ABSTRACT: A paper sheet feeding mechanism for feeding the top sheet from a stack of sheets including power driven feed rollers to contact the top sheet of the stack and move it against corner separating fingers located at the forward corners of the stack.
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PAPER SHEET FEEDING DEVICE FOR THE USE OF PRINTING MACHINES OR COPYING MACHINES

BACKGROUND OF THE INVENTION

This invention relates to a paper sheet feeding device which delivers from stacked sheets of paper one sheet at a time consecutively from the top to a printing machine, or a copying machine, as the case may be.

Generally, a paper sheet feeding device of the type described above comprises a paper rack which is adjustable to maintain the height of the top surface of the paper stack placed on said rack on approximately the same level irrespective of the diminishing height of said paper stack, a pair of perpendicularly erected side plates which come in contact with lateral sides of said paper stack to determine the position of said paper stack in the lateral direction, paper feeding rollers which come in contact with the top sheet of the paper stack in order to deliver said top sheet, and a separating device engageable with the front corners of the top sheet of the paper stack. The separating device is designed to ensure, when the top sheet is being delivered by means of said feeding rollers, delivery of a single sheet only to a printing machine or a copying machine by helping separation of the top sheet from the underlying sheets. In this instance, in order to effect accurate separation, engaging force of the separating device relative to the front corners of the top sheet as well as the slant of the separation fingers must be variable depending on the kind and quality of the sheets of paper placed on the rack. In most cases, the engaging force of the finger section in relation to the front corners of the top sheet is determined by the weight of the separating device and, therefore, separating devices of different weights having slant faces at different angles of positions are used, depending on the kind of paper used in each case.

SUMMARY AND OBJECTS OF THE INVENTION

An object of this invention is to provide a separating device which is easily interchangeable instantly with another so as to facilitate use of any kind of paper.

Furthermore, as the finger section of the separating device needs to be engaged with front corners of the top sheet of the paper stack, it must be designed movable in a horizontal direction depending on the width of the paper to be used. In order to meet this requirement, the known devices called for relatively complicated mechanism and consequently, a considerable number of components.

Another object of this invention, therefore, is to provide a separating device of simple structure which is movable in a lateral direction without complicated mechanisms.

Still another object of this invention is to devise an accurate placement of the separating device, by force of its weight, relative to the front corners of the top sheet of the paper stack so as to ensure accurate separation of the top sheet from the underlying sheets.

Other objects and advantages will become apparent in the following description when read in connection with the accompanying drawings:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view partly in section, of a paper feeding device according to the invention, representing one embodiment of the invention;

FIG. 2 is a partial plan view of the embodiment shown in FIG. 1;

FIG. 3 is a cross-sectional view of the above embodiment taken along lines III-III of FIG. 2; and

FIG. 4 is a perspective view of a separating device viewed from underneath.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, a paper rack 1 is mounted with a pair of perpendicularly erected side plates 2 and 3 which face each other and are adapted to be movable respectively, in opposite directions. By adjusting the positions of these side plates in accordance with the width of paper 4 to be used for printing or copying as the case may be, and bringing said side plates in contact respectively, with the lateral sides of the paper stack, the positioning of said paper stack in the lateral direction is determined.

In order to effect the above-described positioning performance, both side plates 2 and 3 carry, respectively, lower extensions 5 and 6 which are slidable on the paper rack 1 (see FIGS. 1 and 3). On the top sheet of the paper stack 4 are placed two suitably spaced paper feeding rollers 7 and 8 which are rotated intermittently by a driving mechanism, not shown, through a power transmitting shaft 9, thereby delivering the top sheet to a printing machine or a copying machine. The feeding rollers may preferably be made of a friction material such as rubber.

In the front portions of each side plate 2 and 3 are provided vertical notches 10 (FIGS. 1 and 3) which are traversed by the shaft 9 of said feeding rollers. Said notches 10 provide, in the front side (left side as seen in the FIGS.), pillar-shaped guides 11 and 12 on which are mounted, respectively, vertically slidable separating devices 13 and 14. Each separating device carries, respectively, a horizontal finger 15 or 16 mountable on the front corner of the top sheet of the paper stack, and a downward extension 17 or 18. Each separating device, therefore, sits on the front corner of the top sheet of the paper stack 4 supported thereon by its fingers 15 or 16.

In front of the front edge of the paper stack is provided, a front plate 19 which is fixed to the outer frame of the machine and is mounted with a horizontally movable bumper plate 20 that is adapted to come in contact with, and thereby determine the position of, the front face of the paper stack 4.

The horizontal movement of the bumper plate 20 is assisted by a guide pin 21 fixed thereon and a horizontal slit 22 provided on the front plate 19.

Referring now to FIGS. 1, 2 and 3, the lower extensions 5 and 6 of the side plates, respectively, carry downwardly bent engaging pieces 23 which are adapted to fit in indentations 24 provided on each bumper plate 20. It follows that when the side plates 2 and 3 are moved according to the width of the paper on the rack, the bumper plates 20 are also carried therewith and caused to be brought in contact with the front edge of the paper stack at front corners thereof.

Naturally, the surface of the bumper plate 20 which comes in contact with the front surface of the paper stack is projected closer to the paper stack than the inner surface of the extensions 17 and 18 of the separating devices and consequently, the front edge of the paper stack normally comes in contact only with the bumper plate 20, but never with said extensions. If the front edge of the paper stack comes in contact with said extensions, friction force arises therebetwixt, preventing the separating device from engaging freely with the front corners of the paper stack. Construction of this embodiment of the invention eliminates any such nuisance.

As a result of consecutive delivery of sheets from the paper stack 4 on the rack 1, the height of the stack decreases accordingly. The paper rack 1 is designed, however, in such a manner as to be moved upwardly automatically so as to maintain the top surface of the paper stack on the same level. In the present application, however, paper rack moving mechanism known in the art can be utilized and such mechanism is not directly related to this invention, it is not shown in the drawings.

As the top sheet of the paper stack 4 is given a forwarding movement by feeding rollers 7 and 8, it is stopped at its front corners by extensions 17 and 18 and fingers 15 and 16 of the separating device. Driven further by motion of rollers, the top sheet curls until its front corners jump over said fingers and move ahead. As the top sheet is being delivered by motion of feeding rollers, second sheet from the top is also inclined to follow, due to friction force between the top sheet and the second. This friction force, however, is not so strong as to
cause the second sheet to curl to the same extent as the top sheet when the latter is curled. Consequently, while the top sheet is advanced over the finger section of the separating device, the second sheet is kept stopped by the lower extensions and the fingers of the same device, whereby delivery of paper one sheet at a time, to a printing machine, or a copying machine is ensured.

As it is apparent from the above description, separation of the top sheet from the second sheet and subsequent movement of the top sheet over the lower extensions and fingers of the separating device by the action of feeding rollers, depends on the engaging force of the separating device with the front corners of the paper stack through its fingers, as well as on the position of the slant face of said fingers. Consequently, in order to secure accurate separating performance, it becomes necessary to change the above-mentioned engaging force and the position of the slant face of the fingers in accordance with the quality of the paper to be used. This change can be done easily in the present invention by sliding the old separating devices 13 and 14 off from top of the guides 11 and 12 of the side plates and then mounting a new suitable separating device.

As described earlier, depending on the width of paper to be used for printing or copying, the side plates 2 and 3 are moved opposite to each other in a horizontal direction for adjustment. Such an adjusting mechanism is already known in the prior art and as it is not directly related with the present invention, description thereof in the drawings is abbreviated. However, as it will be apparent from the accompanying drawings, the separating device mounted on the guides 11 and 12 is adapted to move together with the movement of the side plates, whereby engagement of finger section of said separating device with the front corners of the paper stack is ensured.

Referring to FIG. 4, the main body 25, a finger 16 and an extension 18 comprises an integral body of the separating device which may be made of metal. In said main body 25 is provided insert 26 made of synthetic resin and by using synthetic resin of different relative weights, separating devices of variable weights can be obtained.

I claim:

1. In a paper sheet feeding device comprising a paper rack adapted to support a stack of paper sheets; opposed, spaced, vertically extending lateral walls adapted to confine the stack of paper sheets against lateral motion; and feed means for applying an endwise advancing force to the uppermost paper sheet for causing said sheet to advance with a leading edge first horizontally from the stack of paper sheet in a feeding direction parallel to the lateral walls, the improvement comprising:

a vertically extending guide post on each lateral wall adjacent the position intended for occupancy by the leading edges of paper sheets in the stack;

a plurality of separating devices adapted for interchangeability positioning on each guide post, each said separating device being demountable from the guide post by lifting in a vertical direction, and each said separating device comprising a hollow body adapted to fit over the guide post in freely sliding relation therewith under the influence of gravity, an extension having a vertically extending wall placed to temporarily block the horizontal advance of the top sheet in the feeding direction by contacting and impeding the leading edge thereof, a horizontal finger positioned to extend from the upper edge of the extension over the corner of the topmost sheet defined by the leading and a lateral edge of synthetic resin within the hollow body, said plurality of separating devices being distinguished by weight differences resulting from weight variations among their respective inserts.

2. In a paper sheet feeding device comprising a paper rack adapted to support a stack of paper sheets; opposed, spaced, vertically extending lateral walls adapted to confine the stack of paper sheets against lateral motion; and feed means for applying an endwise advancing force to the uppermost paper sheet for causing said sheet to advance with a leading edge first horizontally from the stack of paper sheet in a feeding direction parallel to the lateral walls; the improvement comprising:

surfaces defining a vertically extending slot in each sidewall adjacent the position intended for occupancy by the leading edges of paper sheets in the stack, said slot defining a vertically extending pillar-shaped guide portion of the sidewall having vertical sides;

a vertically slideable separating device on each guide portion, each said separating device comprising a sheet metal member embracing the guide portion, said member defining with the guide portion an internal cavity, a weight comprised of synthetic resin material within the cavity, a horizontal finger positioned to overlie a corner of the top sheet of a stack of paper sheets, said corner being defined by a lateral edge and the leading edge of said sheet, and a vertical extension extending below the level of the horizontal finger in the path of the leading edge of a sheet of paper advancing under the influence of the feed means; and

a bumper plate beneath the level of the horizontal finger positioned to abut the leading edges of paper sheets in the stack of paper sheets and space said leading edges from the vertical extension of the separating device.

3. The paper sheet feeding device of claim 2 comprising means for moving the lateral walls and the bumper plates laterally in order to accommodate paper stacks of varying width.

4. The paper sheet feeding device of claim 2 comprising, for each guide portion, a plurality of separating devices, said separating devices in each plurality having different weights as a consequence of variations between the weights therein.