of operation with increasing flexibility.

The innovatige part of this work is making use of a standard chain-stitching mahine and modifying appropriately both mechanically and providing suitable electronics. This machine then is able to provide positioning accuracy in stitching along the periphery of a hemispherical leather cup maintaining a fixed gap between individual stitches. The total number of stitches along the periphery can be varied through keyboard entry. This work has been patented [1] In India and abroad in mostly cricket playing countries.

2. Description of the Developed Machine

Decorative stitching specially on cricket ball surface (refer figure-1) is guided by the standard (IS:

10800: 1983). In order to maintain the specific standard, it is essential to have a two needle sewing system. The existing two-needle system cannot be used to provide the specified decorative stitching on cricket balls for the following reasons:

1. Distance between needles of existing two-needle system is much more than what is required for decorative stitching.
2. Two needles cannot be held closely apart with the existing two needle holding system.
3. Proper needle looper interaction is not possible within extremely narrow space of the order of less than 1mm. between the two needles with the existing two-needle system.

The new system to be implemented on the existing system requires few modifications. Some modifications for implementation of the proposed automatic stitching machine are :

1. A standard stitching-head suitably modified for two-needle simultaneous stitching operation.
2. A stepper motor driven indexing head for rotating the ball.
3. A hemispherical mandrel for holding a hemispherical leather segment.
4. A drive system to facilitate reciprocating up-and-down movement of the needle and circular indexing movement of the leather segment at the speed suitable for proper stitching

An optical sensor mounted on the stitching head to achieve synchronised operation of the needle with the indexing movement of the leather segment.

The developed cricket ball decorative stitching machine, as shown in figure- 2, consists of two major subassemblies namely, stitching assembly with dual needle looper arrangement and indexer assembly. The stitching assembly consists of a pair of needles, needle holders, a pair of loopers and looper holders. The needles are closely spaced in a parallel distance of 3rnrn but offset circumferentially to enable the loopers, fixed in looper holders make coordinated oscillating movements with respect to the reciprocating movement of the needles of diameter 2 rnrn. Two bobbins fixed on the stitching head supply thread required for the stitching operation. A hemispherical mandrel is attached to the machine in such a way that it holds the hemispherical leather segment firmly against the hemispherical cup fixed to the indexer shaft. The hemispherical mandrel is freely mounted on a ball bearing support, which helps the indexing movements of the leather segment. The gear box is suitably designed along with a pair of timer pulleys to provide suitable speed to the needles for stitching. The clutch motor drives the gearbox through V belt. The indexer assembly consisting of a worm and worm wheel is used to hold and provide indexing motions to the hemispherical leather segment with respect to the reciprocating needle movements. A stepper motor has been used to drive the indexer shaft. Locking mechanism has been used as locking device for the indexer assembly while stitching. An electronic control unit has been used to maintain a fixed number of stitches over the full circumference. An encoder mounted on the rear end of the indexer shaft is used to obtain accurate indexing and thereby uniformity in the spacing of the chain stitches. An optical sensor fixed on the upper part of the body of the stitching machine is used to sense the position of the needle with respect to the leather segment. As soon as the needle moves out of the leather segment, stepper motor starts indexing movement and the controller starts counting of the pulses from the encoder. The accuracyof indexing depends on the accuracy of the encoder. The display and switch units are used for interaction with the end-user. The display provides on line information to the user about the number of stitches along the periphery.

The software was developed using assembly language. The flow diagram of the software to control the system and controller block diagram is shown in figure-3 and figure-4. In this arrangement, 8751 micro - controller chip with associated peripherals is used as the master controller to eliminate manual operation. It is a low power, high performance HMOS 8-bit micro-controller with 4KB programmable and erasable memory and 128 bytes of RAM with I/O ports. This micro -controller is interfaced with the optical interrupter type sensor, Encoder of resolution 5000-PPR and stepper motor with proper signal processing circuits:

3. Detail Experimentation and Discussion

The machine is new as there is no such machine existing which is useful for providing decorative stitching on hemispherical leather cup of a cricket ball. Therefore, the machine of the present invention is novel. Specifically the novelty resides in the specific manner in which it is constructed to provide the desired output of decorative stitching which is an essential part during the process of manufacture of cricket balls. The machine with two-needle looper system was used to produce two parallel decorative stitches simultaneously on a hemispherical leather segment using wax coated cotton thread of 20 kg breaking strength. These leather segments were supplied by one of the industries and are actually used for producing the cricket balls as per international/national standards. The specifications of the decorative stitches produced by the machine in context were as follows:

Total number of stitches in a single row over the circumference	:	65
Distance between two rows of decorative stitches	:	3 mm
Diameter of the needle	:	2 mm
Diameter of the thread	:	1 mm
Thickness of the leather	:	3.5 mm -4 mm
Diameter of the hemispherical leather segment	:	72 mm

The system was fabricated and trials conducted to test the effectiveness of the scheme. It was calculated that for sixty-five stitches along the periphery of a semicircular leather segment of diameter 72mrn, the gap between individual stitches is approximately 3.48 mrn, with an accuracy of 45 micron (approx.). The total system was tested successfully with the above parameters. The time taken for sixty-five stitches along periphery was approximately 100 seconds, entailing approximately forty up/down movements per minute of the needle (40 stitches per minute).

The main advantages of the novel machine of the present inventions are :

1. The time taken for sixty-five stitches along periphery was approximately 100 seconds and takes about 5 minutes to complete decorative stitching cycle on one cup whereas It takes about one hour (two rows) on one hemispherical leather segment by the manual process.
2. The quality of stitching is in conformity with standards laid down.
3. The quality of stitching does not depend on the skill of the operator .
4. The cost of machine stitching is much lower than that of the manual stitching.
5. There is an increase in productivity.
6. The cost of machine stitching of decorative rows is much lower than that of the manual stitching.

4. Concluding Remarks

Cricket balls are in. very much demand and the balls being exported are hand made until now. This automatic machine will help producing the cricket balls with better quality and more quantity to meet the export demand.

In view of this, this machine will bring the growth in export-oriented trade of the cricket balls with increased production and better quality of the cricket balls with minimum manpower. This will in turn boosts the production of the cricket balls for in-house anti export use.

Higher rate of production and better quality of cricket balls 'produced by this machine will indirectly have positive impact on quality of life of the workers involved in this industry and this machine will remove drudgery & monotony of manual stitching.

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6. References

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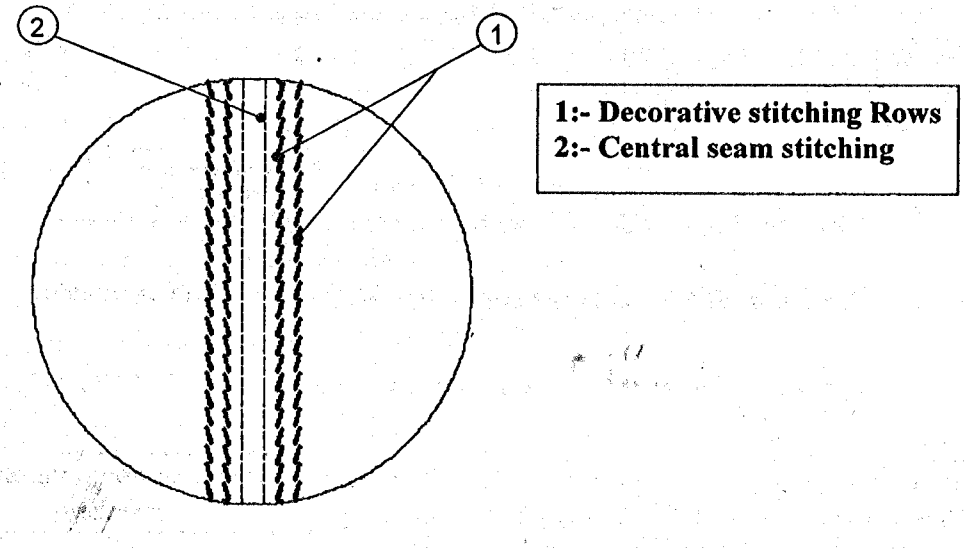

Figure 1 : Type of stitching on Cricket balls

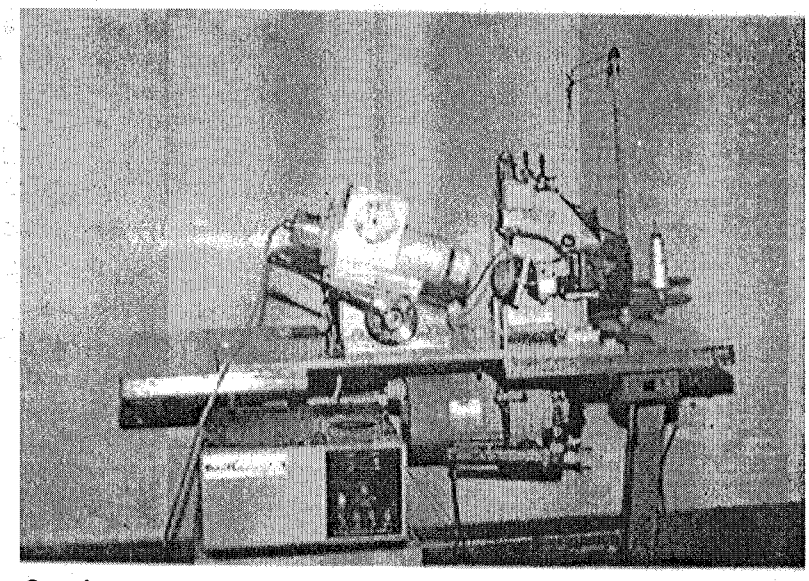

Figure 2 : Automatic machine for decorative stitching of cricket balls

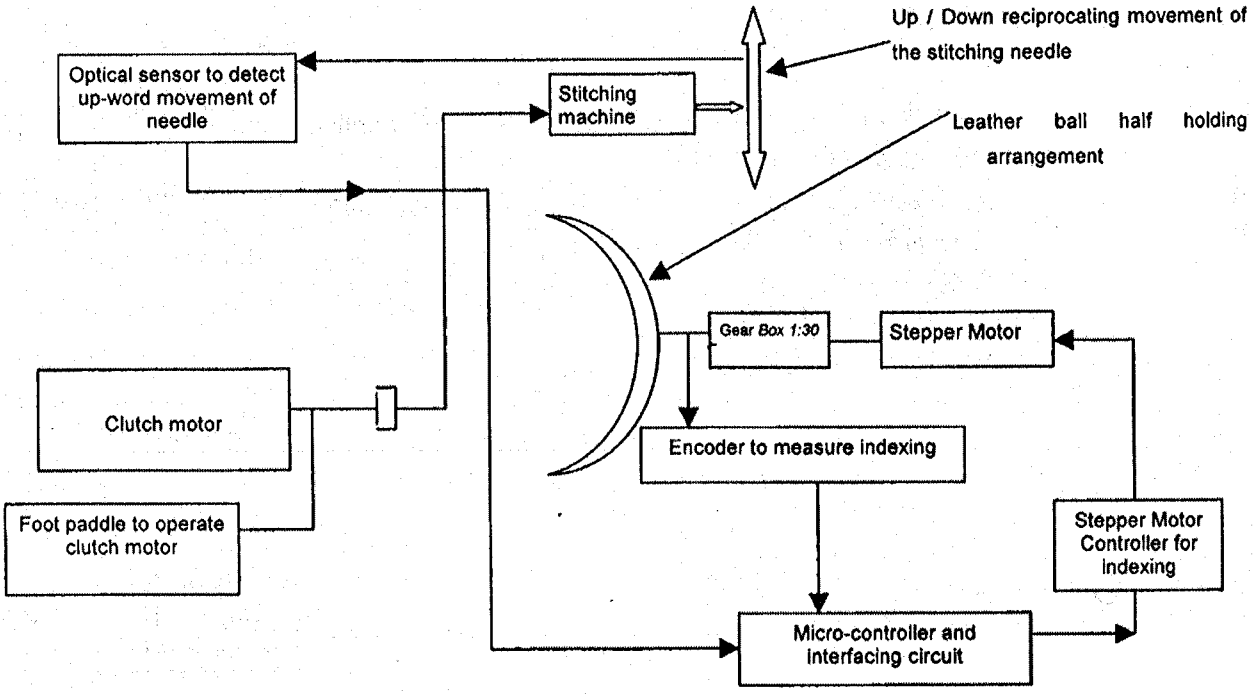

Figure-3: Control logic block diagram of Decorative stitching machine

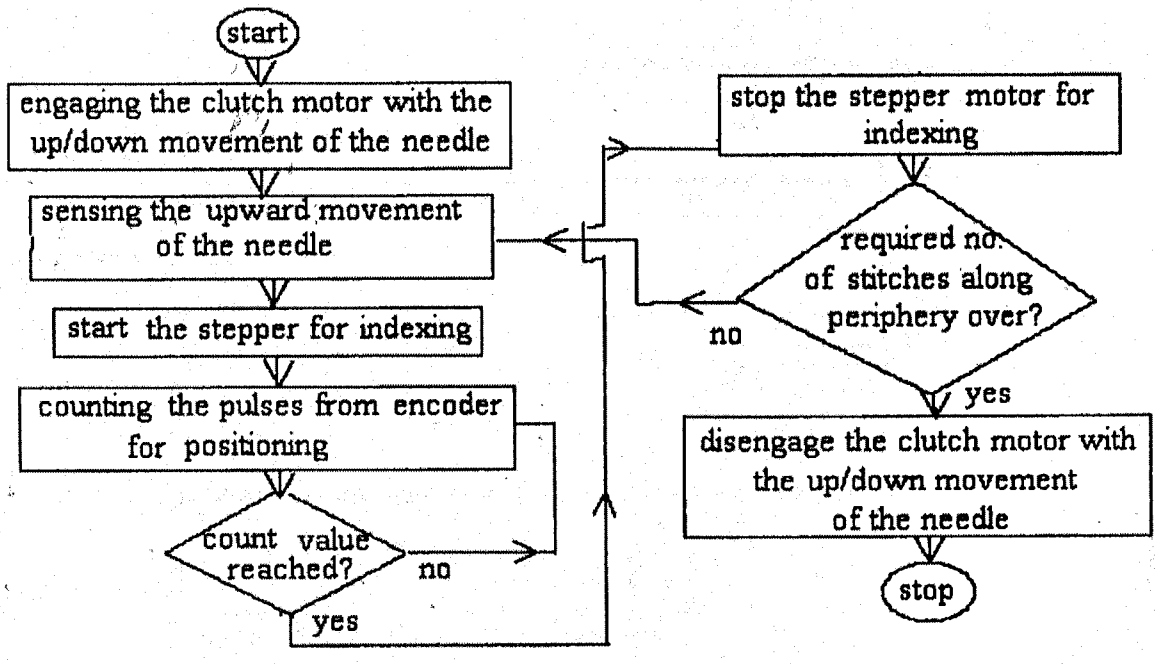

Figure-4: Flow chart of control software