3D MODEL OF PAPER SLITTER MACHINE AVAILABLE AT SERVIN PRINTERS

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ABSTRACT

The design of a paper slitting and rewinding machine for a developing economy which targets small to medium enterprises (SMEs). The current problem is the high cost of such machines on the market hence most SMEs in a developing economy cannot afford them. Through careful analysis of current machines, use of alternative cheaper materials and use of more energy efficient drive mechanisms, it was possible to come up with a low cost and efficient solution. Research on the paper slitting and rewinding industry was conducted on the internet, published scholarly articles and industrial visits to local companies in the same business. The implementation of this design has major positive benefits to the development of the economy.

Keywords
Design, paper slitting, rewinding, machine, developing country

1. INTRODUCTION

A slitter machine, commonly called a slitter rewinder machine, is a machine used with paper, film, and foil material to convert a wide roll of material into several thinner rolls. The slitter starts by unwinding a master or mill roll, then slits the unwound material into various widths. Finally, it completes the process by rewinding the slit material onto cores of different widths. A slitter can be designed in many configurations, depending on the customer's needs.

Slitting is seen as a practical alternative to other cutting methods due to its high productivity and the variety of materials it can manage. Rewind slitting entails rewinding the material through several knives to form narrower rolls of materials.

Roll slitting is a procedure mainly used by the converters industry. The converter industry refers to companies that print, coat, and laminate materials. Converter companies specialize in modifying or combining raw materials such as polyesters, silicone, adhesive tapes, adhesives, foams, plastics, felts, rubbers, liners, and metals to create new products. A standard converter is a company that manufactures flexible packaging material. Their packaging process may involve large rolls of plastic film such as biaxially orientated polypropylene which is then printed according to the customer's design and coated with cold seal adhesive for use on high-speed packaging machines. This material is printed and coated in wide, large-diameter rolls for maximum efficiency. The rolls are then slit with a slitting machine, into smaller rolls of the size to be used on the packaging machine.

Blades cannot be used for harder materials such as sheet metal. Instead, a different form of shearing is used. Two cylindrical rolls with matching ribs and grooves cut a large roll into multiple narrower rolls. This continuous production process is economical yet precise and is usually more accurate than most other cutting processes. However, rough edges known as burrs are commonplace on slit edges. The geometry of these rolls is also determined by specific tolerances and the type of material and workpiece thickness.

1.1 Problem statement

1) Time Consuming Process Due To Manual Work.
2) Requires More Man Power.
3) Overall Affects The Supplier As Well As Reciever.
4) Need Some Advance Developement.

1.2 Objective

1) With the help of these design, the workforce reduces
2) To reduce the man power
3) To increase the production rate

1.3 Scope

1) The material carrying capacity is improve by using high strength roller shaft
2) By using digital weight machine for analysing weight of roller
3) By using lift automation for lifting the roller easily

1.4 Methodology and steps to solve the problems

2. Install the creo software
3. Take the proper dimensions of machine
4. Open the software and start designing
5. Place proper dimensions and design components one by one
6. Give the advancement to the machine according to the trend
7. Assemble the components
8. Inspect the overall work
9. Submit the work with proper documentation

1.5 Need for automation of paper slitter machine

Automation plays an important role in mass production :-

1. To achieve mass production
2. To reduce man power
3. To increase the efficiency of system

4. To reduce work load
5. To reduce material handling
6. To reduce fatigue of workers
7. Less maintainance
8. To reduce production time

2. LITERATURE REVIEW

Paper slitting and rewinding is the process of cutting a large jumbo reel of paper by moving it through an array of knives before rewinding it on one or more shafts into smaller standardised winds for custom uses (Wikipedia, the free encyclopedia, 2015). Machines known as slitter-rewinders are used to cut parent reels into various roll widths and trim off the edges of the sheet in order to meet customer requirements (Convergence Training, 2015). Paper slitting and rewinding process The process has remained a vital part of every paper processing industry around the world since it has direct impact on the quality of the end paper product. Various slitting methods, winding techniques and tension control mechanisms for the web have been developed and successfully implemented in order to maximise the efficiency of the process and the edge quality of the cut paper.

"Design of a paper slitting and rewinding machine for a developing country". [1], discusses how to design an economic slitting and rewinding machine that focuses on small and medium businesses. Present issue is that such machines are very expensive on the market which makes the small and medium business in developing countries cannot afford it. "Design and Analysis of Paper Cutting Machine works on Geneva Mechanism", by Vijay Kumar et al. [2], conducted a study of mechanism incorporating a Geneva wheel and a gear train to achieve intermittent motion is presented in paper. Position, velocity and acceleration are compared. Reduce extreme jerk of Geneva wheel is used to find the non-circular motion of the gear pair. The Geneva drive is an indexing mechanism that converts continuous motion to intermittent motion, allowing the paper to be moved in-between cutting intervals. It describes the cutting operation using a crank-lever mechanism. The cutter return to its original position by means of spring effect. "Advanced Paper Cutting Machine using ARM7", by SS Lavhate [3], proposed that the designed system will be an automated smart length measurement device. It includes a rotary encoder, proximity switches, motor, and an embedded design that includes a microcontroller circuit and other components. The device serves as the control circuit for a paper cutting machine that can cut a variety of materials including paper, plastic, thin film, leather, and nonferrous metal slices. The paper cutting industry uses this system and demonstrates the contribution to a low-cost solution in manufacturing. Patent US4422588A [4], titled "Slitter-rewinder system" a slitter and a drum type rewinder are part of a slitting and rewinding system and method. The core-cutter comprises a tool magazine for storing cores. For severing a selected core into widths according to the setting of the slitter knives, a transversely programmable movable core slitter was provided. The sections of slit core are received by a core transporter, which transports them to the winder drums while also moves the winded roll out of winding position. The paper web severing and adhesive application device cuts the web from the winder and applies adhesive strips to the back's tail and lead corners. III. METHODOLOGY Hierarchy processes required for the development of various modules of an Automatic high-speed rewinding and slitter machine.

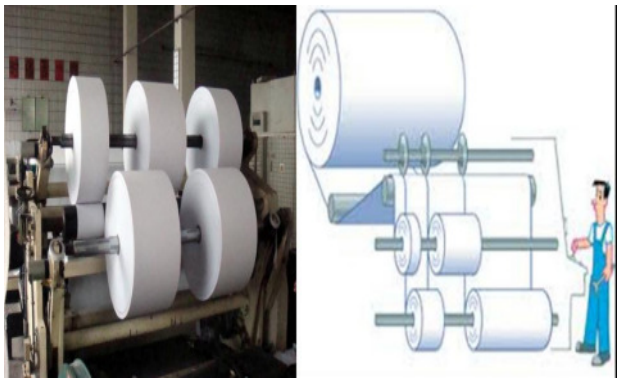

FIG.PAPER SLITTER MACHINE

The slitting process involves feeding a large roll of material through the machine, where it is cut into narrower rolls of the desired width. The slitting is done using circular blades, which can be adjusted to achieve the desired width of the final rolls. The slitting blades can be set to various widths and can be adjusted quickly and easily to meet the specific needs of each job.

The slitting process is typically followed by a rewinding process, where the smaller rolls of material are wound onto individual cores. This process ensures that the material is tightly wound and ready for use in downstream production processes.

Paper slitter machines come in a variety of sizes and configurations, from small tabletop models to large industrial machines capable of processing wide rolls of material. Some machines are designed to handle specific types of materials, such as tissue paper, while others are more versatile and can be used to slit a wide range of materials.

The benefits of using a paper slitter machine include increased efficiency and productivity, improved quality control, and reduced waste. By automating the slitting process, manufacturers can reduce labor costs and improve the accuracy and consistency of their products. Additionally, slitting machines can help reduce material waste by ensuring that each roll is cut to the exact width needed for the job, minimizing excess material and reducing costs.

2.1 About Creo Software

Creo is a suite of computer-aided design (CAD) software programs developed by PTC (Parametric Technology Corporation). Creo was previously known as Pro/ENGINEER, and it is one of the most popular CAD tools used in the manufacturing industry.

Creo provides a comprehensive set of tools for designing and creating 3D models, assemblies, and drawings. It allows users to create complex designs and assemblies, test and validate them using simulation and analysis tools, and generate detailed manufacturing documentation.

2.2 Some of the key features of Creo software

1. **Parametric Modeling:**
   Creo uses a parametric approach to modeling, which means that the design elements are created using mathematical equations that can be modified and updated dynamically. This feature allows designers to make changes to the model at any stage of the design process, without having to start over from scratch.

2. **3D Modeling**:
   Creo allows users to create detailed 3D models of parts and assemblies, which can be viewed from any angle and manipulated in real-time. The software also includes a wide range of tools for creating complex shapes and surfaces.

3. **Assembly Design**:
Creo provides a range of tools for designing and assembling complex mechanical systems. Users can create assemblies of multiple parts, check for interferences, and create detailed exploded views.

4. **Simulation and Analysis**:
Creo includes tools for performing simulation and analysis of designs. This allows users to test their designs for stress, strain, and other factors, and to optimize them for performance and reliability.

5. **Manufacturing Documentation**:
Creo can automatically generate detailed manufacturing documentation, including drawings, bill of materials, and production instructions. This helps streamline the manufacturing process and reduce errors.

Creo is used in a variety of industries, including aerospace, automotive, consumer products, and industrial machinery. It is known for its power and versatility, as well as its ease of use and intuitive interface.

2.3 SYSTEM REQUIREMENTS

System requirements for PTC Creo are relatively low, it is offered for Windows 8 and 10. The CPU requirements are Intel Core, Intel Xeon, Intel Celeron, Intel Pentium, AMD Athlon, AMD Opteron. Video display requirements are any 3D capable graphics cards with OpenGL support. 4 gigabytes of RAM is required to run PTC Creo Parametric, as well as a minimum of 2 gigabytes of hard disk space. Creo also has 24/7 online support to assist any user with questions. Creo requires active internet when being used to be able to refresh and connect to the Creo servers.

Creo has many different software package solutions and features. Creo Illustrate is a good example. Creo Parametric allows users create 3D models with many features such as sweeps, revolves and extrusions. This makes it one of the leadingcadsoftwares that is in use for many engineering and technical based careers.

3. ADVANTAGES, DISADVANTAGES&APPLICATIONS OF PAPER SPLITTER MACHINE

3.1 ADVANTAGES

1. Time saving and efficient
2. Requires less manpower
3. Simple and Easy in Construction.
4. Advance design than older machine.
5. Less accident prone.
6. Accurate cutting.
7. It reduces the wastage.
8. Cost saving.

3.2 DISADVANTAGES

1. Loading and Unloading of paper roll is difficult.
2. Maintainance of machine is high.
3. Large space required for setup.

4. Paper splitter machines can generate noise and dust during operation.

5. Paper splitter machines require trained operators to ensure safe and effective use.

3.3 APPLICATION

1. **Paper processing:** A paper splitter machine is commonly used in paper processing facilities to cut large rolls of paper into smaller sizes that are suitable for various printing and packaging applications.

2. **Printing industry:** In the printing industry, a paper splitter machine is used to cut large sheets of paper into smaller sizes that can be used for brochures, business cards, flyers, and other printed materials.

3. **Packaging industry:** In the packaging industry, a paper splitter machine is used to cut paper into narrow strips that can be used to wrap packages or to create packaging materials.

4. **Office use:** In an office setting, a paper splitter machine can be used to cut large sheets of paper into smaller sizes for printing or to create custom-sized envelopes and notepads.

5. **Crafts and DIY projects:** A paper splitter machine can also be used by artists, crafters, and DIY enthusiasts to cut paper into specific shapes and sizes for scrapbooking, card making, and other craft projects.

4. CONCLUSION

There are several potential areas for future improvement in paper splitter machines, including:

1. **Automation:** Advances in robotics and artificial intelligence may allow for the development of more automated paper splitter machines, reducing the need for human intervention and increasing efficiency.

2. **Precision Cutting:** Improvements in laser cutting technology could allow for even more precise cutting of paper, which could be useful for creating intricate designs or cutting thin paper stocks.

3. **Environmental Sustainability:** As sustainability becomes an increasingly important issue for businesses, there may be a greater focus on developing paper splitter machines that are more environmentally friendly, such as those that use recycled materials or consume less energy.

4. **Ease of Use:** Future paper splitter machines may be designed to be more intuitive and user-friendly, with touch screen interfaces and other features that make them easier to operate.

5. **Versatility:** There may be a focus on developing paper splitter machines that can cut a wider range of materials, such as plastics or fabrics, in addition to paper.

6. **Smaller Footprint:** As space becomes an increasingly precious commodity in the workplace, future paper splitter machines may be designed to be more compact and take up less space.

Overall, the future of paper splitter machines will likely involve continued advances in technology and a greater focus on sustainability, precision cutting, and ease of use.

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