RETROFITTING OF MICROCONTROLLER BASED CLIMAX DOBBY SHEDDING MECHANISM ON CONVENTIONAL LOOMS

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **"RETROFITTING OF MICROCONTROLLER BASED CLIMAX DOBBY SHEDDING MECHANISM ON CONVENTIONAL LOOMS"** is the bonafide work of **S.PRAVEEN, M.DHAMODHARAN, S.PRABAKARAN, R.M.SARAVANA KUMAR,** Who carried out the project work under my supervision.

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ABSTRACT

In recent years imported machineries spread over our country and everywhere we can find new machineries with electronic control and electronic devices. But the value of such machines will not be affordable by many of the cottage industries. Though the technology is being very useful and attractive, all the entrepreneurs cannot utilize such technology unless they are introduced in a simple and economic way. Dobby is a simple machine whereas it is a main feature in the loom to perform a beautiful fabric. But from the beginning of the industry no development was done in the India for better performance. This means, imported machines are only having such facilities to give high production, with higher efficiency, better quality with low man power. But our Indian machines are being in the same style of old technology, giving low efficiency, low production, medium quality with consuming more man power etc.

If we convert the machine with new technology automatically the quality of the product will be improved equivalent to that of imported looms. Production will be automatically improved due to less stoppages and man power also will be reduced to some extent to minimize the cost of product. This can be achieved by retrofitting of micro controlled climax dobby using magnetic bar and lifting lever principle which can run at 200-240 rpm. This will reduce the cost of manufacturing. In this model pattern correction is easy to rectify so that the pegs and lags are eliminated, which will be controlled electronically the movement of heald frames.

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LIST OF ABBREVIATIONS

1	Rpm	Revolution Per Minute
2	CPU	Central Processing Unit
3	RAM	Random Access Memory
4	ROM	Read Only Memory
5	i/o	Input and output
6	PLC	Programmable Logic Control
7	LCD	Liquid Crystal Display
8	USB	Universal Serial Bus
9	VAT	Value Added Tax

CHAPTER 1

INTRODUCTION

The production of the patterns on tappet shedding is limited to 8 heald frames. Dobby shedding is another mechanism for pattern requirement up to 24 shafts or heald frames. In this case the the healds are all operated by jacks and levers and occupy less space advantage is the order of lifting and lowering the heald frames, as per the lifting plan, which is controlled by a lifting chain that gives a good scope for weaving designs repeating a large number of picks and ends. It is very easy to change the pattern chain whenever a new design is required, to be woven; provided of course the number of heald frames and order of drawing the ends remain the same.

1.1 TYPES OF DOBBY

There are many types of dobbies available, both for general and special purposes. As in the case of Tappet shedding, dobbies are also classified as negative and positive in action. They are further subdivided into (a) single lift, single jack (b) double lift, double jack.

1.2 SINGLE LIFT OR DOUBLE LIFT

Single lift dobbies are characterized by the following facts for (a) effecting shaft movement takes place by using the same machine element for every pick. Consequently (b) this element must be ready for operation for any required pick in the selected pattern.

Double lift dobby is provided with two elements or systems having opposite working cycles. One element is responsible for the even numbered picks and the odd numbered picks. Alternatively they can cooperate to ensure that the shafts are lifted in the manner required. There is available time taken by two crank revolutions of the loom for the selection of the healds. This permits a high dobby speed to be obtained.

Single lift and double lift dobbies may be of open or closed shed machines.

1.3 POSITIVE AND NEGATIVE DOBBY

A positive dobby raises and lowers the heald frame without the use of reversing motion. They are used for weaving heavy cotton, woolen and worsted fabrics and on high speed looms.

A negative dobby can only control the heald frame in one direction either raising or lowering the heald frame. Most of the dobbies are mounted on the top of the loom and therefore they lift the frame. The reversing is carried out by springs, elastics or a special reversing motion.

1.4 OPEN AND CLOSED SHED

Negative dobbies may be subdivided according to type of the shed formed viz. open and closed. With the closed shedding, all warp threads are leveled after each pick. To change the position of the shafts in closed shed dobby, the heald shafts are first accelerated and then slowed down until they stop; they are then accelerated again and once more slowed down. This double cycle of acceleration and deceleration has a adverse effect on the dobby itself and the service life of the heald shafts. On the other hand it may be successfully adopted in wool weaving where all warp threads are at approximately the same tension during the beat up. However in practice, it has been found that about 5% of all articles are woven by closed shed method, whereas 95% woven goods are produced by open shed method because of the following reasons

a) The desire of high speeds

b) Open shed method showed a reduction in warp thread breakage by about 20%.This is attributable on one hand to a reduction of the continuous friction of the warp threads in the reed and on the other hand to the smoother shaft movement of open shed weaving.

1.5 DOBBY SETTING:

1) The sweep on the bottom shaft connecting the driving rod to the T-lever should be at dead level when the crank is in between top and bottom centers. This position can be changed depending upon the type of the fabric being woven.
2) With the sweep in the horizontal position the T-lever of the dobby should also be horizontal.
3) The driving rod connecting the sweep to the T-lever should be straight.
4) When the T-lever is horizontal the two knives are equidistant from the ends of their respective slots in the T-lever. At this position they are about half way along their traverse.
5) The draw bolts are fixed in the slots provided in the T-lever. They can be raised or lowered to increase or decrease the traverse of the knives.
6) The driving rod is coupled to the sweep on the bottom shaft, and a slot is provided in the sweep for increasing or decreasing the traverse of the knives; which in turn affects the depth of the warp shed.
7) When the draw knife goes in, to the limit of the slot in the frame, there should be a clearance of about 10mm between the knife and the hook. When the knife moves out again to engage the hooks, there will be sufficient dwell period for the heald frames that are lowered. However this should not be mistaken as the real dwell period discussed under the

tappet shedding. It is not possible to provide a real dwell period because of the type of drive given to the knives. The modern dobby shedding with cam driven arrangement is therefore an improvement over the connecting arm drive, when such a dwell period is possible.

8) The amount of movement given to the cylinder is important in order to bring the lag exactly under the feelers. It is, therefore important to check the throw of the pawl whenever the dobby sweep is altered. When the bottom knife is in its extreme outward position, there should be about 8mm clearance between the tip of the pawl lever and the engaging teeth of the ratchet wheel.

9) The pegs of the pattern lattice should be of the same height and should be firmly held in the hole. A broken or missing peg will result in a wrong design. Steel pegs are proved better than wooden pegs.

10) The setting of the cylinder is also important. If it is too close to the feelers then turning might be difficult; on the other hand, if it is too much away, the feelers may not be raised sufficiently.

1.6 CHARACTERISTICS OF A DOUBLE-LIFT DOBBY

1. A double-lift dobby forms an open shed.
2. The weft is beaten up in a crossed shed.
3. Each heald frame is controlled independently by a pair of hooks, one at the top and the other at the bottom.
4. Drive from the bottom shaft of the loom activates the dobby.

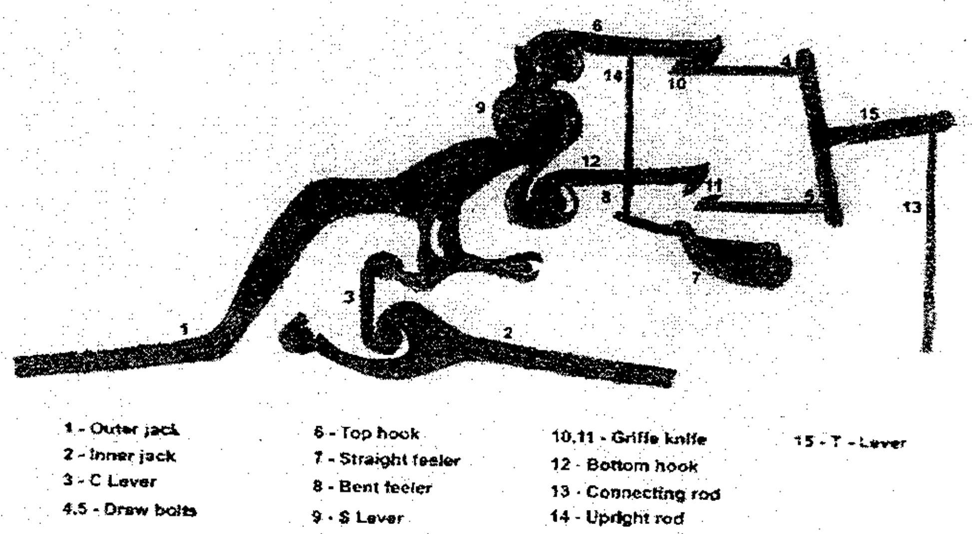
1.7 ADVANTAGES OF A DOUBLE-LIFT DOBBY

1. In a double-lift dobby all the moving parts are involved in a series of movements during which two successive picks are inserted. Hence the time available for selecting the given hook is twice that available in a single-lift system.
2. A shed is produced in less time than in a single-lift dobby and with the least amount of strain on the warp.
3. There is less wear and tear of the working parts.
4. The rising and falling healds work in better equilibrium in a double-lift dobby system.
5. A loom with a double-lift dobby works more steadily than one with a single-lift dobby.
6. The weft is beaten up in a crossed shed and so a greater number of picks can be inserted per unit length.

CHAPTER 2

LITERATURE REVIEW

2.1 DOUBLE LIFT DOUBLE JACK [1]



The climax double jack dobby combines two jacks by means of a single short link known as 'c' link. As shown in fig the outer jack '1' fulcrumed at 'O1' is controlled directly by the baulk lever 'B' as with the single jack dobby. The short link 'L' couples the outer jack '1' to the inner jack '2' fulcrumed at 'O2' and both the jacks are lifted together without the aid of either teeth or streamers.

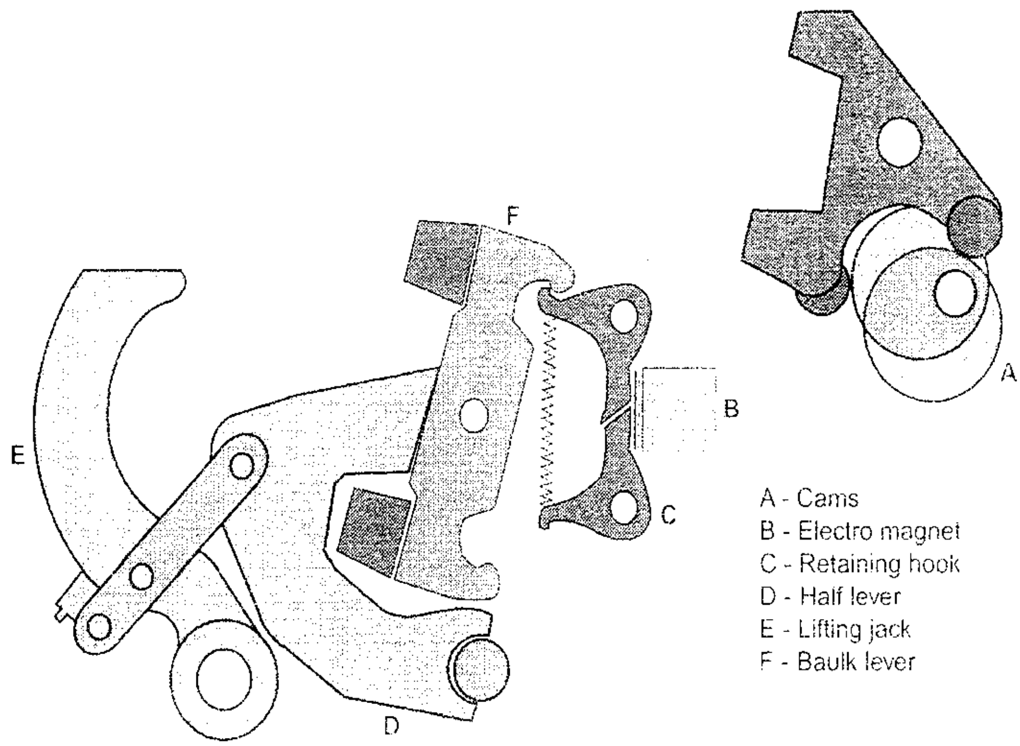
When the loom is started the 'T' lever swings, reciprocating the knives through draw bolts, and the knives complete on reciprocation every two picks because they are driven from the bottom shaft. Simultaneously with the movement of the knives, the pattern cylinder with the lags move one eighth of a turn bringing a lag with pegs and blank-directly beneath the feelers. A peg in the lag will lower the corresponding hook which will engage with the draw knife. For example, if the straight edge feeler is lowered by lifting it up at the back by a peg on the lag, the top draw hook '6' is also lowered to engage with the top knife '10'. Similarly if the curve edge feeler is lowered the bottom draw hook '12' is lowered to engage with the bottom knife '11'. Then the draw hook which has been dropped down to engage with the knife will be drawn forward along with its baulk lever by the knife during the sweep of the T-lever. If the top part of the baulk lever is pulled forward the bottom part rests solidly against the stop bar 'K2'. Conversely if the bottom part of the same lever is pulled forward the top part rests against the stop bar 'K1'. Thus the stop bars K1 K2 act as a fulcrum for the forward moving baulk levers, which in turn lift the jack lever and the heald frame. A blank in the lag will keep the respective draw hook raised above the knife and so the heald frame is not lifted.

If a heald frame is to remain up for two or more consecutive picks, both the top and bottom draw hooks 6 & 12 belonging to that heald are lowered through the action of pegs provided on the two rows of holes corresponding to that particular heald. However, one of the draw hooks is drawn forward by its knife, and the fulcrum for the same baulk lever is automatically changed, either from 'K1' to 'K2' or from 'K2' to 'K1'.

For example, if the top knife pulls the baulk lever forward to lift the jack lever and for the next pick if the same heald frame has to remain up, the bottom knife pulls the same baulk lever again forward, transferring the work of lifting the heald frame from the top knife moving in, to the bottom knife moving out.

The pattern cylinder is driven by a pawl and a ratchet wheel. The pawl A is connected to the lower end of the draw bar lever and it engages with a ratchet wheel B on the pattern cylinder C. During the forward movement of the lower draw knife, that is, every second pick, the pawl A pushes the ratchet wheel B one tooth and the cylinder C moves one eighth of the a turn. Then the cylinder is steadied by a spring acting finger N fulcrumed at D, resting on a flat sided star wheel P. This star wheel is also mounted on the pattern cylinder shaft on the opposite end of the ratchet wheel.

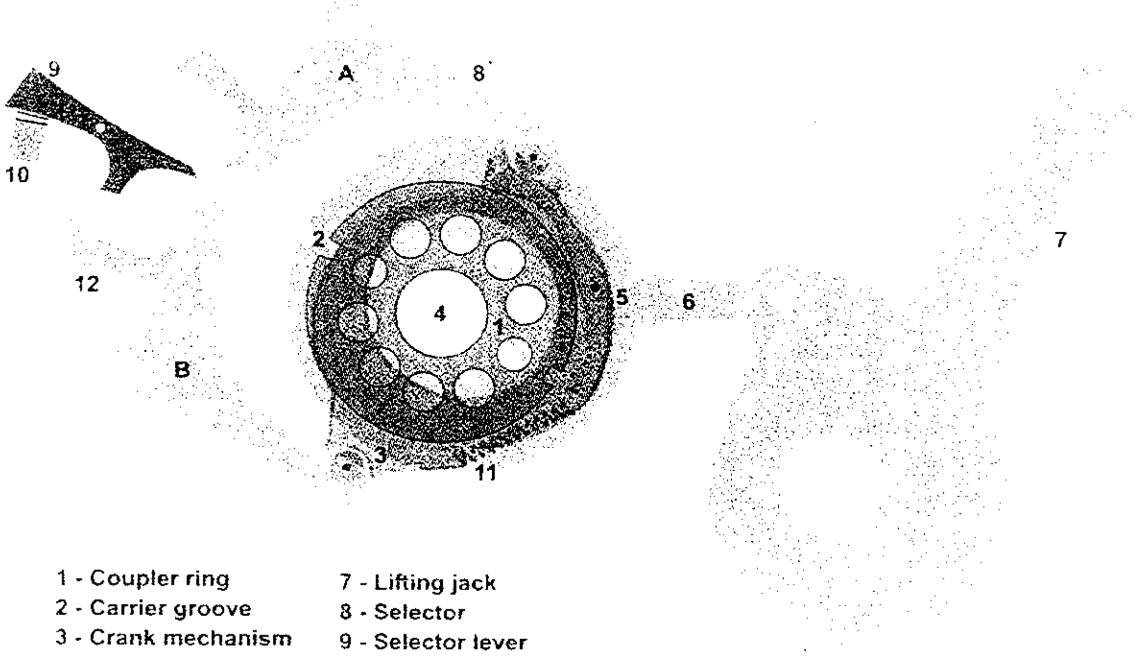
2.2 ELECTRONIC NEGATIVE DOBBY (STAUBLI) [2]



This is a negative cam dobby in which electronic devices and a special programme select the heald frame. The principle of this dobby is illustrated in fig . It is similar in construction to a negative cam dobby. This lifting jacks are connected to a baulk lever by means of a small link and a half-lever. The baulk lever is activated to move to and fro by push bars which are driven directly by complementary cams. The retaining hook selects the hinged hooks of the baulk lever by an electromagnet that is either charged or not, depending upon the selection programme. With minimum pivots, smooth working movement and high accuracy in selection this concept enables this machine to run at high speed without vibration.

In some models, the selection is made by mechanical principle, where lags and pegs are used instead of an electromagnet for selecting the retaining hooks.

2.3 ELECTRONIC DOBBY –THE POSITIVE ROTARY PRINCIPLE[2]



1 - Coupler ring
2 - Carrier groove
3 - Crank mechanism
4 - Cam shaft
5 - Catch
6 - Cam disc
7 - Lifting jack
8 - Selector
9 - Selector lever
10 - Electro magnet
11 - Spring
12 - Guide

This high performance electronic rotary dobby operates according to the rotary principle. The dobby consists essentially of two units, a cam unit and an electromagnetic selection control unit.

The revolving parts of the cam unit are all mounted on the camshaft which is driven by the main shaft of the loom. The cam unit consists of a coupler ring keyed to the camshaft and having two-carrier grooves on opposite sides. Adjacent to the coupler ring is a crank mechanism, which encloses a cam with ball bearings and mounted loosely on the camshaft. The catch fulcrumed at the outside of the cam unit connects it with the coupler ring by its projection always being engaged with one of the carrier grooves by means of a spring. The cam in the crank mechanism projects outside and a cam disc is loosely mounted on the projection. The cam disc activates the lifting jack, depending on the position occupied by the cam inside the cam disc. There are thus three discs arranged in three layers side by side on the camshaft. Among these three plates only the coupler ring gets the direct drive from the camshaft while the rotation of the other two discs depends upon the engagement of the catch with any one of the carrier grooves. If the catch is engaged with a groove, the cam unit and the cam disc will rotate along with the coupler ring. The 180 degree rotation of the cam causes a lifting or lowering of the heald frames. The electromagnetic selection unit consists of two selectors which are activated by the selector lever fulcrumed at the middle. The position of the selector lever is altered by the attraction of the electromagnet. A combined oscillatory movement is given to both the selector lever and the electromagnet by the matched cams. When the selector lever moves down along with the electromagnet, which if it is in a charged state, it pushes the selector. Alternatively, it pushes the selector if it is not charged. As a result the catch is released from the coupler ring or engages with it depending on which selector is pushed by the selector lever. All the elements discussed so far are involved in the lifting or lowering of one heald frame.

According to Guo yeuyang & Chen Ruiqi [3], A new type of micro processor controlled positive dobby article concluded that a microprocessor controlled positive dobby has been developed which was converted from Staubli 2521, a negative mechanical control dobby. It consists of solenoid valves and other several mechanisms to accelerate the response of selection mechanism. It is a microprocessor controlled dobby, which requires more work to feed weave data by the workers.

2.4 DEFECTS IN DOBBY WEAVING [2]

A defect that is common to all dobby systems is "jack missing". This is the failure of the heald shaft as and when required. When this happens, the weft may be seen as a float yarn running across the warp ends and give rise to a fabric defect called 'stitching'. This is a major but very common defect in dobby shedding. In this event, the ends and picks are not interlaced according to the desired order of the pattern and hence a defective cloth is produced. The 'stitching' defect may sometimes cause the shuttle to fly out of the shed or cause breakage of warp threads and other associated defects. There are various causes of jack missing.

1. A bent peg in a lag may not be able to touch or move the feeler and bring about dropping of the corresponding hook on its knife.

2. Wooden pegs may get bruised with frequent use and may not serve their purpose efficiently.

3. Improper spacing of the lags may cause a wrongly spaced lag to ride on the cylinder and prevent it from passing freely under the feelers. In this

event, the pegged face of the lag may itself contact more feelers than required and cause the lifting of all major part of the peg lever.

4. The pattern barrel may tend to move in a lateral direction and move pegs away from their intended location.

5. The needle operating the hook may get stuck. This could be avoided by using good quality oil and keeping the parts free from grease.

6. A stout or broken peg may also be responsible for a stitching defect, since it cannot lift the hook high enough to bring in contact with the knife.

7. In the middle of the stroke, the hook may engage the knife incompletely and slip off.

When the floats occur, the problem parts that cause them have to be identified. This is done by locating the ends that are affected and identifying the healds that are involved. The knives and hooks that actuate these healds are then identified and adjusted to work properly to rectify the defect.

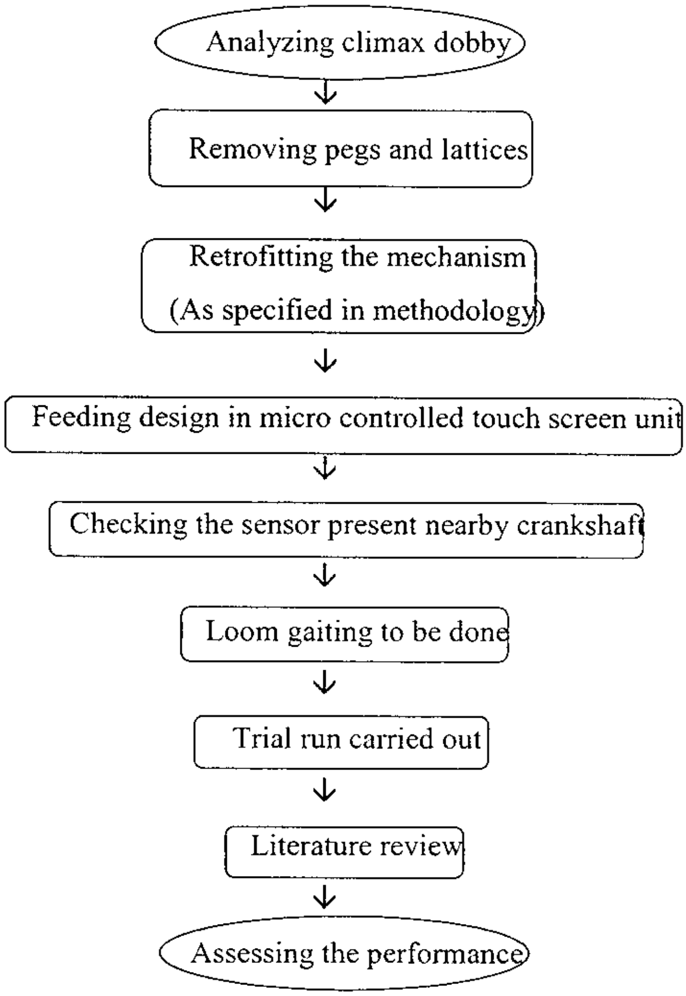
The electronic climax dobby using micro controlled application overcomes the above disadvantages.

CHAPTER 3
METHODOLOGY

The methodology for retrofitting of micro controlled climax dobby mechanism on power loom includes the following,

- Introducing electronic devices to plan the design and feed the design
- Removing the pegs and lags arrangements.
- The magnet bar is arranged according to the number of levers to be worked.
- To fix lifting device mechanically to move the magnetic bar up and down.
- To connect the magnet bar follower with peg plates of dobby by twine cord.
- Fix a sensor with crank shaft for operation.
- Feeding the design of peg plan through touch screen in micro controller.
- The loom gaiting to be done and the machine are ready for trial run. Thus the above mentioned objectives would be met with this type of mechanism.

3.1 WORK PLAN



3.2 PRINCIPLES

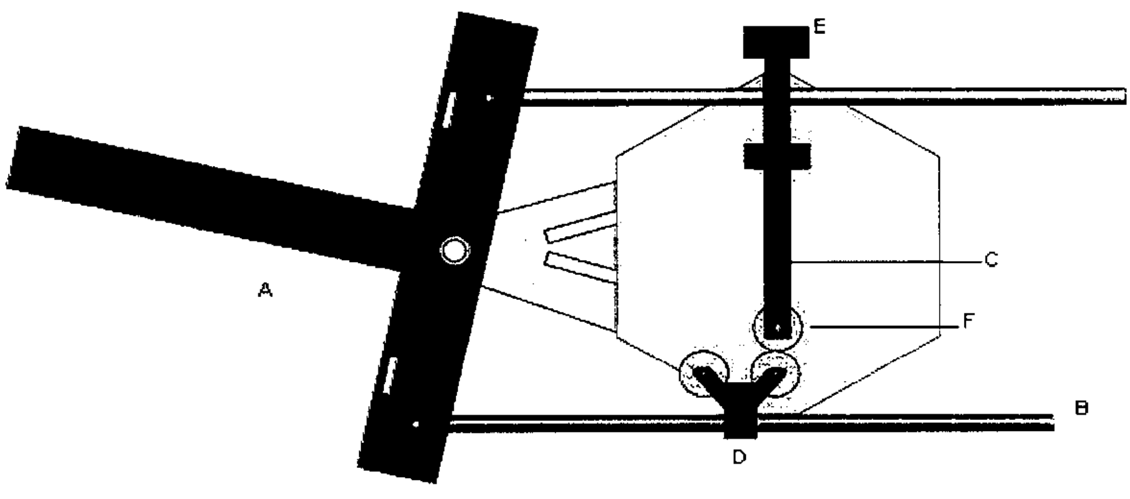
In this project, the electronic climax dobby will work with electromagnetic bar and the lever principle which is controlled by micro controlled circuit board with touch screen unit. And the specially made lifting arrangement is used to lift the hooks for raising and lowering of heald frames. A sensor which is fixed near by the crankshaft, at every revolution of shaft the power transmitted to the magnet and according to this selection the machine will function.

3.3 OBJECTIVES

The main objective of our electronic dobby is as follows:

- To reduce the cost of manufacturing.
- To minimize the parts compare to other electronic dobbies.
- To reduce the floor space and labor intensive.
- To improve the weaving efficiency and maximum of 3000 picks/repeat.
- To make it versatile and easy to maintain.
- To make it more advantages for the dobby loom manufacturer that gives more scope for improving their production with increase in speed of the loom.

The retrofitting mechanism is shown in the figure



A- T lever
B- Bottom knife
C-Straight lever
D-Pair of rollers
E-Magnetic bar
F-Bearing

3.4 CONSTRUCTION

The 'T' lever is connected with the bottom shaft by means connecting rod. The bottom knife and top knife is connected with T- lever. By this arrangement, the reciprocating movement is given to the bottom knife and top knife.

In this mechanism, the hole is made on the bottom knife's centre and lifting lever arrangement is fixed on the bottom knife. It acts as a fulcrum and it converts reciprocating into linear motion thus both knife move up and down by this mechanism. The selecting mechanisms are fixed on the top of the lifting arrangement to raise the follower up and down.

The electromagnetic bar is placed over the top knife. The follower is placed in a separate shaft. It is below the electromagnet. Due to the movement of the selecting mechanism the follower is raised and lowered for every pick. The electromagnet bar is controlled by the micro controller. The design is feeded through a touch screen arrangement fixed on the micro controller.

3.5 WORKING

Due to the motion of the bottom shaft the T lever is reciprocated with the help of vertical rod. This in turn provides to and fro motion to the knife. This motion of the bottom knife provides the up and down movement for the lifting arrangement. The selecting mechanism receives motion from the lifting arrangement in such way that when one roller hits the bearing the magnetic bar moves upward. Thus the follower moves up and down for the each pick.

The electromagnet bar is energized by the micro controller. When the follower moves up, the followers corresponding to the energized electromagnet bar are attracted. Therefore these followers remain up, and the other follower dropped down. The feeler is connected with the follower using a twine card. The upward motion of the follower tends to lift one end of the feeler this then gives downward motion to the other end of the feeler. The corresponding hook would get engaged with knife. The corresponding heald shaft receives up and down motion from to and fro motion of the knife.

3.6 ADVANTAGES OF OUR ELECTRONIC DOBBY

- Pegs missing can be avoided.
- Replacing time of pegs and lags is saved.
- Fabric faults are reduced.
- Maximum of 3000 picks/repeat is possible.
- Pattern correction can be easily rectified.
- Workers can look after more looms (up to 6).
- The speed of the dobby can be increased to 200-240 Rpm instead of having 100-140 Rpm.
- When compared to other electronic dobby this model will be more easy and operator friendly.

CHAPTER 4

MICRO CONTROLLER

Microcontroller is general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip.

1. The CPU core
2. Memory (both ROM and RAM)
3. Some parallel digital i/o

Microcontroller will combine other devices such as

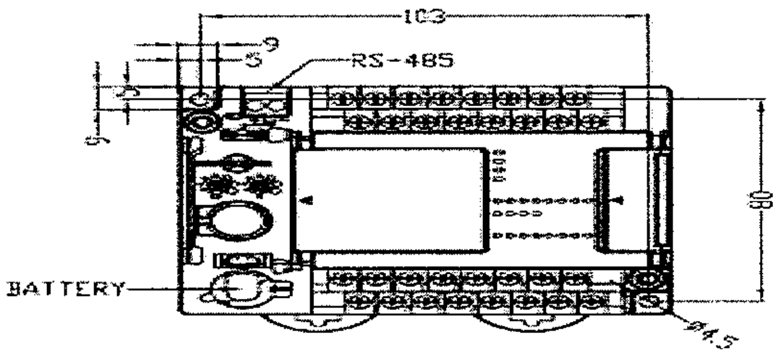
1. A timer module to allow the microcontroller to perform tasks for certain time periods.
2. A serial i/o port to allow data to flow between the controller and other such as PLC or another microcontroller.
3. An ADC to allow the microcontroller to accept analogue input data for processing.

4.1 DVP-EH2 SERIES

4.1.1 FEATURES

EH2 series is well equipped with outstanding operational speed, large programming capacity and built in application and communication instructions, multiple special extension modules and function cards, enabling the efficiency of the MPU to be utilized to its fullness.

4.1.2 SPECIFICATIONS



MPU points: 16 / 20 / 32 / 40 / 48 / 64 / 80

- Max. I/O points: 512
- Program capacity: 16K Steps
- Instruction execution speed: 0.24μS (basic instruction)
- Communication port: Built-in RS-232 and RS-485, compatible with MODBUS ASCII / RTU communication protocol
- Data register: 10,000 words
- File register: 10,000 words
- High-speed pulse output:
  20-point and 32-point models support 2-point 200KHz pulse output (Y0, Y2); 40-point models support A/B phase 200KHz pulse output (Y0, Y1)(Y2, Y3) and 2-point 200KHz pulse output (Y4, Y6).
- Built-in 4 groups of hardware high-speed counters
- Bandwidth refers to the max. counting range of a single counter.

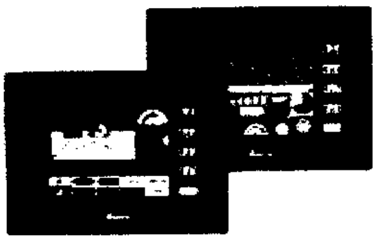
4.1.3 APPLICATIONS

High-speed 3-axis servo welding machine, high-speed cutting machine, bar feeder, distributed monitor system in production line.

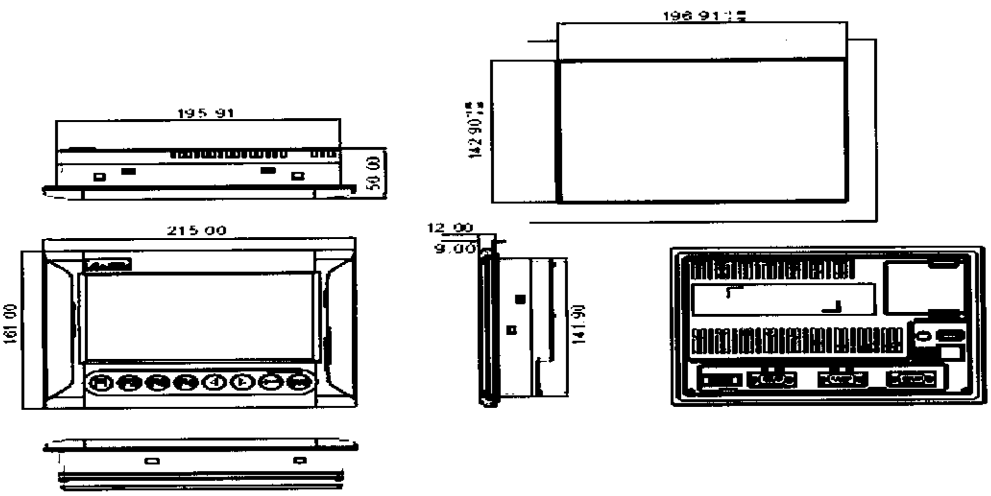
4.2 DOP-AS SERIES

4.2.1 FEATURES

This series is standard simple design model and it can meet the basic user's requirement. Currently, there are models of 3.8", 5.7" display with monochrome or colorful, light and compact features.



4.2.2 SPECIFICATIONS



- 3.5" TFT LCD 65536 colors
- 3.8", 5.7" STN LCD 8 Shades of Blue

- 5.7" STN LCD 256 colors
- ARM9 32-bit CPU
- 320 * 240 pixels
- 4 function keys
- 1M Flash Memory
- 128K bytes SRAM
- Provides USB Host for USB flash drive, printer
- USB 1.1 for high-speed screen data download
- 3 sets of COM ports for multiple communication protocols
- Provides extension slot for extension modules
- Supports max. 8 different languages for multilingual screen editing
- Touch screens comply with IP65 / NEMA4 standards
- CE & UL approved

4.2.3 APPLICATIONS

Major applications include: A wide range of industrial monitoring systems, such as HVAC, Printing Machine, Exposure Machine and Product Line Monitoring Equipment.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 COMPARING WITH STAUBLI ELECTRONIC DOBBY

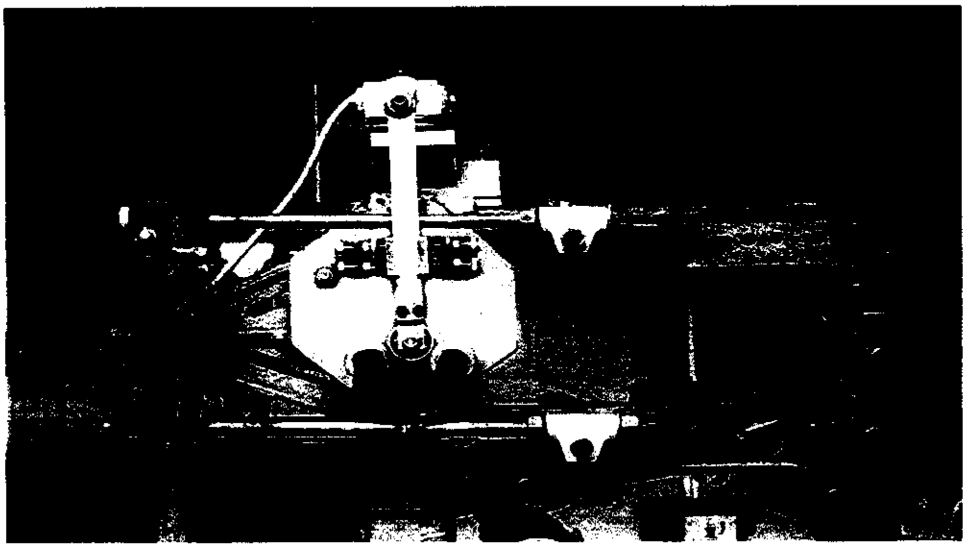
Parameters	**Retrofitted**	**Staubli**
Cost(INR)	39,656	1,20,000
Efficiency (%)	65	85
Speed	220 rpm	450 rpm
Power consumption	Low	High
Maintenance	Cheap	Costlier

5.2 COST OF MATERIALS

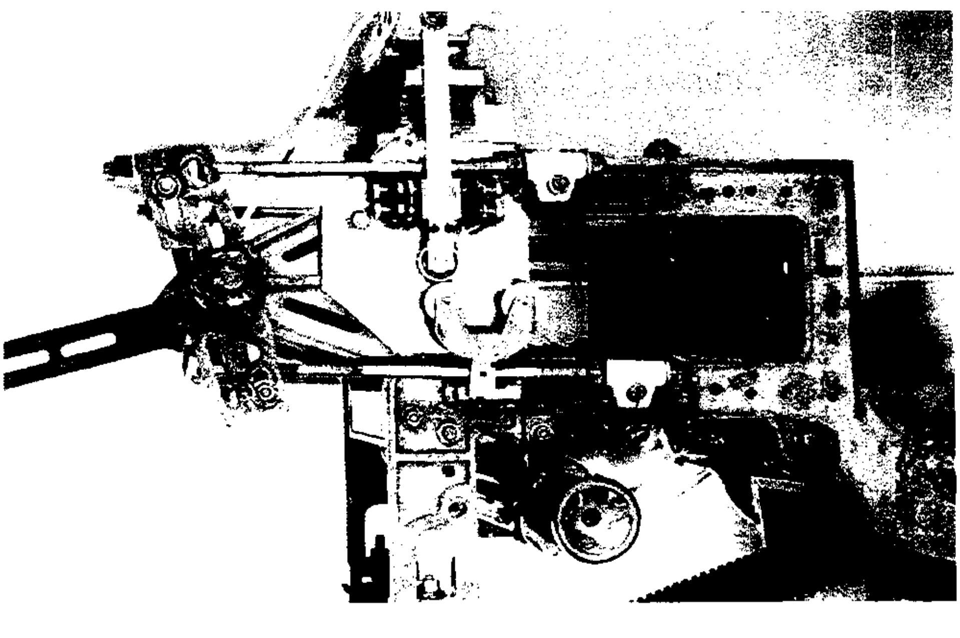
S.no	Description	Quantity	Amount(Rs)
1	'Staubli' type bar magnet(16 jack)	1 no	4000/-
2	'Staubli' type 'T' type auxillary fork	16 no	1000/-
3	Touch screen display unit for dobby design pattern entry and monitor	1 no	15000/-
4	PLC for dobby design control (CPU-microprocessor)	1 no	12000/-
5	Power supply for dobby magnet and PLC & user screen(230v/24v)	1 no	1500/-
6	Cable and accessories	1 set	1250/-
7	Proximity sensor	1 no	250/-
8	Push buttons(fwd & rev control)	1 set	250/-
			35250/-
9	+ VAT taxes @ 12.5%		4406/-
	TOTAL		**39656/-**

CHAPTER 6
PHOTOS

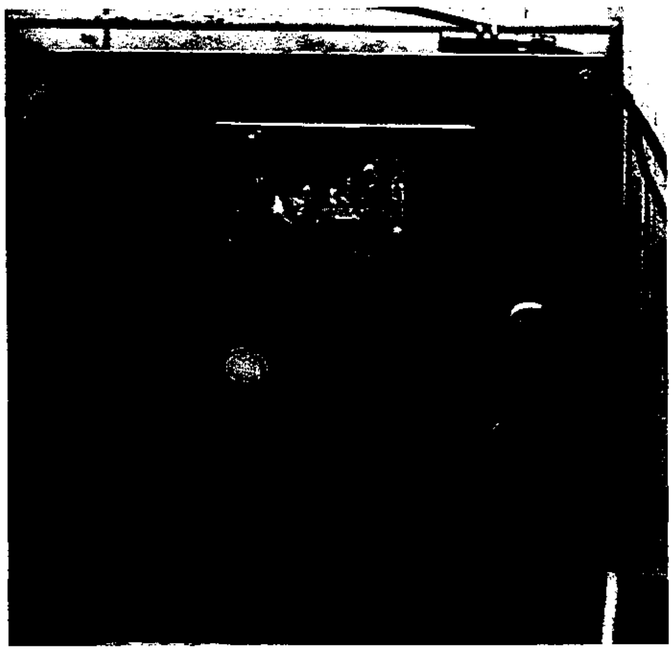
SELECTING MECHANISM (SHED CROSSING VIEW)



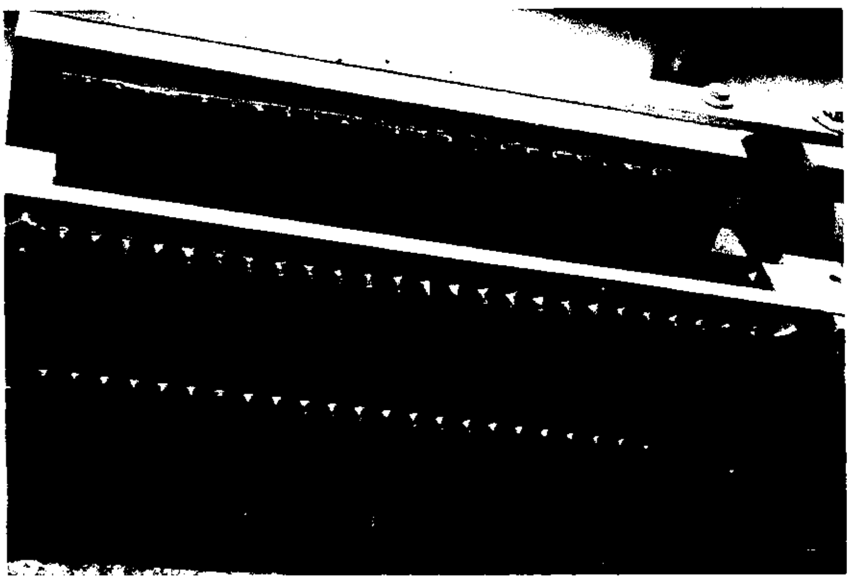
SELECTING MECHANISM (SHED OPENING VIEW)



MICRO CONTROLLER WITH SENSOR



MAGNETIC BAR WITH FOLLOWER STAND



CHAPTER 7
CONCLUSION

Our project is about micro controller based climax dobby mechanism used in conventional looms tested under laboratory conditions and the results are as follows

- The microcontrolled electronic dobby are far superior in performance than the other dobbies.
- Easy operations through programming, high efficiency due to accurate balanced Shed formation.
- Designs can be easily imparted using touch screen display.

CHAPTER 8

SCOPE FOR FUTURE WORK

1) This mechanism can be tried in a very large scale units.
2) Interfacing with computer can be incorporated.
3) More Techno- economics survey can be done.
4) More number of designs can be attempted.

CHAPTER 8

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