

AUTOMATIC HARD COVER MAKING AND BOOK BINDING MACHINE

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Abstract

Bookbinding is the process of physically assembling a book from an ordered stack of paper sheets that are folded together into sections or sometimes left as a stack of individual sheets. The stack is then bound together along one edge by either sewing with thread through the folds or by a layer of flexible adhesive. For protection, the bound stack is either wrapped in a flexible cover or attached to stiff boards. Finally, an attractive cover is adhered to the boards and a label with identifying information is attached to the covers along with additional decoration. Book artists or specialists in book decoration can greatly expand the previous explanation to include book like objects of visual art with high value and artistic merit of exceptional quality in addition to the book's content of text and illustrations.

Important part of process is the hardcover making. A hardcover or hardback (also known as hardbound, and sometimes as case-bound) book is one bound with rigid protective covers (typically of cardboard covered with buckram or other cloth, heavy paper, or occasionally leather). It has a flexible, sewn spine which allows the book to lie flat on a surface when opened. Hardcover books are often printed on acid-free paper, and are much more durable than paperbacks, which have flexible, easily damaged paper covers.

Introduction

Bookbinding is a specialized trade that relies on basic operations of measuring, cutting, and gluing. A finished book depends on a minimum of about two dozen operations to complete but sometimes more than double that according to the specific style and materials. All operations have a specific order and each one relies on accurate completion of the previous step with little room for back tracking. An extremely durable binding can be achieved by using the best hand techniques and finest materials when compared to a common publisher's binding that falls apart after normal use.

Bookbinding combines skills from other trades such as paper and fabric crafts, leather work, model making, and graphic arts. It requires knowledge about numerous varieties of book structures along with all the internal and external details of assembly. A working knowledge of the materials involved is required. A book craftsman needs a minimum set of hand tools but with experience will find an extensive collection of secondary hand tools and even items of heavy equipment that are valuable for greater speed, accuracy, and efficiency.



Fig No. 1: Hard covers Binding Machine

Objective

- To modify existing machine in such a way that it will lead to reduction in space requirement.
- To combine all operations on single workstation so that one single operator can handle the machine.
- To make it versatile by providing some controllable parameters in machine itself.
- To reduce the cost by arranging all operations on single workstation with better design.
- To minimize human efforts by making some operation automatic.

Problem Definition

The major intension in designing machine is combining all operations on single workstation. We intend to perform academic project under the title, "Advance Hard Cover Book Binding Machine. Our motto is to design and manufacture excellent machine to minimize manual efforts and increase accuracy and efficiency in processes at low cost. The objectives of this project are to design an automatic book binding machine using single workstation and machine could bind a book in a range of 15 to 20 mm thickness.

Scope

For the hard cover placing over rexin paper pneumatic arrangement is used but due to compressor and piping arrangement it becomes complicated to place the paper, so different mechanical arrangement can be used. One of such mechanism is shown in figure no.20. This mechanism is to be added for making machine completely automatic and yet simple in construction. The mechanism have three different compartments for hard board. This compartments are controlled by rack and pinion for vertical movement. For the easy placing of pages at the middle strip of working tables instead of grippers the Robert arm can be used with the rotational movement of 180 degree.

Microcontroller can be used to control all movements sequentially, instead of push buttons. This will make the machine fully automatic.

Literature review

Thesis on Automatic Book Binding Machine by Anis Zafirah Binti Adnan from University of Malaysia -

In this report, controlling of sequential operations in the machine is with the help of programmable logic controller. They have mention hydraulic actuators in various linear movements. To control the movements at accurate positions they have used sensors. The report on Automatic hard cover book binding machine explains various benefits over its contemporary machines.

Survey of machines available in market (www.fellows.com) -

There are number of machines available in market having different applications and mechanisms in it. This site provide the information about the Thermal binding machine, Wire binding machine and others. It gives detailed information regarding cost and design features of different machines.

Espresso Book Binding Machine -

This paper also suggests that despite the benefits of the machine, certain technical issues such as poorly developed cataloguing system or primitive printing techniques, and broader issues related to the increased competition and the quality of the content must be addressed and dealt with in order to utilize the full capacity of Espresso book binding machine.

Loose-leaf book-binding mechanism US 1732444 A –

This invention relates to improvements in 12 may be shaped from metal or made from loose leaf books. Any other suitable material other than wood the general object of the invention is too such as stated. Provide a loose leaf book wherein the binding the binder ring mechanism may be of any ring mechanism is secured to the binding in desired type.

Study of various mechanisms –

The study of various mechanisms for number of applications is carried out. For this purpose S.S. Ratan book is refer. From that information is taken. It gives information about various mechanisms such lifting mechanism, sliding mechanisms.

Mechanism for connecting book binding and paper supplying machines US 6099224-

Paper supplying apparatus has a rotatable member around a horizontal axis, a pair of clamp plates supported by

this rotatable member mutually parallel and in face-to-face relationship for clamping a book block in between, and guide plates each attached to an associated one of these clamp plates, extending downward from the clamp plates to a lower edge part of the book block when the book block is held vertically. Such a paper supplying apparatus can be removably connected to a book binding machine by attaching a guide rail to an outer wall of the book binding machine and a runner to the paper supplying apparatus. The runner is slidably engageable with the guide rail, allowing the paper supplying apparatus to move along the guide rail selectable towards or away from the book binding machine.

9th Century Qur'an in Reza Abbasi Museum Sammelband of three alchemical treatises, bound in Strasbourg by Samuel Emmel ca.1568, showing metal clasps and leather covering of boards The codex-style book, using sheets of either papyrus or vellum (before the spread of Chinese papermaking outside of Imperial China), was invented in the Roman Empire during the 1st century AD. First described by the poet Martial from Roman Spain, it largely replaced earlier writing mediums such as wax tablets and scrolls by the year 300 AD. By the 6th century AD, the scroll and wax tablet had been completely replaced by the codex in the Western world.

Western books from the fifth century onwards were bound between hard covers, with pages made from parchment folded and sewn onto strong cords or ligaments that were attached to wooden boards and covered with leather. Since early books were exclusively handwritten on handmade materials, sizes and styles varied considerably, and there was no standard of uniformity. Early and medieval codices were bound with flat spines, and it was not until the fifteenth century that books began to have the rounded spines associated with hardcovers today. Because the vellum of early books would react to humidity by swelling, causing the book to take on a characteristic wedge shape, the wooden covers of medieval books were often secured with straps or clasps. These straps, along with metal bosses on the book's covers to keep it raised off the surface that it rests on, are collectively known as furniture.

The earliest surviving European bookbinding is the St Cuthbert Gospel of about 700, in red goatskin, now in the British Library, whose decoration includes raised patterns and coloured tooled designs. Very grand manuscripts for liturgical rather than library use had covers in metalwork called treasure bindings, often studded with gems and incorporating ivory relief panels or enamel elements. Very few of these have survived intact, as they have been broken up for their precious materials, but a fair number of the ivory panels have survived, as they were hard to recycle; the divided panels from the Codex Aureus of Lorsch are among the most notable. The 8th century Vienna Coronation Gospels were given a new gold relief cover in about 1500, and the Lindau Gospels (now Morgan Library, New York) have their original cover from around 800.

Working

WORKING INCLUDED IN THE AUTOMATIC HARD COVER BOOK BINDING MACHINE

- ❖ GLUING AND CONVEYOR MECHANISM
- ❖ FOLDING AND LIFTING MECHANISM
- ❖ GRIPPER MECHANISM

1. GLUING AND CONVEYOR MECHANISM

Gluing mechanism is one of the crucial and starting mechanisms in advanced hard cover book binding machine. It consists of two pairs of rollers with same diameter and length. In most of the cases gluing tank is placed below the rollers, in which bottom roller is half dipped in glue. But in the project glue tank is above the rollers along with sliding movement for proper distribution of glue. There are three spur gears attached to each other. Rotational movement is given to the only one spur gear by the motor. Due to compound gear train same directional movement of driver gear and third gear is occurred and middle gear is rotates in opposite direction to both initial and final spur gear.

Details of various components used in gluing mechanism are as follows:

- 1) **Rollers** – Rollers are made up of light weight material. It Reduces power required to rotate rollers. Due to light weight small DC motor is used.



Fig. No. 11 Gluing Mechanism

1. Purpose of gluing mechanism:

Gluing mechanism is essential to place the glue over one side of rexin paper. Generally this type of work is done manually in many printing press, which take much more time and lots of human effort. Objectives of gluing mechanism are as follows:

- To minimize time required to spread glue
- To effective handling of glue
- To reduce the wastage of glue
- To minimize human effort

1.1 Working principle of Gluing Mechanism-

It works on, when two round bodies rotates in opposite direction, having clearance in between them push the object forward.

When the paper is feed through the rollers, due to opposite movement of the roller paper moves forward. As glue is spread on the upper roller one side of the rexin paper gets glued and passes on the working table. For easy movement of the rexin paper from gluing mechanism to working table clearance in between rollers is kept at the height of working table. Two separate motors are used for the movement of rollers.

2. FLIPPING MECHANISM:

2.1 Purpose of Flipping Mechanism:

Flipping mechanism is used for various applications in various industries, such as automobile industries and food processing industries. In this project Flipping mechanism is used to folding corners of rexin paper, which is helpful to hold hard covers with rexin paper.

2.1.1 Construction of Flipping Mechanism:

Plates are used to fold rexin paper on hard covers. Movements to plates are given by motors having 30 to

60 RPM. Plates are attached to the motor shaft by arc welding operation. Clockwise and anticlockwise movements are controlled by push button and control knob. There are six motors and six plates attached to it. These plates and motors are arranged around the work table.

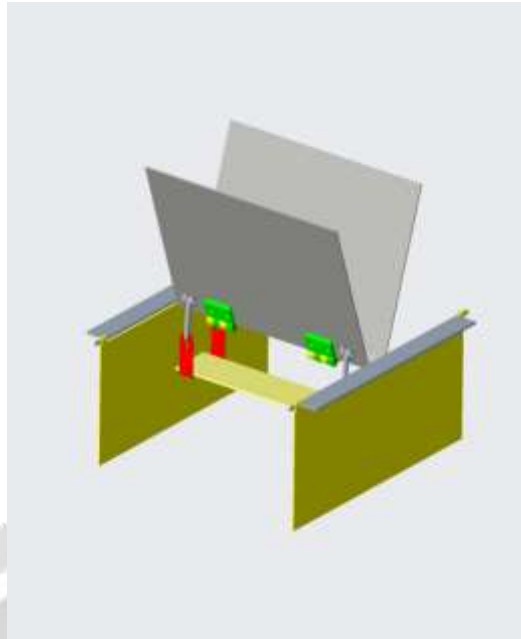


Fig. No. 6 Flipping Mechanism

2.2 Working of Flipping Mechanism:

When power supply is provided to motors at that time plates rotate in 180 degree in clockwise direction. This movement tends to press the edges of paper on hard board and this also presses due to weight of plate. Due to movements of plates resin paper is stick to hard cover. Return movement of plates is done by anticlockwise movements of motors.

3. Gripping Mechanism:

3.1 Components of gripping mechanism:

There are only few components in gripping mechanism;

- 1) **Grippers:** Grippers are used for holding the bunch of pages. Mechanical Gripper consists of two jaws which are made up of two metal strips which are easily adjustable by nut and bolt. Grippers are used in many industrial applications.



Fig. No. 7 Gripping Mechanism

- 2) **Rack and pinion Arrangement:** Rack and pinion arrangement is used for to and fro motion of bunch of papers. It is controlled using motors along with the push button.

- 3) **Prime mover:** DC motor having 60 RPM is used as prime mover in case of gripping mechanism.

Advantages:

1. **Single Workstation:** In this project numbers of workstations are combined into single workstation. All processes carried on single workstations.
2. **Less space Requirement:** Due to single workstation design of compact mechanisms space requirement is very less as compared to machines which are now available in the market.
3. **More Economical:** Minimum parts, better design, minimum number of mechanisms and due to availability of standard parts in the market, machine became economical.
4. **Less Human Effort:** Total numbers of mechanisms are push button operated so human efforts are less.
5. **Less cycle time:** Cycle time required to bind single book is around 2 minutes.
6. **Smooth movements:** of mechanisms are achieved due to better design and proper lubrication.
7. **Less maintenance:** as no hydraulic or pneumatic circuits are used, less or no maintenance is required. This leads to reduction in total operating cost.
8. **Durability:** Total mechanisms are based on mechanical system hence durability of entire machine is very high
9. **Proper handling of pages:** pages to be bound are most important factor in entire process as gripper is provided there is careful handling of pages without any damage. Also gluing mechanism is automated there is no chance of damaging pages by excess glue.

Disadvantages:

1. **Non Uniform movement of Gripper:** At the time of gripping of book, movement of gripper is not uniform due to overhang of system and welding of straight metal strips to rack.
2. **End result is less impressive than manual operation:** As this is raw prototype of an idea, it still has lot of scope for improvement. The final book that was bounded through machine is not as good as manual operator made book but it is more than satisfactory performance from a prototype
3. **Large linear distance:** Due to large linear movement, one side rack length is more. This is done to accommodate variation in the binding process
4. **Complicated Wiring:** Due to various mechanisms in limited space, wiring became complicated. This results in more time consuming operation at the time of failure.

Future scope

For the hard cover placing over rexin paper pneumatic arrangement is used but due to compressor and piping arrangement it becomes complicated to place the paper, so different mechanical arrangement can be used. One of such mechanism is shown in figure no.20. This mechanism is to be added for making machine completely automatic and yet simple in construction. The mechanism have three different compartments for hard board. This compartments are controlled by rack and pinion for vertical movement.

Conclusion

In this project numbers of workstations are combined into single workstation. All processes carried on single workstations. We can save both time and money.

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