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Tsukamoto

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[54] **SHEET PAPER FEED OUT DEVICE IN COPIER**

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[52] **U.S. Cl.** **271/126**, 271/160

[51] **Int. Cl.** **B65h 1/04**, B65h 1/12

[58] **Field of Search** 271/39, 22, 126, 128, 147, 271/160

[56] **References Cited**

UNITED STATES PATENTS

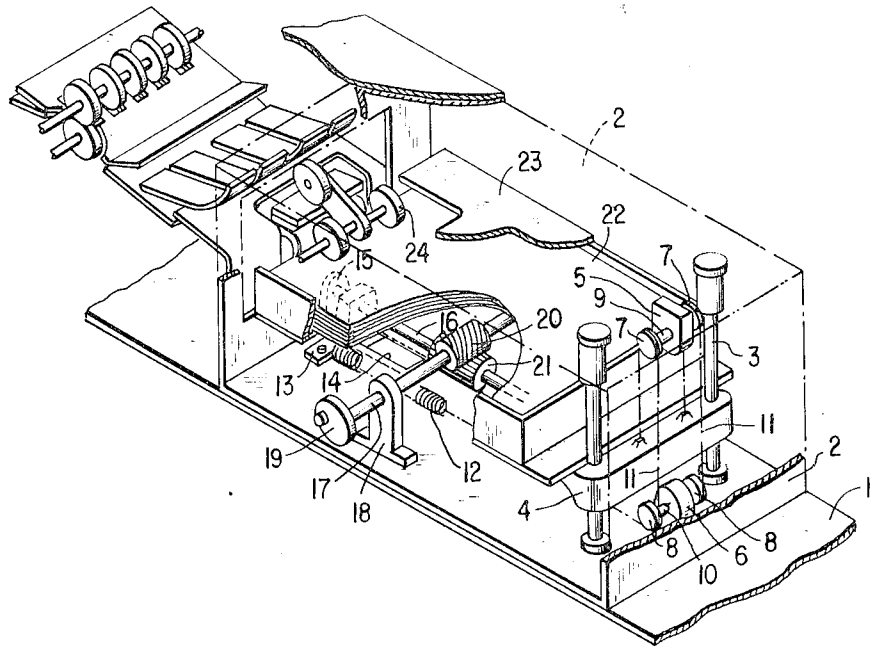
749,113	1/1904	Sternberg	271/39
852,100	4/1907	Bullaro	271/39
937,017	10/1909	Adams	271/39
1,061,584	5/1913	Armstrong	271/39
1,478,464	12/1923	Waters	271/39 X
3,165,313	1/1965	Limberger	271/39 X

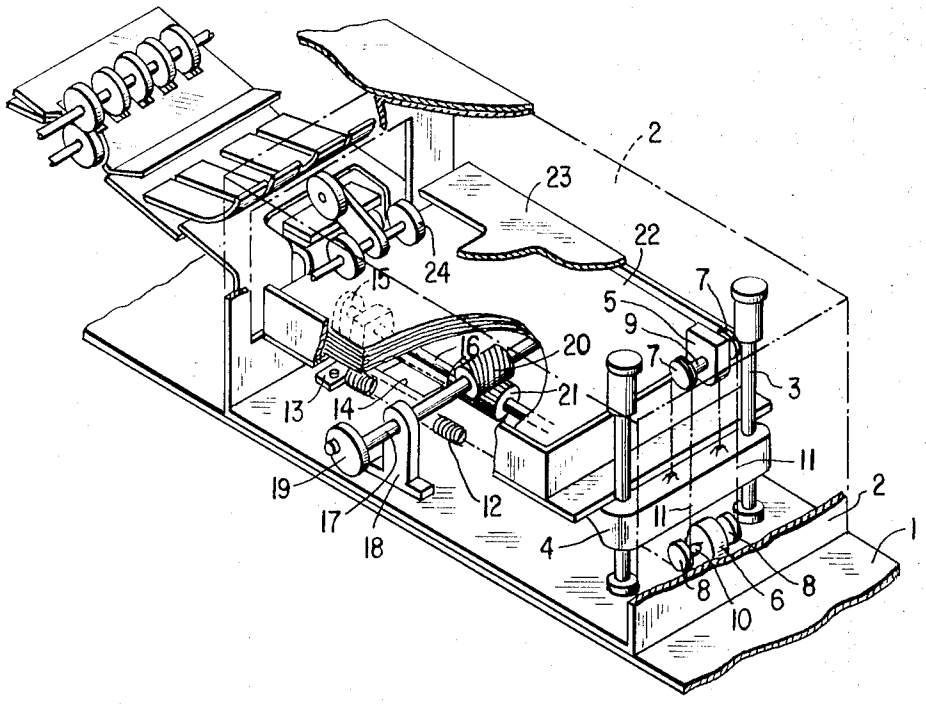
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[57] **ABSTRACT**

Sheet papers are piled up on a lifter which is spring biased upward and the uppermost paper is in pressed contact with a set of feed out rollers. The feed out rollers are rotatably provided at a fixed position and the papers are pressed thereon from underneath. The force by which the papers are pressed on the feed out rollers is controlled to be constant regardless of the number of sheets of papers by controlling the force of the spring for biasing the lifter upward.

5 Claims, 1 Drawing Figure




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SHEET PAPER FEED OUT DEVICE IN COPIER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a sheet paper feed out device in a copier, and more particularly to a paper feed out device using feed out rollers in a copier wherein the papers are fed one by one from a stack of papers.

2. Description of the Prior Arts

Heretofore, there have been two types of rollers used in this kind of sheet paper feed out device, one of which is a so-called arm type roller wherein feed out rollers are mounted to an end of arms which are rotatably supported at the other end thereof, and the other of which is a weight type roller wherein a lifter for lifting papers is normally urged upward on stationary feed out rollers by means of a weight, for urging the lift upward.

The above-mentioned prior arts, however, have been disadvantageous in practical use. In case of the arm type sheet paper feed out rollers, for example, it is very difficult to determine the shape of a guide plate provided downstream of the feed out rollers since a feed out angle of the arm type feed out rollers varies as the number of the sheet papers decreases. In case of the weight type feed out rollers, mis-feed out of the sheet papers is liable to occur since the pressure of the sheet papers on the feed out rollers varies as the number of the sheet papers decreases. Further in the latter case, the number of sheet papers which can be piled up on the lifter is limited.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide an improved sheet paper feed out device wherein the guide plate can be easily designed with a constant feed out angle of the papers.

Another object of the present invention is to provide an improved sheet paper feed out device wherein the passage of the sheet papers fed out is always at a fixed position regardless of the number of sheet papers left so that the design of the guide plate can be easily made.

Still another object of the present invention is to provide a sheet paper feed out device in which the pressure on the feed out rollers exerted by sheet papers is made constant at its optimum value.

A further important object of the present invention is to provide a sheet paper feed out device in which mis-feed of sheet papers is remarkably reduced.

In order to accomplish the above objects, the sheet paper feed out device in accordance with the present invention employs spring means for urging a lifter upward and making sheet papers on the lifter be pressed on feed out rollers driving at a fixed position. The force of the spring means is reduced as the number of sheet papers on the lifter decreases so that the pressure of the papers on the feed out rollers may be kept constant and the passage of the papers fed out of the stack of papers on the lifter may be at a constant position.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE is a perspective view partly broken showing an embodiment of the sheet paper feed out device in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Now referring to the drawing, the reference numeral **1** shows a copier body, **2** shows a frame fixed to and within said body **1** for retaining a sheet paper feed out device therein, **3** shows guide poles vertically provided in the frame **2**, and **4** shows a lifter movable up and down along said guide poles **3** by way of bearings and the like. The reference numerals **5** and **6** respectively show support members fixed to the upper surface and lower surface of the internal wall of the frame **2** for supporting shafts **9** and **10** of chain wheels **7** and **8**. The reference numeral **11** shows a pair of chains fixed at one end thereof to the upper surface of said lifter **4** and fixed at the other end thereof to an end of tensions springs **12** and tensioned therebetween by way of said chain wheels **7** and **8**. The reference numeral **13** shows a slider engaged with the other end of said tension springs **12** which can be moved along a dove-tail groove **14** provided on the bottom of said frame **2**. The slider **13** is further engaged with a screw rod **16** screwed therein which is rotatably supported by a bearing **15**. The screw rod **16** is provided with a worm wheel **21** fixed thereon which is in turn engaged with a worm **20** fixed on a control shaft **17** rotatably supported by a bearing **18**. The control shaft **17** is provided at an end thereof with a handle **19**, by the rotation of which the screw rod **16** is rotated through said worm **20** and worm wheel **21**, whereby the slider **13** is moved back and forth along the groove **14** to control the tension of the springs **12**.

The selection and control of the springs **12** is determined by taking the weight W_1 of the maximum number of sheet papers **22** (papers retained in a cartridge **23** in the embodiment shown in the drawing), the weight W_2 of the cartridge **23**, the weight W_3 of the lifter, and the optimum pressure P of the sheet papers **22** on the feed out rollers **24** driven at a fixed position into consideration. In this consideration, the selection and control of the springs **12** is conducted so that the following relationship may be always satisfied where x_1 and F_1 are a displacement and force of the spring **12** when the maximum number of sheet papers **22** are set and x_2 and F_2 are a displacement and force of the springs **12** when all the sheet papers **22** are fed out and the number thereof becomes zero.

$$F_1 = kx_1 = P + W_1 + W_2 + W_3$$

$$F_2 = kx_2 = P + W_2 + W_3.$$

What is claimed is:

1. A sheet paper feed out device comprising

at least one feed out roller for feeding out sheet papers by friction;

a lifter for lifting a stack of sheet papers located under said feed out roller;

at least one tension spring for urging said lifter upward toward said feed out roller and pressing the stack of sheet papers against said feed out roller;

at least one cable connected to the top of said lifter for moving said lifter vertically;

pulley means for connecting said cable to one end of said tension spring; and

tension control means connected to the other end of said tension spring so that the maximum tension in said spring, which occurs when the lifter is fully loaded with said sheet papers, and the minimum tension, which occurs when the lifter is unloaded,

may be adjusted to keep the spring force substantially constant regardless of the number of sheet papers on the lifter.

2. A sheet paper feed out device as in claim 1 including at least one vertically disposed guide pole along which said lifter is guided, the lifter having an opening therein for receiving the guide pole.

3. A sheet paper feed out device as in claim 2 where at least one bearing is provided in said opening for facilitating the movement of said lifter along said guide pole.

4. A sheet paper feed out device as in claim 3 where said tension spring is disposed in a plane beneath and parallel to the plane of said lifter.

5. A sheet paper feed out device comprising at least one feed out roller for feeding out sheet papers by friction;

a lifter for lifting a stack of sheet papers located under said feed out roller;

at least one tension spring for urging said lifter upward toward said feed out roller and pressing the stack of sheet papers against said feed out roller, said tension spring being disposed in a plane beneath and parallel to the plane of said lifter;

at least one cable connected to the top of said lifter for moving said lifter vertically;

pulley means for connecting said cable to one end of said tension spring;

at least one vertically disposed guide pole along which said lifter is guided, the lifter having an opening therein for receiving the guide pole and where at least one bearing is provided in said opening for facilitating the movement of said lifter along said guide pole;

a slider connected to the other end of said tension spring for controlling the tension in said tension spring so that the maximum tension in said spring, which occurs when the lifter is fully loaded with said sheet papers, and the minimum tension, which occurs when the lifter is unloaded, may be adjusted to keep the spring force substantially constant regardless of the number of sheet papers on the lifter; and

manual control means for moving said slider in the longitudinal direction of said spring, said manual control means being disposed outside of said sheet paper feed out device.

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