

Mechanically Operated Paper Shearing Machine

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ABSTRACT: This Research work is aimed for design and fabrication of mechanically operated paper shearing machine. This machine has the capacity to cut up to 25mm thick and 300 mm wide paper. The cutting force is obtained from screw press. Screw press is a device in which rotary motion of flywheel is converted into small displacement of ram with greater force. The reason for choosing screw press as main component of machine is its variation in force produced. In addition to paper cutting other applications like Bending, Punching, and Embossing can be done. Further it occupies less floor space when compared to existing cutting machines. Also the blade can be removed easily for grinding. In this proposed paper shearing machine there is an integration of clamping and cutting mechanism, so the operator effort is reduced when compared to existing types. The components of our proposed machine are Screw press, Blade and clamping mechanism. The spring clamp is attached to the blade. The blade is fixed on the tool holder.

KEYWORDS: Screw Press, Spring Clamp, Bending, Punching.

I. INTRODUCTION

The paper-cutting machine is a recent development in the industrial world. The difficulty of making a successful machine of this kind to meet the new demands for accuracy, speed, convenience, and safety, has been overcome gradually in recent years and there are now several machines quite efficient and adequate to meet these demands of the modern manufacturer. To coordinate a number of inanimate pieces of steel and iron, to operate at high speed with precision, requires fine skill. The evolution from the first cutting machine—the old hand-operated wooden plough and press—to the present power-driven steel mechanism is like the advance from the old wooden sailing vessel to the modern steel ship.

So our Paper Shearing Machine extracts the unused/empty papers of blue books by pure mechanical energy application. The approximate number of papers that can be cut counts at around 100 sheets i.e. about 4-5 bluebooks at one stroke of cut. Acme thread used convert the rotary motion given by the operator, to translating motion of the blade causing shear to occur. The carbon steel blade of inclined shaper at the cutting edge enables faster and easier cutting action. Effective cutting comes with challenges like slipping of sheets which can be resolved by providing supports to the books

II. RELATED WORK

In the small scale industries mechanically operated cutters are preferred due to the following reasons:

- Skilled labour is not required
- Servicing and maintenance is easy
- Less initial investment

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Also on closely observing the machine some of the disadvantages were found.

- Because clamping and cutting mechanism are separate there is an need for operator effort
- This existing machine can perform only paper cutting operation
- Operation time is more

So in our proposed model we are trying to overcome the above said disadvantages.



Figure 1: Mechanical Type Paper Shearing Machine



Figure 2: Automatic Paper Shearing Machine

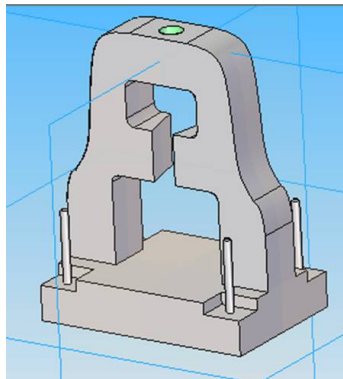
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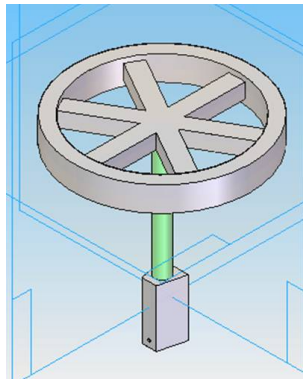
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III. DESIGN & DEVELOPMENT

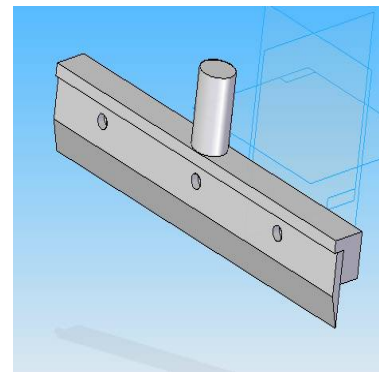
The Design of some mechanical parts has been carried out in Solid EdgeV19 Software & it as shown in the figures



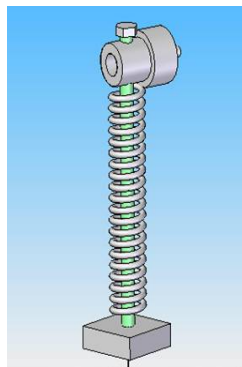
(a) Main Body



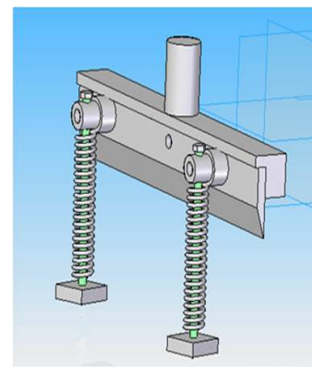
(b) Rotating Wheel



(c) Blade Holder and Blade



(d) Spring Clamps



(e) Assembled Model

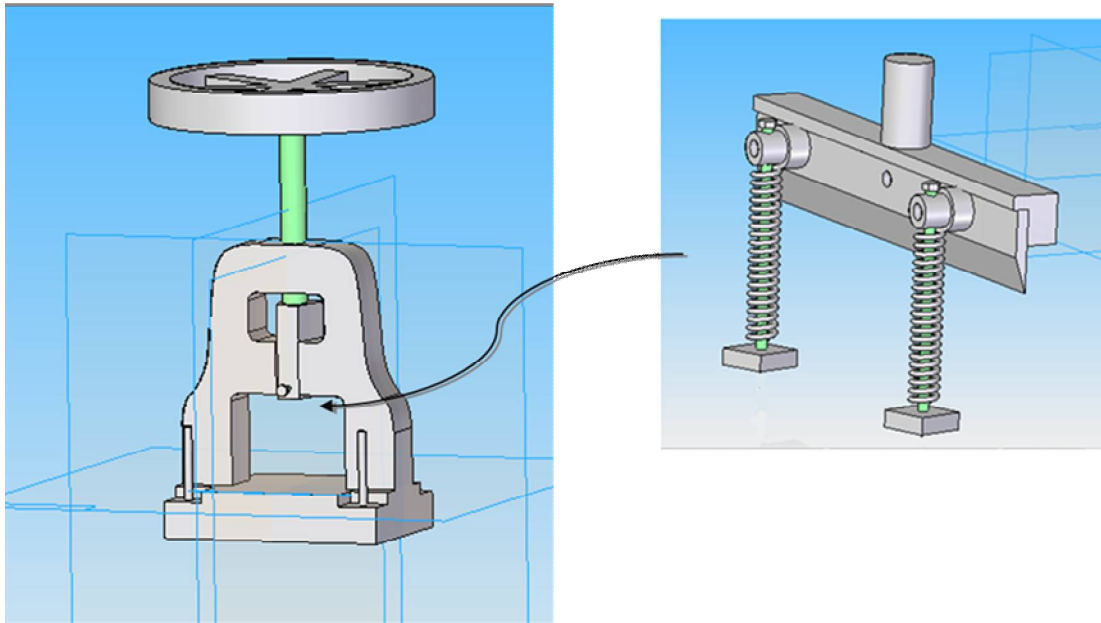


Figure 3: Principle of Operation:

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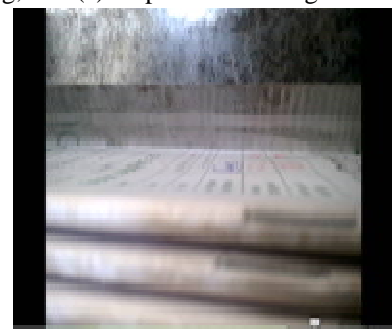


As shown in Fig.3, the whole assembled model of the Blade and Spring Clamps is fixed to hole present in the heavy mass of the Main body. The rotational energy of flywheel is converted into small displacement of heavy mass. The blade moves down with a large force. First the spring comes with contact with paper, holds them firmly following which the blade comes down and shears the paper.

(a) Snapshot of Clamping,

(b) Snapshot of Compression of Spring,

(c) Snapshot of Cutting



(a)

(b)

(c)

The usage of papers in institutions is in a large amount which has to be reduced, reused and recycled in order to move towards a better eco-friendly environment. The use of paper can be reduced, by switching to different alternatives which replaces paper in a better way. The unused sheets of the answer booklets and other documents can be reused.

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Figure:4 Screw Press

Paper Shearing Machine extracts the unused/empty papers of blue books by pure mechanical energy application in which impact energy by means of a heavy mass is transferred to a blade shearing the desired amount of papers. The approximate number of papers that can be cut counts at around 500 sheets.

In addition to extraction of papers in the small scale printing sectors and educational institutes, this machine can also perform the following operations with a change in tool.

- Punching
- Cutting
- Chiseling
- Pressing
- Bending
- Stampin

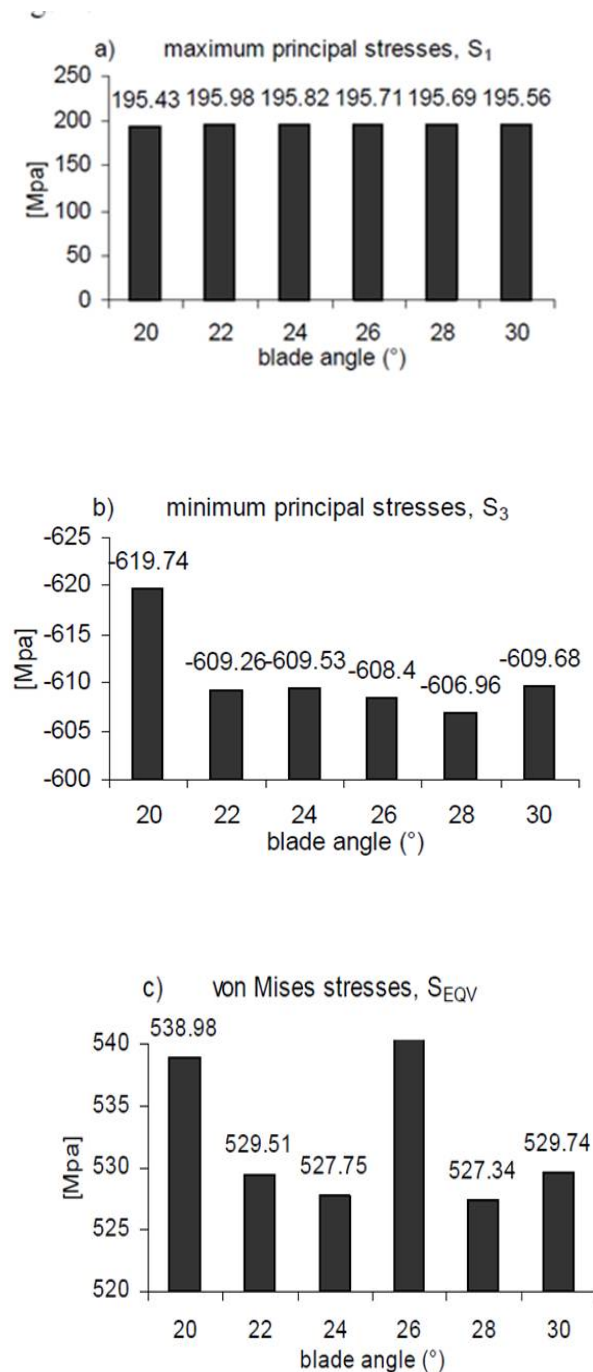
IV. EXPERIMENTAL RESULTS

The Effects of Blade Angle on Blade Stresses During Cutting of Different Kinds of Paper Materials. In this study, during the cutting of different kinds of paper material, the effects of blade angle on blade stresses has been investigated. In this analysis, according to changes to blade angles of 20, 22, 24, 26, 28 and 30, changes have been observed in maximum principal stress, S_1 , minimum principal stress, S_3 and von Misses Stresses, $SEQV$.

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- a) Maximum principal stress, S_1
- b) Minimum principal stress, S_3
- c) Von Mises stress, S_{EQV}

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In Conclusion, since Von mises stresses and especially max. Compressive stresses (min principal stress, S_3) occurred at the lowest level for rake angle of 28 degrees. It has been decided that for increased durability of the knife the critical blade angle in terms of abrasion or breakage of the blade should be 28 degrees rather than the more widely used angle of 24 degrees. A blade angle below 22 degrees is not advised.

V. CONCLUSION

Paper Shearing Machine as a whole performs operations purely based on mechanical energy and thus is economical when compared to hydraulic cutters. The cuts which it provides are effective since the clamping used gives firm grip over the sheets and thus cutting becomes easier. Designing of components has been made based on data relating to different papers and also different metals/ alloys used in blade.

The blade angle kept 28 degrees and the blade material kept as carbon steel which ensure effective cutting, thus making the paper shearing machine an economical and easy means to obtain the cut sheets of papers.

When compared to the mechanically operated paper cutting machine used in printing sectors the proposed machine can do almost all of its function with less cost. Also this proposed machine can be used for other applications like metal forming etc. This machine can find a application in small scale industry and educational institutions because of its low cost. At the end of every semester thousands of bluebooks gets accumulated after sessional tests, among those books more or less about 30% of the unused papers can be extracted.

The sheets can be reused for academic purpose. This proposed machine has less lead time when compared to now existing mechanical cutters. Blade can be easily removed from the machine to perform grinding . Also it occupies less floor space when compared with conventional paper cutters.

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