Design And Fabrication Of Automatic Paper Punching And Cutting Machine By Using Geneva Mechanism

D.Devaiah[1] , S.Saikrishna[2] , U. Shiva Kumar[3] , S.Vinay Kumar[4]

1. Associate professor, Department of mechanical engineering, Vaageswari College of Engineering, Karimnagar, T.S, India.

2, 3, 4 . Student, Department of mechanical engineering, Vaageswari College of Engineering, Karimnagar, T.S, India.

ABSTRACT

The design and fabrication of automated paper punching and cutting machine based on Geneva mechanism. The machine cut the papers equal lengths as well as punching based on geneva mechanism. The machine uses a 12V motor in order to drive the entire system. A shaft was used in this machine which is directly connected to the motor and cam drive by the support(frame). This shaft has a sprocket which is connected to scissors by a chain in order to drive the cutting mechanism for cutting paper. And also the cam drive is employed with slider crank mechanism which gives the motion to punching motion. Now another sprocket is connected to a geneva mechanism wheel. This wheel was used to drive paper feed into the cutter mechanism. When the motor is run through battery and the cam drive rotates clockwise direction then punching is doing on paper as well as cutting through chain drive here punching and cutting is doing on single operation. With this machine save the lot time.

1. INTRODUCTION

Thereis lot of competition in the market. So there is need of developing a new method or process for effective manufacturing. That process or methods should fulfill the requirement about accuracy Productivity. This represents the automatic paper cutting and punching machine by using Geneva mechanism. And it is the extension of the project both punching and paper cutting is done on single operation. This equipment is very accurate to cut and punching the papers. This concept will be mainly used in the paper manufacturing industry to cut the papers in huge numbers as well as in Xerox centers for punching. The equipment is fabricated in less cost and good efficient. The aim of this concept is to reduce the human fatigue and time savings in industries by eliminating the paper marking time and human need for punching. Here it has analyzed to use Geneva Mechanism. This is the mechanism used to get intermittent motions. This mechanism consists of the following parts like Geneva wheel, rotating disc, bearing, frame and DC motor. In industries the paper cutting machines go through a time taking process of paper marking which is required to cut the paper of required dimensions, so this model is designed by

using Geneva mechanism which eliminates the paper marking time and feeds the paper of equal length in each rotation. Geneva mechanism is used as a mechanism for transforming rotary motion into intermittent motion running with acceleration jumps at the beginning and the end of the active phases.

2.Literature review

The design and analysis of paper cutting machine based on Geneva was analyzed by Vijay et al. [1], they presented a comparison of the position, velocity, acceleration, and jerk between the classical Geneva wheel mechanism and the proposed mechanism. This analysis presents a kinematic study of a mechanism incorporating a Geneva analysis and succeeded largely due to its positive economic factors. The design and fabrication of paper cutting machine using Geneva mechanism is useful to cut papers in equal and accurate dimension. Kundan Kumar [2], he proposed system a design and fabrication of auto roll punching machine without Geneva mechanism in place of this mechanism uses motor and commutator and punching on work pieces based on we propose a punching on paper as well as sheets thus saving the lot of time. The analysis and synthesis of Geneva mechanism with elliptical crank has been studied by Han Jiguang Yu Kang [3],it has been analyzed that for both internal and external Geneva mechanism, the kinematics coefficient of the Geneva mechanism is a constant if the groove number of the Geneva wheel is a constant. The elliptic crank using as the drive crank of the Geneva wheel is equal to the mechanism which has a variable length and a variable speed along the elliptical moving crank. Therefore the kinematics coefficient of the Geneva mechanism can be changed. Hrones and Nelson [4], in their paper on Analysis of the Four-Bar Linkage gives review that a 4-bar mechanism is a basic 1-DOF (degree of freedom) mechanism. A 4-bar is created by selecting four link lengths and joining the links with revolute joints to form a loop. A wide variety of paths are possible by arbitrarily choosing a point on the coupler curve. These different curves can be obtained by constructing a physical model of the mechanism and viewing the path of various points without detailed mathematical analysis. In the Force analysis of the Geneva wheel and face cam in automat, Madhoo et al. [5], driven the automat using single motor for different operations. Here they focus on two main parts they are Geneva wheel and Face cam which are used for their respective operations. Geneva Wheel is used to index the drum which consists of 96 spindles. Due to this Geneva mechanism each of the spindles will hold the ceramic body when the drum is being indexed. Due to which there is a force which is generated in the Geneva wheel is in maximum and minimum position in Cutting mechanism by giving feed through Geneva mechanism. Kalisindhur et al. [6], designed a mechanism for cutting by giving intermittent feed. This intermittent feed is given by continuous rotation of circular disk in Geneva mechanism. We have designed a belt drive with the help of Geneva mechanism which is used for giving feed and gives smooth operation and smooth movement of the feed at required time interval. The feed from the Geneva drive was cut by using slotted lever

mechanism which was designed using slider crank mechanism. wheel and a gear train to achieve intermittent motion and was declared as a designated.

3. METHADOLOGY

This project is designed with using Geneva mechanism moving arrangement and punching mechanism. Punching machine is designed with mechanical arrangement in which movements are controlled by using Geneva mechanism.

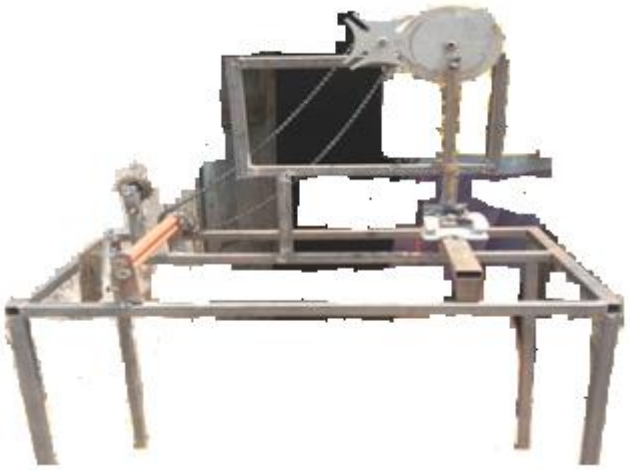

Fig.1 Punching and cutting machine using Geneva mechanism.

This machine consists of three sections. One section is automatic feeding mechanism and the second section is conversion of rotary motion into linear reciprocating motion of punching tool(slider crank mechanism) and third one cutting paper of equal lengths. The first section consists of Geneva wheel disc keyed to shaft at one end and the other end is connected with chain sprocket wheel. This Geneva wheel shaft is supported on nylon bushes. The sprocket is attached to wheel and transmit the rotary motion from the Geneva wheel to the feeding rollers through a chain drive. Hence when the Geneva wheel is rotated, the paper also moved for punching operation.

The second section consists of electrically operated DC motor, nylon bush, crank wheel with a pin, connecting rod and punching tool. The second section is used to convert the rotary motion of the crank wheel into reciprocating motion of punching tool. The rotating shaft is keyed to the crank wheel at one end and the other end is connected to DC motor. This shaft is supported on nylon bush. The punch tool slide is reciprocated by the connecting the crank wheel through the connecting rod .The paper is fed automatically by the rotation of Geneva wheel. The third section consist of paper cutting it consists of scissor connected to a sprocket through a shaft this scissor should be operated by spring action the entire section connected to a motor shaft. In these two operations are performed during the operation one is punching and another one is cutting paper of equal lengths.

4.Working principle and components the machine

When the motor is powered the cam drive disc is rotated. The linear rod which is attached to the cam drive disc with eccentricity from the center is reciprocated on the punching machine. The punching machine consists of a punch head, when the linear rod is moved down it presses the punch head. The punch head consists of punch tools which punches the paper in required manner. The rotating drive wheel has the pin that reaches into a slot of the driven wheel advancing into it by one step. The drive wheel also has a raised circular blocking disc that locks the driven wheel in position between steps. The Geneva drive or Maltese cross is a gear mechanism that translates a continuous rotation into an intermittent rotary motion. The rotating drive wheel has a pin that reaches into a slot of the driven wheel advancing it by one step. The drive wheel also has a raised circular blocking disc that locks the driven wheel in position between steps. In the most common arrangement, the driven wheel has four slots and thus advances by one step of 90 degrees for each rotation of the drive wheel. If the driven wheel has n slots, it advances by 360˚/N per full wheel rotation of the drive wheel. This driven wheel has sprocket connected to a rollers through chain drive which draws the paper after punching and then push the paper for cutting. At the cutting section by the four mechanism the cutting will takes place on paper of equal lengths.

4.1 Components used in the machine

Geneva wheel	12v motor
Shafts	Supporting frame
Paper rollers	Scissors
Connecting Rod	Shaft Connectors
Mini Punch Machines	Sprockets
Chains	springs, battery

4.2 Design of Geneva mechanism

- Geneva wheel radius (b) = 75 mm
- No. of slots in Geneva wheel (n) = 4
- Drive pin diameter (p) = 8 mm
- Allowed clearance (t) = 2 mm
- Centre distance (c) = $\frac{b}{\cos(\frac{180}{n})} = \frac{75}{coc(\frac{180}{4})}$ = 106 mm
- Drive crank radius (a) = $\sqrt{c^2-b^2} = \sqrt{106^2-75^2}$ = 75 mm

- Slot center length (s) = (a + b) - c = (75 + 75) – 106 = 44 mm
- Width of slot (w) = p + t = 8 + 2 = 10 mm
- Angle between two slots (θ) = 2 x 180/n = 2 x 180/4 = 90º
- Angle at the entrance of the pin into the slot (Ø) = 45º
- Stop arc radius (y) = a – (p x 1.5) = 75 – (8 x 1.5) = 63 mm
- Thickness of Geneva wheel (h) = 6 mm
- Stop disc radius (z) = y – t = 63 – 2 = 61 mm
- Thickness of crank drive (i) = 9mm
- Height of pin = h + t = 6 + 2 = 8mm
- Distance of drive pin from the center of the disc (a) = 75 mm
- Number of revolutions per minute (N) = 51 rpm
- Total cycle time (Tc) = 1/N = 1/51 = 0.0196 min
- Available service time per cycle (Ts) = (180 + θ)/360 x N = (180 + 90)/360 x 51 = 0.014 min
- Dwell time or processing time (Td) = (180-θ)/360xN

  = (180-90)/360x51

  = 4.901 x 10-3 min

4.3 Auto cad design of Geneva wheel

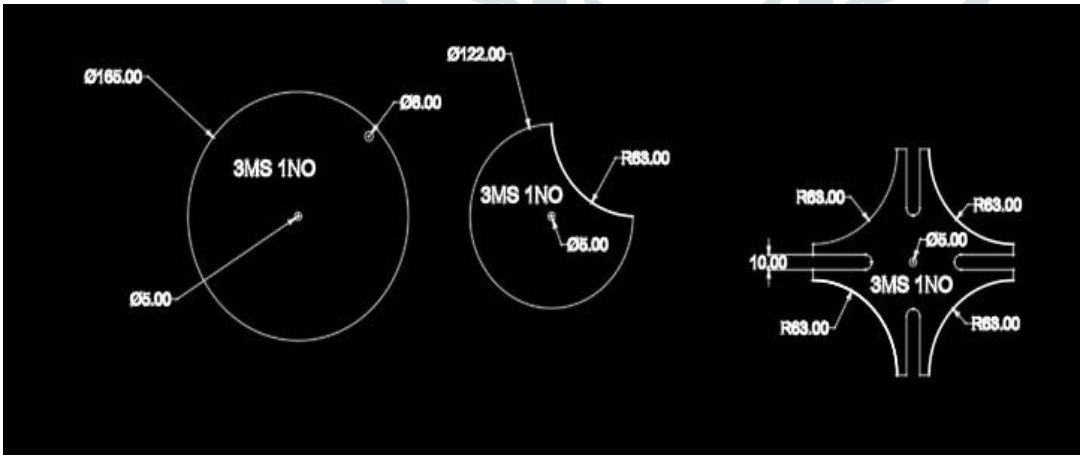

Fig.2 The Geneva wheel for paper cutting machine

5. Result and discussion

The punching and cutting was possible by combining both machines as a new one called design and fabrication of automatic punching and paper cutting machine by using geneva mechanism the operation of cutting and punching is done on paper one by one in which a hole is punching on paper after that cutting will takes on paper the obtained shape size of the paper is dependent upon feed of the paper through roller which is driven by geneva mechanism which converts rotary motion to intermittent motion so indirectly the number of slot of geneva are playing roll in feeding the amount of paper. Thus to get the A-4 size cut of paper, intermittent motion need to change accordingly and compared with the standard size with most efficient outcome by consuming less power and energy given to system thus aim was achieved by paper cutting and punching machine using Geneva mechanism.

6. Conclusions

The design and fabrication of a automatic paper punching and cutting by using geneva mechanism is very use full for small scale industries There are machine based on paper cutting and punching but it has demerits like large in size, costly, need skilled labours to operate and it need electrical input. But we have our machine which will overcome this demerit by compact size, less cost no need for skilled people and there is no need of electrical input. The mainaim of this machine is to reduce timing for paper cutting and neglect the time for marking the paper. And it very useful for marking series of holes of same diameter and constant pitch thus it can be useful for punching applications and also one advantage when cutting is not required we can able to remove chain from the motor to cutter and punching is carried out This aim can be achieved by our machine.

7. REFFERENCE

[1] Vijay Kumar U, Ghanshyam Kumar, DhareshBansod, Deepak Sahu, RishabhBendre and AakankshaSuryawanshi, Design and Analysis of Paper Cutting Machine work on the Geneva Mechanism, IJARIIE, 2(2), 2016, 35-43.

[2] Kundan Kumar, "DESIGN AND FABRICATION OF AUTO ROLL PUNCHING MACHINE", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, Special Issue 8, May 2016, 96-104.

[3] Han Jiguag Yu Kang, Analysis and Synthesis of Geneva Mechanism with Elliptic Crank, International Journal of Hybrid Information Technology, 8(8), 2015,253-260.

[4] Hrones J. A. and Nelson G.L., Analysis of the Four-Bar Linkage,IJARIIE, 1(5), 1951, 15-20.

[5] Madhoo G, Mohammed Sameed, Mohsin Ali and Ashwin C Gowda, Force Analysis of Geneva Wheel and Face Cam Used In Automat, International Journal of Engineering Research and Applications, 4(6), 2014,73-88.

[6] P.Kalisindhur, Y.Karthik, T.Vijay, Y.Sasikanth and G.SriHarsha, Cutting mechanism by giving feed through Geneva Mechanism, IJISET,2(4), 2015, 1172-1175.