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An overview of ontological paper cutting machine

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ABSTRACT

Overview of existing papers cutting machine and evolution of paper cutting machine has been analyzed and discussed. First, the theoretical and practical operating principles of various types of paper cutting has been analyzed and complete structural analyzes has been made to improvise machine operation. The various types of existing paper cutting machines are manual, semi-automatic, fully automatic hydraulic then, the inherent parts of the paper cutting machines has been illustrated.

Introduction

The urge for intuition is increasing exponentially in today's world. We are in need of intuitive paper cutting machines. The existing intuitive paper cutters are of huge size, heavy weight and high cost which is not preferable for commercial purposes. The demand on state of the art high speed cutters vary as much as materials to be cut they should perform cutting with hairline accuracy quickly cutting big and small jobs alike and above all it should be capable of cutting every kind of materials. A high-speed cutter is expected to perform a precise and clean cut and to be constructed very sturdily in order to cut even the hardest materials accurately. In the operation of modern high speed cutters it is unavoidable that cutting differences are encounter occasionally, in spite of accurate aching adjustment and most careful alignment of the material to be cut by the operator. High-speed cutters combine innovative technologies, solid design and high-performance electronics for one goal. The existing paper cutters have completely mechanical based principle which makes the system complex. The quality of a machine should be checked continuously otherwise the performance rate will go down. The coolant should be provided for existing machine in order to avoid over heating when it run continuously. To overcome all this factors, the high-speed cutters we have designed belong to a new, innovative machine generation and are pioneering the use of modern industrial manufacturing processes and technology. At the same time, we have improved existing functions and integrated new features.

Importance of paper cutter

The importance of the paper-cutting machine can hardly be overestimated. The correct position of the printed matter, the widths of head, tail, and fore edge may be destroyed by careless cutting. With the invention of printing and the multiplication of books larger and stronger means were necessary to cut the sheets. Although the book with the untrimmed sheets was the rule of this earlier time, and of a later time, for the smaller books and for divisions of the sheet a cutter was necessary. No matter how fine the printing and color work is, if the margins are uneven and the folds mismatched, then the resulting air of slovenliness discredits the entire work. The final touch that gives the character to a piece of printed matter is the way it is trimmed. A paper-cutting machine is used for dividing piles of large sized sheets into smaller sized sheets; also for squaring a pile; *i.e.*, making all four corners rectangular; and for trimming off irregular or incorrect edges.

Evolution of the paper-cutting machine

The earliest cutting machine was no doubt a sharp stone or a stick; then a piece of metal, dragged across the parchment, with a guide to keep the cut in a straight line. The sheet was simply held by the hand, and later the straight-edge formed a clamp also. For a time the cutting of piles of paper was done by hand with a knife, a small pile being put upon a table and a weight laid upon it. The operator leaned his weight with one hand upon it, while he cut with the other. The earliest attempt to improve this consisted of a table, a framework of wood or metal above it, having a groove in which the knife could be worked, and a screw clamp to hold the pile. The knife was originally short; then longer, until it became long enough to cut through the thickness of the book. The deckle-edge of the earlier and untrimmed books was improved upon and made easier to turn over and refer to rapidly by the improvement of trimming the leaves. The hand-plough cutter was probably the first successful machine intended to cut a number of sheets at a time. The earliest among them is the lightly constructed hand-driven vertical cutter of 1855. This consisted of two side frames, the knife-bar guides in their slots and a large hand wheel at the right. The next stage was a cutter of 1876, a hand-driven wheel at the right turning gears above and outside the table. A crank and a rod connected to the center top of the knife-bar pulled the knife in the direction of the two slots in the knife-bar, giving it a shearing motion. This model is the same as that used by most German manufacturers for both hand and power-driven cutters until within a few years, when and more convenient American

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examples became known. From simply pressing with the hand to hold the sheets the hand clamp was evolved; then the clamp was attached to a gear by which it could be held down on the sheets with greater and steadier pressure. To quicken this operation the spring clamp was devised, with automatic pressure fixed at first, then variable to suit varying requirements. The evolution of the cutting machine has been rapid and distinctly marked in all its essential features, from the oscillating plough to the vertical stroke, to the shear stroke, to the double-shear stroke; from a single-rod pull-down of the knife (by a chain, by a cam, or by a crank) to the two-rod pull-down by cams, rolls, slots, slides, to the cranks which give a fixed dependable stroke; to the cranks which give a fixed dependable stroke, and at the same time pull the knife endwise; from swinging-link shear to a straight-line shear; from man-drive to power-drive; from driving by power fixtures in front and outside the frame to fixtures located back and underneath; from low piles to high piles; from hand clamp to power clamp, to self clamp, to automatic clamp, finally to friction adjustable pressure clamp; from measuring by rule to the use of rapid automatic measuring and spacing devices. The best paper-cutting machine is designed with a knife motion operated by cranks which give an endwise pull to the knife; with the table of medium height; with quick and accurate adjustments for the knife; with a foot treadle for bringing the clamp down to the pile when desired to see exactly where the knife will strike; with an accurate and dependable device for moving the back gage and the pile and measuring quickly the widths to be cut; with starting handles easily reachable without bending; with a powerful clamping pressure automatic for all height piles and instantly adjustable for heavy or delicate work; with universal fine adjustments for squaring the back gage with the knife; with a simple change for the cutting stick; with the driving shaft running at a low speed; and with a powerful main driving clutch or friction material that will not cut or damage the parts under the heavy, constant thrusts.

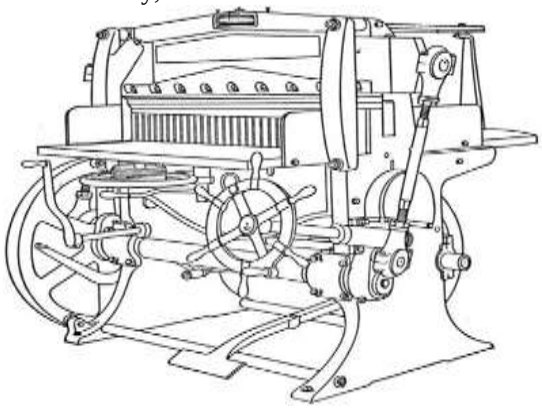

Fig.1 Initial paper cutting machine

Extising paper cutting machine

Manual paper cutters:

This type of paper cutters works according to the force applied at the cutter handle by the humans. The handle should be moved up and down to cut the papers. This is mainly used to cut A4 sheets. The ordinary Paper Cutting Machine is the most simple in operation, economical & efficient machine with requirement of maximum floor space are designed to cut much higher stocks than similar other machines. The knife holder can be adjusted to reimburse the grinding of the knife. This is an inefficient machine for cutting big labels. Back gauge is adjustable for cross cutting. Fine finish, excellent painting and essential parts are nickel plated. The paper alignment will not proper in this type of cutting. Accuracy is less compared to other of cutting machine.

Fig 2: Manual paper cutters

Semi-Automatic Paper Cutting Machine

This paper cutter is an electric, semi-automatic paper cutter, which includes the German manufactured Solingen steel blades and a steel blade carrier. This MBM paper cutter offers the new digital display measurement to ensure the exact position of the back gauge. The paper cutter also has a second measuring scale on the side guides. Accuracy is guaranteed with the new LED optical cutting line, which displays exactly where your cut will be accurately made on your paper stock. Using the spindle handle on the front of the cutter, you can easily reposition the back gauge to any measurement you prefer. Once you have positioned the paper, simply throw the lever on the fast action clamp to tightly secure the paper stock. This paper cutter, featuring electric blade drive, is able to cut up to 1-1/2 inches of paper at a time. This cutter assures automatic blade return regardless of its position and disc break to instantly stop the knife from cutting any further. Comprehensive Safety Cutting System features are provided, including two hinged safety covers positioned on the front and rear table, which are controlled and locked electronically. Unlike the manual operated cutters, has electronically controlled, two-hand operation. By simply pushing two buttons located on either side of the front of the cutter, the cut is safely and properly executed. This cutter is portable, can be used with the optional cutter stand or cabinet, and is reliable for many cutting jobs.

Fig 3: Semi automatic paper cutting machine

Fully Automatic Hydraulic Type Paper Cutting Machine

Once machine is turned on, the back gauge will move to coordinate the true position into the computer. The back gauge and the knife should be in up position. The paper to be cut should be placed against the back gauge and the side guide. Initiate clamp and knife to start the cutting process by pressing the corresponding buttons in the computer. It takes a few seconds to cut the paper that is being placed. The clamping pressure should be adjusted based on the number of pile sheets placed. The knife alarm displays a message to remind the

operator to change the knife. The lube alarm displays a message to remind the operator to have the machine lubricated. The lube alarm will also display the name and phone number of the Challenge dealer from which the machine was purchased. To change the value of the knife alarm change the parameters in operating controls knife count. The lube alarm value is factory set at 2,500 cuts and cannot be changed. When the process is completed, the back gauge will be automatically moved to the desired position that is predefined**.** Electric eyes are used to prevent the reaching of cutting area while cutting process is started. When false clamping plate is removed then sensors will indicate the signals to the computer then automatically the computer allows minimize cut**.**

Fig 4: Fully automatic hydraulic paper cutting machine

Inherent Parts Of Machine

The knife:

The knife is most important. It must be kept sharp. It must be of the proper shape and thickness and bevel and temper and free from any burrs or lumps on its back edge. A cutting-machine knife is like a razor that, stropped correctly, does not pull the beard, but stropped an infinitesimally different way a difference impossible to see except with a microscope pulls hard. No matter how carefully the machine is built, an imperfect knife cannot cut right. Most knives are imperfect in spite of the rigorous specifications given them by makers. They vary in thickness, straightness, concave, bevel, flatness, temper, and quality of steel; and also in the character of their sharpening and honing, which varies with the fineness or coarseness of the grinding wheel and stone. These variations need only be a few thousandths of an inch to cause trouble. Use a perfectly straight and clean-edged steel rule and pass it along from one end to the other. A dark spot shows the point of contact of the rule with the knife. These dark spots should show only exactly at the cutting edge and at the back edge. If a dark spot shows away from the cutting edge, it indicates that the knife is imperfect there and will not make a true cut. Regrinding the face by the makers can correct this fault, except where it is the fault of the one who hones the knife after it is sharpened.

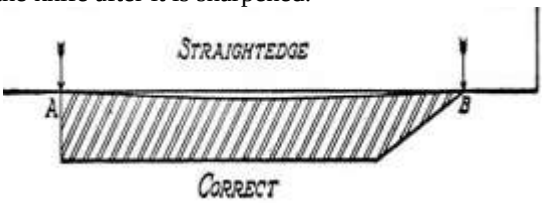

Fig 5: Knife edge

Flaws of the existing machine

- Initial cost is high
- More floor space is required
- High skilled labors are required
- Maintenance cost is high
- Heavy weight
- Always machine should be adjusted to monitor whether the friction is released or not.
- Only wrenches are used to furnish

Conclusion

This paper explains the working of existing paper cutting machine. All the machines are made of heavy metals and they work with mechanical effects. Since the working is mechanical type they are huge in size and weight. The manufacturing is also a tedious process. In order to overcome the flaws of existing paper cutting machine, mechanical parts of the machine are replaced by pressure sensor and transducer that are designed using Micro Electro Mechanical System (MEMS).

Proposed Work

The flaws of the existing paper cutting machines are The Proposed work is to design a Piezoelectric Transducer and Piezoelectric pressure sensor using MEMS. Micro Electro Mechanical Systems(MEMS) refers to the device that have characteristic length of less than 1mm but more than 1 micron that combines electrical and mechanical components that are fabricated using integrated circuits batch processing technologies. It is a creation of 3 dimensional structures using special micromaching processes. Micro devices can have characteristic lengths smaller than the diameter of human hair. Piezoelectric transducer is selected because it has high thermal stability and high sensitivity. Piezoelectric Transducers are used to measure vibration, force and pressure which are relative to dynamic event. By analyzing the various types of transducer, piezoelectric transducers are more advantageous and produce better performance. Piezoelectric sensors are highly strong to react to temperature. Piezoelectric sensors will work in high frequencies. The accuracy is very high in piezoelectric sensors.

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