THE SELF ACTIVATING PAPER MIXING MECHANISM AND PROCESS THEREOF

Chintan A. Prajapati

Assistant Professor in Mechanical Engineering department
Swarnim startup and innovation university, Gandhinagar, Gujarat, INDIA.

Abstract

The present invention relates to printing industry where the challenge is of mixing original and duplicate copies of bill books. Currently in the present days it is carried out laboriously with manual operation, so it leads to delay in delivery and also there is high chance of failure. To dwindle down this kind of failures the present invention is trying to make a self-activating paper mixing machine with a help of components like compressor, vacuum nozzle, vacuum tubes, AC motor, and the like. Today's generation is so advanced and innovative that everyone wants their work to be accomplished as early as possible. So, this apparatus provides a method of processing at very minimum probability of errors, enhanced quality and increased output when compared to manual operation. The present invention also provides advantages in cost, rate of paper mixing, so delivery can be done on time. This machine can assist and promote productivity and product quality.

Keywords—*vaccum plunger, vaccum pump,timer belt, etc*

INTRODUCTION

The present invention generally relates printing industry, and more particularly, to a paper feeding machine and

mixing process thereof. In view of the disadvantages inherent in the above cited prior arts, the present invention primarily relates to a paper feeding machine and process thereof which enhances the productivity and is time efficient. The aforementioned aspects along with the objectives and the advantages can be achieved as described herein. In one aspect of the present invention the original and duplicate copies are loaded in paper loading frame at both sides. Loaded paper is Locked by paper lock.

In one aspect of the present invention as power supply starts, motor starts running. Speed of machine varies by different size of pulley. Timing of paper mixing is set by fly wheel. After that Vacuum Compressor starts and vacuum is created in vacuum nozzle. In one aspect of the invention the exhaust air from vacuum compressor is fed to loaded paper. Because of vacuum pressure, paper is picked and transferred on feed roller. And collected in collector.

EASE OF USE

Paper mixing machine is an automatic machine which runs on mechanical principles so all who has a knowledge of offset printing machine they can operate paper mixing machine easily. As well as its maintenance is less because there is no electric part or coding is required for operating. Also as per design we fixed a knob which set on paper size and weight so there is no requirement to adjust vacuum pressure.

B..BACKGROUND OF THE INVENTION

Paper feed apparatus for offset printing machines and the paper feeding mechanism have been disclosed in various prior arts.
1. The invention US4454466A discloses a paper discharging device for an offset printing machine, an object of which is to make it feasible for the portion from a gripper to the surface on which the papers are

discharged to be kept at a desired height, so as to improve the proper arrangement of the papers when the same are discharged. The process of adjusting the height of the table in the midst of printing is avoided by constructing the apparatus in such a way that the table is lowered when the papers are discharged and is not lowered when papers are not discharged.
2. Another patent US4146217 discloses an improvement in the feeding of paper sheets in an offset printing machine which can be used for sheets of different weights so that such sheets can be fed equally

into an offset printing machine without getting jammed in the machine.

3.   Another patent CN2706317Y relates to an offset printing press feed reverse mechanism with high printing precision on both sides of the paper.

4.   In another invention US5172900A discloses a paper feeding mechanism which achieves stable paper feed and double paper feed prevention.

5.   In yet another invention US6877736B2 discloses a roller apparatus for automatic paper feeding mechanism, wherein a sun and planet wheel matched with an elastic component and a differential structure are exploited to effectively control the downward paper-leading action of a paper-in roller.

Because of the foregoing problems, a need has arisen for an improved paper feeding process which enhances productivity, saves time and incurs low maintenance cost in the printing industry.

DESIGN DISCRIPTION.
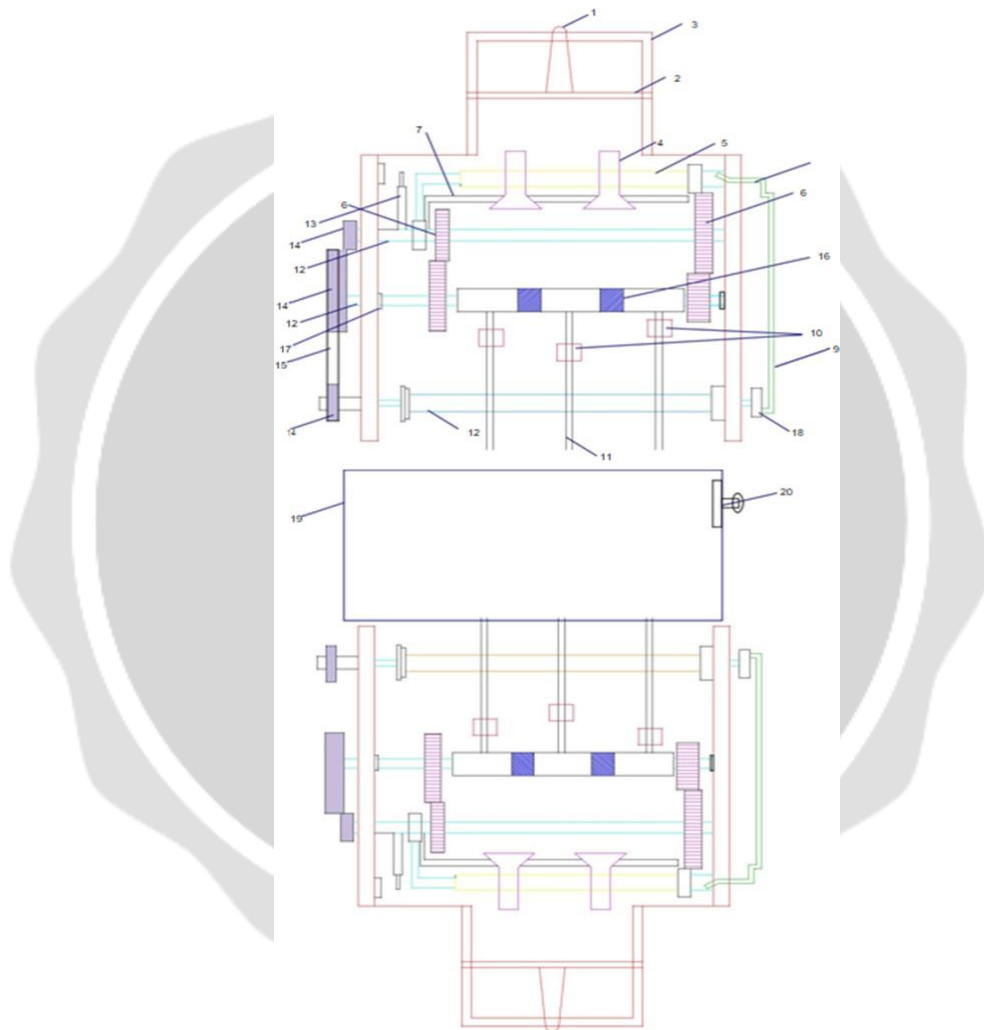
The principles of operation, design configurations and evaluation values in these non-limiting examples can be varied and are merely cited to illustrate at least one embodiment of the invention, without limiting the scope thereof.

The embodiments will be described in detail with corresponding marked references to the drawings, in which the illustrative components of the invention are outlined. The embodiments disclosed herein can be expressed in different forms and should not be considered as limited to the listed embodiments in the disclosed invention. The various embodiments outlined in the subsequent sections are construed such that it provides a complete and a thorough understanding of the disclosed invention, by clearly describing the scope of the invention, for those skilled in the art.

As illustrated in Fig 1 of the present invention it relates to a paper feeding mechanism which comprises a vacuum compressor; a motor; spaced side walls (not seen) having a paper loading trolley (3); a paper locking means (1); at least one vacuum nozzle (4); a paper unloading trolley (19) for receiving a stack of paper which is

controlled by a gear chain mechanism (20); a feed roller (16) mounted between the side walls for rotation; a runner belt (11) attached to the feed roller (16) driven by runner (10); wherein the runner belt is attached to the paper unloading trolley (19).

In another embodiment, the present invention discloses a process of paper feeding mechanism which comprises loading of paper stacks in paper loading trolley (3); the loaded paper stacks are locked in by the paper lock (1). When the power supply is switched on, the motor starts operating thereby turning on the vacuum compressor and vacuum is created in the vacuum nozzle (4).

The exhaust air from the vacuum compressor is fed to the loaded paper. Due to the build-up of vacuum pressure, paper picked from the paper loading trolley (3) is transferred onto feed roller (16). The paper from the feed roller (16) moves through the runner belt (11) driven by means of runner (10). The paper from the runner belt

(11) is collected in the paper unloading trolley (19) wherein the upward and downward motion of paper unloading trolley (19) is controlled by gear chain mechanism. The speed of machine depends on the different sizes of pulley (14). The vacuum pressure is cut by vacuum cut off valve (13)

As per one embodiment of the present invention is to provide a paper feed apparatus for offset printing machines and the paper feeding mechanism comprising of; *spaced side walls having a paper loading trolley (3);*

    iii.   a paper locking means (1);

    iv.   at least one vacuum nozzle (4);

    v.   a paper unloading trolley (19);

    vi.   a feed roller (16);

    vii.   a runner belt (11);

    viii.   paper unloading trolley (19)

➢ DESIGN SPECIFICATION

1. 1/2 hp motor
1440 rpm motor ac motor
For speed control deemer (1/2 hp) **2.Shaft**
14 mm shafting
3. Fly wheel for timing setting
13 mm hole in Fly wheel 5 inch diameter
4. Gear system file up down
timer change R41 chain diameter R41
5. chain system Conveyor belt 8 mm (5 belt) diameter 13 inch Increase
conveyer belt size-
13 to 17 inch conveyer belt for LEGAL paper size
6. Timer belt pulley -
8mm pulley hole , 2,25 inch diameter 3pully running - d50 timer belt
7. Paper feeding power from motor through belt - 2490 timer belt
8. Compressor running by 1/2 motor Capacity (40- 250 GSM)
9. suction nozzle outer diameter 10 mm inner diameter 7 mm 5
mm hole
10. paper feeding runner roller length 46 mm
11. tube for vacuum supply
around 5 meter length , 1.3 cm diameter

➢ **Require Vacuum Pressure Calculations**

    i.   vacuum compressor;

    ii.   a motor;

- For Standard Size A0 70 GSM Paper

- Weight is 70 Gram

- Size of A0 = **16** (A4 size paper)

For, 70 GSM A4 Size paper Wight = 70 / 16

$$= 4.375 \text{ Gram}$$

$$= 0.004375 \text{ kg}$$

☐ **Calculation For A4 70 GSM Paper**

☐ Equation $F_{th} = \text{mass} \times g \times \text{FOS}$

    Where, F_{th} = Theoretical Holding Force , N m = mass , kg

    g = Gravitational Force (9.81), m/s^2 FOs = Factor of Safety

    For, 70 GSM to 110 GSM = 1.5

    110 GSM to 250 GSM = 2

    ☐ **$F_{th} = (0.004375) \times (9.81) \times (1.5)$**

$$= 0.0643781 \text{ N}$$

☐ **F_s = Suction Force**

☐ **$F_s = F_{th} \div n$**

    n = number of Nozzle

$$Fs = 0.0643781 \div 2$$

$$= 0.03218 \text{ N}$$

❖ **Suction Pressure (P) = F_s /2A**

    ➤ A = Nozzle Area = $\prod D2 \div 4$

$$= \prod (0.005)2 \div 4$$

$$= 1.96 \times 10^{-5} \quad \text{m}^2$$

❖ Require Vacuum pressure

$$P = 0.03218 \div 2(1.96 \times 10^{-5})$$

= 819.447 Pa

$\tilde{}$ = 0.819 Kpa

= 0.1187 psi

☐ **Calculation For A_4 40 GSM Paper**

- mass of 40 gsm A_4 paper

  = 40 gsm A_0 paper sheet ÷ 16

  = 2.5 gram

  = 0.0025 kg

- Equation F_{th} = mass × g × FOS

- Where, F_{th} = Theoretical Holding Force , N m = mass , kg

  g = Gravitational Force (9.81), m/s² FOs = Factor of Safety

     For, 70 GSM to 110 GSM = 1.5

      110 GSM to 250 GSM = 2

- **F_{th} = (0.0025) × (9.81) × (1.5)**

  = 0.03678 N

- **F_s = Suction Force F_s = F_{th} ÷ n**

  n = number of Nozzle F_s = 0.03678 ÷ 2

  = 0.01839 N

❖ **Suction Pressure (P) = F_s/2A A = Nozzle Area = $\prod D^2 ÷ 4$**

                = $\prod (0.005)^2 ÷ 4$

                = 1.96×10^{-5} m²

❖ Require Vacuum pressure P = 0.01839 ÷ 1.96 × 10^{-5}

   = 468.40 Pa

   $\tilde{}$ = 0.46840 Kpa

   = 0.0679 psi

→ Table of mass for different GSM paper of A4 (16 paper sheet of A4 = A0 sheet)

Types of GSM	40	60	70	90	110
Ao size sheet weight (gram)	40	60	70	90	110
A4 Sheet Weight (Gram)	40/16 =2.5	60/16 =3.75	70/16 =4.375	90/16 =5.625	110/16 =6.875

(Table 1)

→ Table of mass for different GSM paper of Legal (13 paper sheet of legal = A0 sheet)

| Types of GSM	40	60	70	90	110
Ao size sheet weight (gram)	40	60	70	90	110
A4 Sheet Weight (Gram)	40/13 =3.07	60/13 =4.61	70/13 =5.38	90/13 =6.92	110/13 =8.46

(Table 2)

RESULT

 i.   Advantageous in saving time.
 ii.   The worker can be used for other work. So that production rate increases.
 iii.   Productivity is increases.
 iv.   Also Net Profit increases.
 v.   Over all Price of bill book printing decreases per unit.
 vi.   More customers satisfaction because of fast working.
 vii.   Apply in all bill book printing Industries.
 viii.   Can provide premium bill book by using of carbonless paper.
 ix.   can able to feed 40gsm to 110 gsm paper with 5000 copies per hour speed.
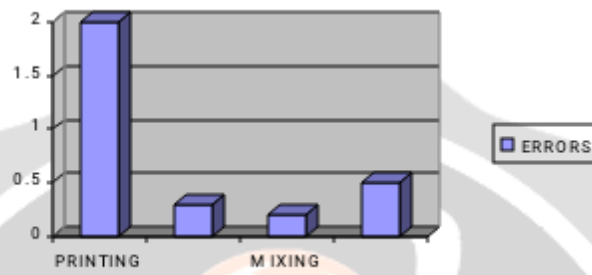
Generally all of printing machine purchased from out of countries so machine maintenance cost is high. but for our innovation has no that type of problem means low maintenance.

As after survey we get result which so errors difference between conventional and advance manufacturing process of bill book.

☐   Below chart shows results for ten bill books of 100 pages two copy.

☐   where in conventional process manufacturing time is approx 4 to 5 hours while it's fall down at 1 to 1.5 hours if we use paper mixing machine.
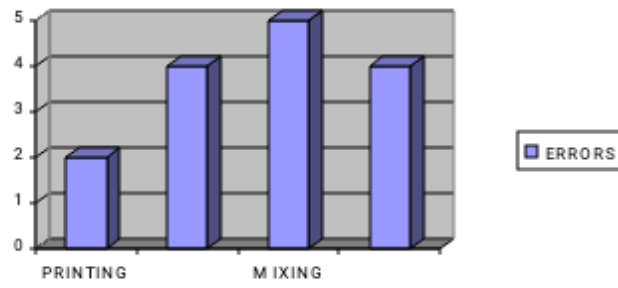
(Before Using Paper Mixing Machine)

(After Using Paper Mixing Machine)