

[54] **PAPER FEED APPARATUS FOR GRIPPER-TYPE PAPER TRANSPORT DEVICE**

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[58] Field of Search 271/10, 12, 13, 6, 7, 4, 271/16, 17, 204, 206, 277, 275, 265, 266, 270, 202, 242, 243, 258, 259, 229, 110, 111

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[57] **ABSTRACT**

A paper feed device for a gripper-type paper transport device where sheets of paper are individually fed from a stack. Each sheet is detected by a first detector to stop the sheet in an unbuckled condition at a standby position. When the gripper of the transport device reaches the standby position it is opened and in response to its opened condition, a second detector is actuated to restart the feeding of the paper sheet into the open gripper where the paper is fed at a speed faster than that of the gripper. After the paper is fed into the gripper, means are provided for closing the gripper so that the paper can be transported thereby.

6 Claims, 3 Drawing Figures

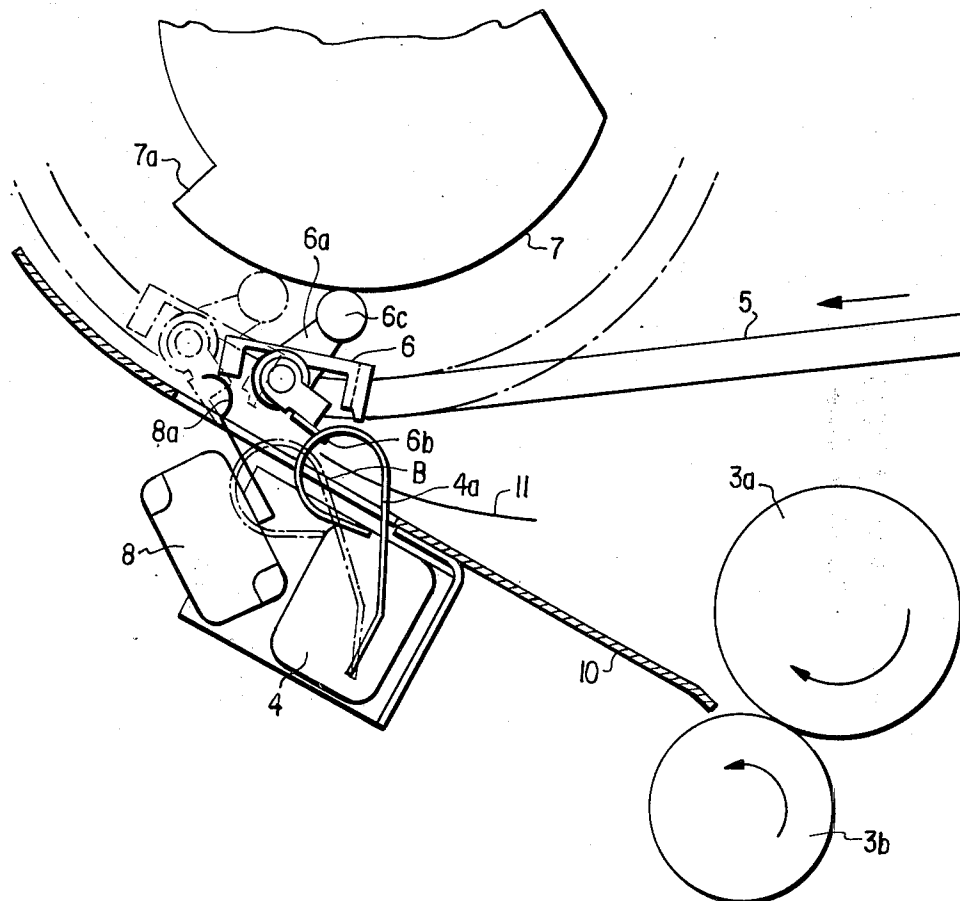


FIG. 1

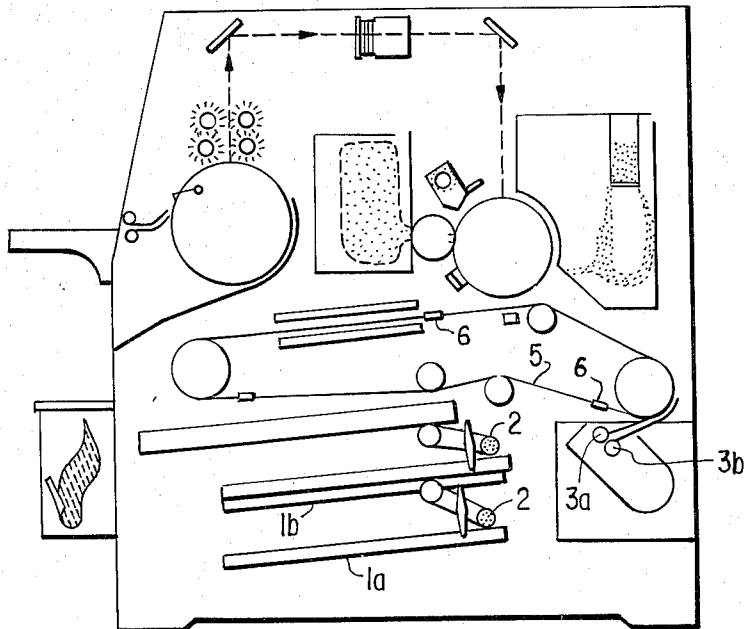
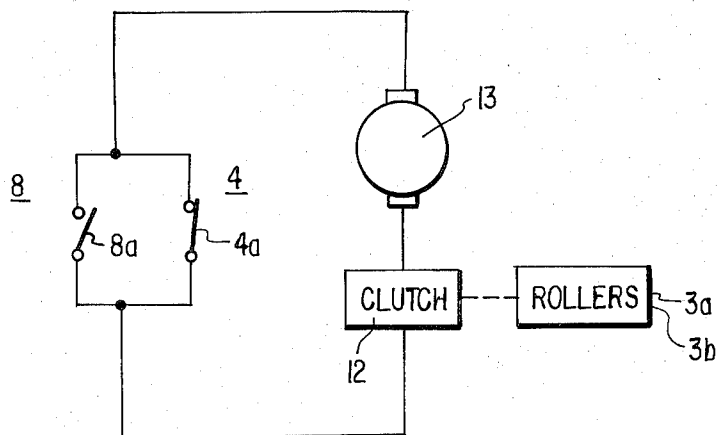


FIG. 3



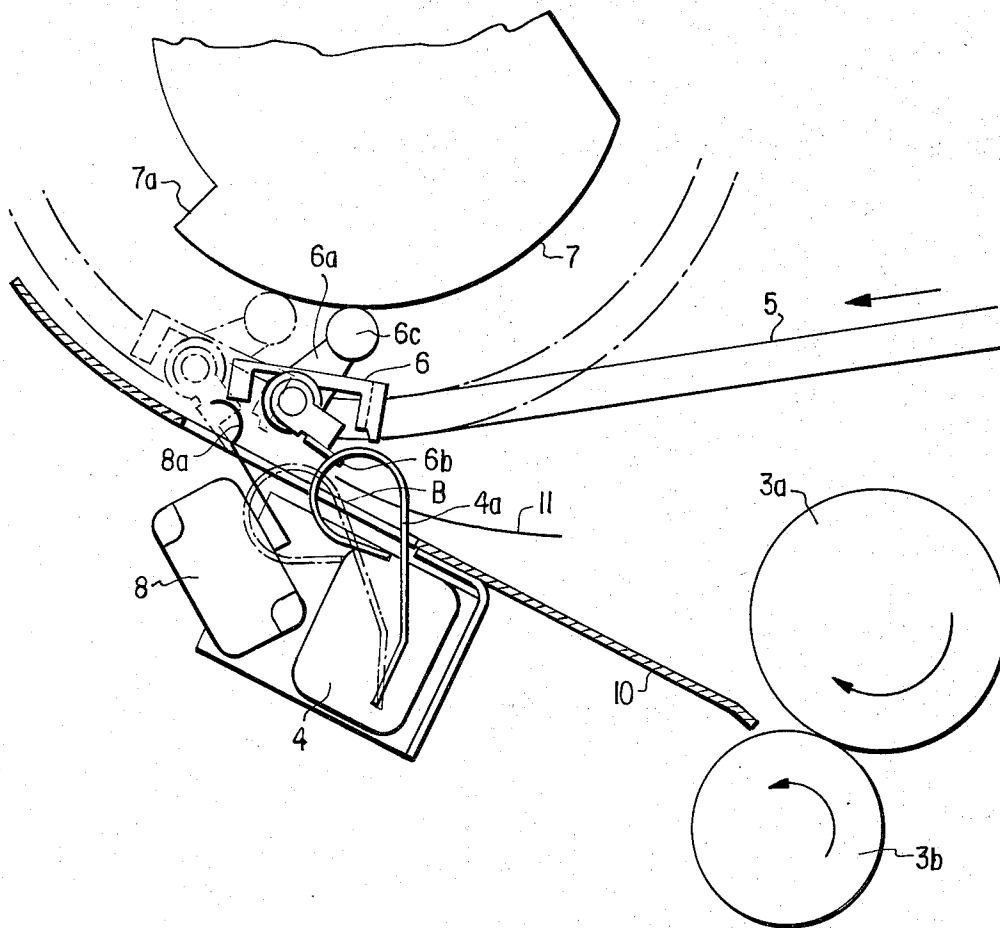


FIG. 2

PAPER FEED APPARATUS FOR GRIPPER-TYPE PAPER TRANSPORT DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a paper feed device for use with a printing machine or a copying machine, and more particularly, to a paper feed device in which a chain gripper is used for transferring a sheet of paper.

Other objects and advantages of this invention will become apparent upon reading the appended claims in conjunction with the following detailed description and the attached drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic view of a paper feed device according to the present invention, in which the paper feed device is used in an electrophotographic copying machine.

FIG. 2 is a side view showing an outline of a paper feed device according to a preferred illustrative embodiment of the present invention.

FIG. 3 is a schematic diagram of an illustrative circuitry associated with the paper feed device of this invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

A preferred embodiment is illustrated in FIG. 1 where a paper feed device of the present invention is used in an electrophotographic copying machine. Sheets of paper are fed one by one from a pair of paper feed trays 1a and 1b by means of feed rollers 2 and transferred leftwardly in FIG. 2 by a pair of feed rollers 3a and 3b as shown in FIG. 2. The leading edge of each sheet of paper depresses a contact 4a of a micro-switch 4 attached at a predetermined position to a baffle 10, the contact 4a extending through an opening in baffle 10. When the leading edge reaches a point B, the micro-switch is turned on and an electromagnetic clutch 12 (see FIG. 3), which operatively connects feed rollers 3a and 3b with a driving source 13, is rendered inoperative thereby stopping the rotation of the pair of feed rollers 3a and 3b. Hence, the transfer of the sheet of paper is stopped at a paper standby position.

Subsequently, a normal rotating chain gripper 6 mounted on a paper transfer chain 5 comes to assume a position above the sheet of paper, the chain gripper 6 having a pawl 6b rotatably attached on a pivot shaft 6a journaled in the gripper and adapted to be opened. Levers 6c are also provided at both ends of shaft 6a. The levers 6c are urged downwardly by a cam 7 to open pawl 6b. When the apex of the opened pawl 6b comes across the leading edge of the sheet of paper, the chain gripper 6 pushes a contact 8a of a micro-switch 8 disposed adjacent to the end of baffle 10, the contact 8a extending through an opening in baffle 10. The aforementioned electromagnetic clutch again becomes operative to connect the feed rollers 3a and 3b with the aforementioned driving source thereby rotating the pair of feed rollers 3a and 3b and thus the sheet of paper is again transferred leftwardly in FIG. 2.

The circumferential speed of feed rollers 3a and 3b is 20 percent greater than the linear velocity of the chain gripper 6, such that the leading edge of the sheet of paper catches up with the pawl 6b and eventually is inserted into the clamp portion thereof. The sheet of paper, while in the clamp portion, is further advanced

until the leading edge thereof contacts a wall provided in the chain gripper 6 so that registration of the sheet of paper is effected.

As chain gripper 6 continues to be moved by chain 5, the lever 6c becomes disengaged from cam 7 at portion 7a and the pawl of chain gripper 6 is closed. Thus, the chain gripper 6 continues to travel with its pawl clamping the sheet of paper.

In the embodiment described, micro-switch 8 is operated by chain gripper 6, and a cycle-switch may be separately provided for serving as a timer in like manner with the above embodiment.

In order to further ensure the positioning of the sheet of paper at the paper standby position B, an electromagnetic brake may be attached to feed rollers 3a and 3b as to act in a reverse manner to the ON-OFF operation of the driving electromagnetic clutch. Further, to prevent floating of the sheet of paper when it contacts contact 4a of micro-switch 4, a keep plate 11 may be provided. Thus, probability of retention of paper sheets at baffle 10 is lessened.

The paper feed device according to the present invention, although the paper feeding mechanism is simple, can positively feed a sheet of paper to a paper standby position where it awaits to be gripped by a travelling gripper means. It is further positively fed from the standby position to the gripper means so that it can be firmly held thereby.

Referring to FIG. 3, there is shown illustrative circuitry for use with the paper feeding device of this invention. With switches 4 and 8 set as shown in FIG. 3, a sheet of paper is fed from one of the trays 1a or 1b and when the paper standby position is reached, switch 4 is opened to de-energize clutch 12 and stop rollers 3a and 3b. The paper sheet waits until the gripper 6 opens, which causes switch 8 to close and thus re-energize clutch 12 which feeds the paper sheet into the open gripper. After the gripper closes, the switch 8 opens and the gripper removes the paper sheet from the standby position, the gripper being connected to the paper transfer chain 5, which is driven by a separate power source not shown. After the paper sheet is removed from its standby position, switch 4 returns to the closed position to complete the feeding of the standby position. Thus, the above-described cycle is ready to be repeated.

Numerous modifications of the invention will become apparent to one of ordinary skill in the art upon reading the foregoing disclosure. During such a reading, it will be evident that this invention provides a unique paper feed device for accomplishing the objects and advantages herein stated.

What is claimed is:

1. A paper feed device for feeding sheets of paper from at least one receptacle therefor, said device comprising:

paper feeding means for feeding sheets of paper from said receptacle at a first rate of speed;
first detecting means responsive to the presence of each of said sheets of paper for rendering said paper feeding means inoperative and stopping each said sheet of paper in a substantially flat condition at a predetermined paper standby position;
chain delivery means having a gripper for clamping each sheet of paper, the locus of said chain delivery means being adjacent to said paper standby position, and the linear speed of said gripper being less than that speed at which said paper sheets are fed;

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means for opening said gripper when it is adjacent said paper standby position;

second detecting means for restarting said paper feed means in response to an opened condition of the gripper when the gripper is adjacent the paper standby position to feed each paper sheet from its standby position into the open gripper; and means for closing said gripper after each paper sheet has been fed into the open gripper so that the paper sheets may be removed from said standby position and transferred by said chain delivery means.

2. A paper feed device as in claim 1 where said first detecting means includes first switching means having a contact disposed in the travel path of said paper sheets, said paper sheets depressing said contact to operate said first switching means, said paper feeding means being responsive to the operation of said first switching means for stopping said paper sheet at said paper standby position.

3. A paper feed device as in claim 2 including means for maintaining said sheets of paper along their path of travel as they depress the contact of said first switching means.

4. A paper feed device as in claim 2 including a drive means for said paper feed means, said first switching means disconnecting said drive means from said paper feed means when said first switching means is operated.

5. A paper feed device as in claim 2 where said second detecting means includes second switching means having a contact disposed in the travel path of said gripper, said gripper, upon being opened, pushing said last-mentioned contact to operate said second switching means, said paper feeding means being responsive to

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the operation of said second switching means to feed each paper sheet into said open gripper.

6. A paper feed device comprising:
at least one paper tray for receiving therein sheets of paper;

paper feed means including feed rollers for supplying sheets of paper one by one from said one tray;

means for detecting the arrival of a leading edge of said sheets of paper and for stopping each said sheet of paper in a substantially flat condition when the leading end of each said sheet of paper reaches a predetermined paper standby position;

chain delivery means having a gripper for clamping each sheet of paper, the locus of said chain delivery means being adjacent to the travel path of the sheet of paper at a predetermined distance from said paper standby position;

means for opening the gripper when it assumes a position on the said locus adjacent the travel path of the paper;

means for restarting said paper feed means in response to the opened condition of said gripper when said gripper assumes said position on the said locus adjacent the travel path of the paper to feed each sheet of paper from its standby position into the open gripper;

the paper feeding speed of said paper feed means being higher than the travel speed of said chain delivery means; and

means for closing said gripper after each paper sheet has been fed into the open gripper so that the paper sheets may be removed from said standby position and transferred by said chain delivery means.

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