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Multifunctional Hand-Operated Stapler-Punch Combination

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Abstract: **The most important things in the Office & Desk Accessories mainly comprises of the stapler and punching machine. A stapler is a mechanical device that joins pages of the papers by propelling a thin metal staple throughout the sheets and then crimping the ends, while a punching machine is used to produce holes by punching the dies in the paper and the paper is being sheared cut. Both these items individually are of utmost importance but when it comes to carrying them individually or their accessibility at the required time it creates turmoil along with this enormous amount of resources are consumed for their production resulting in a heap of waste. To deal with this problem a new concept of stapunch is put forward which an integration of stapler and punching machine into a single tool. The new tool is more convenient to use, easy to carry, small in size and lightweight, low production cost, short production time, and more design flexibility. Initially, the existing models and designs of stapler and punching machines are taken into consideration their pressing mechanisms are analyzed. The multifunctionality of various tools is also insighted to get a brief idea regarding the integration of functionalities of these two different tools.**

Keywords: Stapler, punching, punching dies, elongating mechanism, resources, feasibility.

I. INTRODUCTION:

Mankind is carrying out most of his daily work with the assistance of tools, gadgets, and appliances. This has given rise to a drastic increase within the number of tools in any working environment just like the industry, office, kitchen or lebensraum. Therefore, multifunctional tools are being developed to integrate these tools and thus reduce the number of tools within the working environment. In Multifunctional tools, more functions combine and amalgamate their power into one product. The several advantages of multifunctional tools are that clutter is reduced, material handling time is reduced, the value of the tool to its cost is increased and therefore the number of tools is reduced.

Multi-functionality is additionally the trend employed in the office with gadgets like the printer which can also photocopy and scan or the fax machine which can scan, print and even make calls. maintaining with this trend, integrating functions into one product is the need of the hour. The stapler and punch both belong to an equivalent domain of stationery items. The stapler and punch use an equivalent mechanical action as input to drive their functioning. Therefore, they're ideal for integrating into a multifunctional tool, however, a mainstream product which performs both the functions is a unique initiative.

The study aims at developing concepts for a multifunctional tool that can perform the functions of both the stapler and also the punch thereby making it more convenient to use.

II. LITERATURE:

A stapler is a mechanical device produced for a number of different uses and in many different sizes. The basic principles behind their working is that they are used to joins two or more things, such as papers, tissues, or parts together by driving a thin metal staple through them. Manual staplers are normally hand-held while a hole punch, also known as hole puncher, or paper puncher, is an office tool that is used to create holes in sheets of paper, often for the purpose of collecting the sheets in a binder or folder. A typical hole punch, whether a single or multiple hole punch, has a long lever which is used to push a bladed cylinder, the punch, straight through one or more sheets of paper and then through a close-fitting hole in the die. Paper staplers and punching machines are widely used in government, business, offices, homes and schools all over the world. The widespread use of these tools implies that large quantities are manufactured, distributed, and purchased annually. The average lifespan of these tools is about 5 - 8 years. This relatively short lifespan coupled with widespread use implies that large amount of stapling and punching machines are disposed of annually. It also implies that large amount of resources are consumed in the manufacturing and distribution of them. These enormous amounts of resources consumption and waste generation could have significant negative impacts on human health and on the environment. It then becomes necessary to evaluate the potential environmental burden that could result from manufacturing, distribution and end-of-life management of stapling machines [1].

Following are the previously introduced designs with the same ideology of stapunch:

Concept 1: This concept uses a convenient knob on the handle as a selector mechanism for choosing the punch or stapler function. Since the force is applied on the paper as moment using the handle, less force is required in its operation. Therefore, more pages can also be punched or stapled using this concept. This concept makes up for its lack of compactness by being easy to use [2]

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Concept 2: This concept uses the conventional design of a stapler. It has an expandable attachment for a punch. When the punch is not in use, the punching pin and its linkages remain folded by its side and stapler can be utilized. To use the punch, the punching pin and its linkages are expanded as shown in the Fig 2. This concept is very compact. The only disadvantage in this concept is that the force is directly applied on the paper while the stapler is in use. Therefore, relatively more force is required for its operation [3].

Concept 3: This concept uses the conventional design of a punch. It has an additional arrangement in the middle for a stapler as shown in the figure. The stapler and the punch use different handles for its operation. This concept is both very compact and easy to use. It also requires relatively less force for its operation as the force is applied as a moment through the handle. The only disadvantage in the above concept is that it contains a relatively small stapler pin container [4].

III. FLAWS IN THE EXISTING SYSTEM:

Various designs with the same ideology of integrating stapler and punching, machine were introduced but due to some flaws in the existing systems the redesign of this concept was studied.

Some of the problems of the existing system are as follows:

Sr no	Flaws	Reason
1	Heavy weight	The proposed model was much heavy in weight and thus not handy to use and carry.
2	Colossal Design	The entire tool was big in size and hard to lift for carrying out the stapling function
3	Unfeasible to use	Due to heavy weight and bulky design it was not handy to use
4	Complicated switching mechanism	Both the punching and stapling operations interfered with each other
5	Complicated pin loading mechanism	The pin loading mechanism was complicated and time consuming.
6	Difficult to carry	The tool due to heavy weight and bulky design was not feasible to carry.

IV. PROPOSED SYSTEM:

Stapunch is a tool proposed with is a combination of the stapler and the punching machine. The 3 main components of this tool are the mini stapler, the 2 punching dies embedded in the craft punch, and the joining mechanism. The 2 separate mechanisms of punching and stapler are independent and do not interfere with each other during its functioning, thus making it easy to operate. The tool design emphasis a mini stapler that is joined to the two craft dies which consists of the punching die embedded in it. The mini stapler is used to carry out the stapling activity and the punching is carried out using the punch crafts. The punch crafts are elongated using a joining mechanism which lengthens to a specific distance that is to be maintained within the 2 holes ,and are pressed manually to generate the holes. Once punched the dies can again be restored to its original position. This compact multifunctionality mechanism makes it easy to carry out both the operations using a single tool and we do not have to carry 2 separate tools for it.

V. CAD (Design) MODELS:

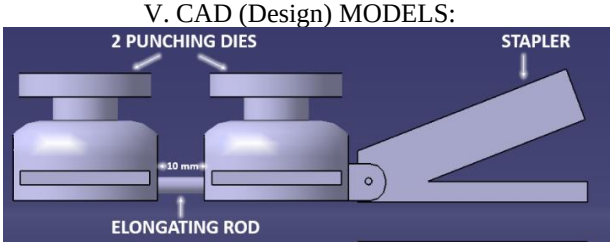

Fig1: Proposed design of Stapunch

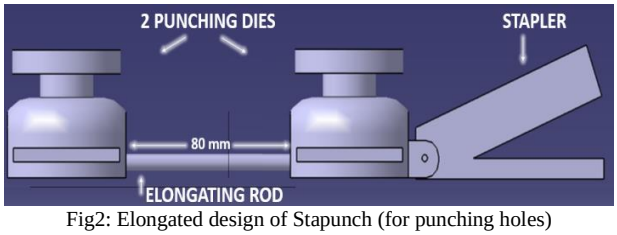

Fig2: Elongated design of Stapunch (for punching holes)

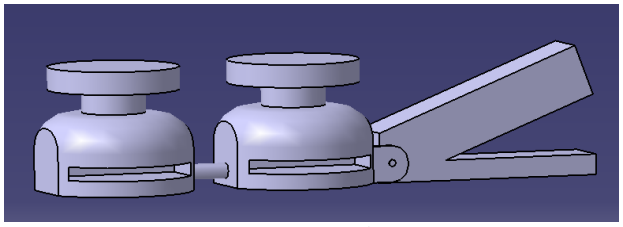

Fig3: Isometric view of Stapunch

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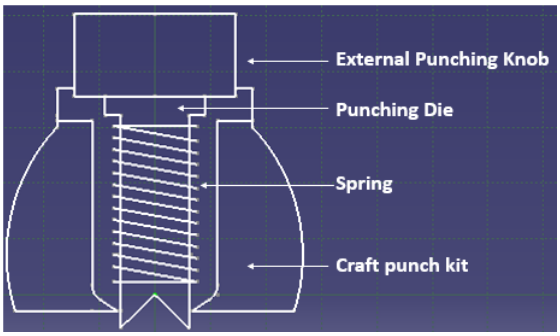

Fig4: Cross-sectional View of Punching Kit

VI. SYSTEM ARCHITECTURE:

1. *Small stapler:*

- Material: plastic and metal
- Quick loading mechanism
- Built in staple remover
- Loading Capacity: 50 Staples
- Stapling Capacity: 10 Sheets

2. *Punching die*

- Material: Steel die
- Diameter: 5.5mm
- Length: 15 mm

3. *Small Punching kits*

- Material: Plastic body, steel die
- Punching capacity of 10-12 papers

4. *Elongation Mechanism:*

- The joining and elongating mechanism between the two punching dies
- Material: steel
- Minimum length: 10mm
- Maximum elongation:80 mm

5. *Punching Spring:*

- Stiffness: 400 N/m
- Diameter: 7mm

VII. SPECIFICATIONS DESCRIPTION TABLE:

Weight:	254.41 gm
Material:	Plastic, Steel
Size:	Length (100mm)
Mechanism:	Independent of each other (stapling and punching)

VIII. ADVANTAGES:

- Simple and compact tool Design.
- Ease in Selecting the desired Mechanism.
- Independent Punching or Stapling mechanism.
- Minimum force required.
- Aesthetic design and proper finishing.
- Light weight and easy to carry.
- Simple and combined construction, thus considerably decrease in production cost.
- Ergonomically designed grip.

IX. CONCLUSION:

The study investigated different parameters dealing with the design of stapunch for integrating stapler and punching machine. It started with briefing the basic use of stapler and punching machine, and the objectives of integrating them. Survey carried out depicted the different tools with the same ideology and the flaws within them. Important factors were the basic designing parameters and the feasible tool required. Material selection was carried out in order to reduce the weight. Analysis helped in calculating the force required for punching. Thus, a combined tool with mulfunctionality of punching holes and stapling was designed for convenient use and reduce the wastage of resources used to produce both of them.

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