

Sheet Feeding Device

The present invention relates to a sheet feeding device mounted on an image forming apparatus or the like.

For example, an image forming apparatus such as a copying machine or a printer requires sheets (transfer paper, sensitizing paper, thermosensitive paper or the like) on which an image is formed. A sheet feeding cassette detachable from the main body of the apparatus has been known as a device for feeding the sheets.

The sheet feeding cassette can contain a plurality of sheets. When the sheet feeding cassette is mounted on the image forming apparatus, the sheets are fed one at a time by a feed roller provided in the main body of the apparatus. In order to feed the sheets by the feed roller, supply pressure must be applied to the sheets with front ends of the sheets pressed to the feed roller. If supply pressure is applied, the friction force is produced between the feed roller and the sheets. The sheets can be fed by rotating the feed roller in the state.

Accordingly, in order to apply supply pressure to the

sheets, the sheet feeding cassette is generally provided with a mounting plate 1, as shown in Fig. 1. The mounting plate 1 is so adapted that its forward portion can be moved up and down centered with respect to its rear end and is urged upward by a spring 2. Since the sheets contained in a cassette case 3 are mounted on this mounting plate 1, the front ends of the sheets are pushed upward by the mounting plate 1 to be brought into contact with a feed roller 4.

A non-slip pad 5 having a high coefficient of friction is affixed to an upper surface of the forward portion of the mounting plate 1. The non-slip pad 5 is affixed in such a position that it comes into contact with the feed roller 4 when there remain no sheets. The non-slip pad 5 is used for holding the friction force between the sheets and the mounting plate 1 when there remain a few sheets on the mounting plate 1 to prevent the remaining sheets from being fed at one time.

The foregoing will be described in more detail. It is assumed that the non-slip pad 5 is not provided on the mounting plate 1. In this case, the friction force between the last sheet and the mounting plate 1 is smaller than the friction force between the sheets. Accordingly, if there remain a few sheets, for example, there remain five or six sheets, the situation is often encountered

where no slip occurs between the sheets where the friction force is large but slip occurs between the last sheet and the mounting plate 1 where the friction force is small so that five or six sheets are fed at one time.

Consequently, the non-slip pad is an indispensable member to prevent, when there remain a few sheets, the remaining sheets from being fed at one time.

However, the conventional sheet feeding cassette having the above described non-slip pad has the disadvantage in that a buzzing sound is liable to be produced in feeding the last sheet.

This buzzing sound is mainly produced by friction between the non-slip pad and the last sheet. Accordingly, if the non-slip pad 5 is eliminated, no such sound is produced. However, when there remain a few sheets in the sheet feeding cassette, the remaining sheets are liable to be fed at one time, as described above. Therefore, the non-slip pad cannot be eliminated.

Accordingly, which is desired is a sheet feeding device eliminating the possibility of producing a buzzing sound and capable of feeding, even if there remain a few sheets, the sheets one at a time until the last sheet has been fed.

The present invention provides a sheet feeding device comprising:

- a feed roller;
- a sheet containing section for containing a plurality of sheets;

- a mounting member for mounting the sheets arranged in the sheet containing section, wherein at least a forward portion of the mounting member in the direction in which sheets are to be fed is movable up and down;

- urging means for urging at least the forward portion of the mounting member upward at least when the sheets are to be fed, such that the sheets can be brought into contact with the feed roller and such that the forward

portion comes into direct contact with the feed roller when the sheet containing section is empty of sheets; and

a non-slip pad arranged on an upper surface of the forward portion of the mounting member in such a position that the pad will not come into direct contact with the feed roller even when the sheet containing section is empty of sheets.

Thus, it is possible to arrange the position at which the non-slip pad is affixed on an upper surface of a forward portion of the mounting member and the shape of the non-slip pad in such a manner as to produce no buzzing sound in feeding the last sheet and not to feed, even if there remain a few sheets on the mounting member, the remaining sheets at one time by preventing the last sheet from being fed together with the other sheets until there remains only the last sheet.

The pad may be a sheet-shaped member having an arbitrary shape and having a predetermined thickness. Preferably, two such pads are provided bilaterally symmetrically in a direction at right angles to the sheet feeding direction.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a sectional side elevation view showing an example of the construction of a conventional sheet feeding cassette;

Fig. 2 is a plan view showing a sheet feeding cassette of a device according to one embodiment of the present invention;

Fig. 3 is a section taken along line

III-III shown in Fig. 2;

Fig. 4 is an enlarged view showing main parts of the sheet feeding cassette shown in Fig. 3;

Fig. 5 is a plan view showing other shapes of a non-slip pad; and

Fig. 6 is a diagrammatical cross sectional view showing a sheet feeding device according to another embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 2 is a plan view showing the state of a sheet feeding cassette according to one embodiment of the present invention as viewed from above, where the position of a feed roller 11 in a case where it is mounted on an image forming apparatus is represented by a one dot and dash line.

Fig. 3 is a cross sectional view taken along a line III-III shown in Fig. 2.

Referring now to Figs. 2 and 3, a sheet containing section 12 in a sheet feeding cassette 10 is provided with a mounting plate 13. The mounting plate 13 is a plate-shaped member for mounting sheets contained in the sheet containing section 12. The mounting plate 13 is provided with a supporting shaft 15 in its rear end (on the left in Figs. 2 and 3) and can be shaken around the supporting shaft 15. When the sheet feeding cassette 10 is mounted

on the image forming apparatus, a forward portion of the mounting plate 13 is urged upward, so that an upper surface of the forward portion of the mounting plate 13 is brought into contact with a peripheral surface of the feed roller 11. The urging means are not shown in Figures 2 and 3.

A pair of dents 13a and 13b is formed on the upper surface of the forward portion of the mounting plate 13, and a pair of non-slip pads 14a and 14b is affixed to the pair of dents 13a and 13b. The non-slip pads 14a and 14b are arranged in bilaterally symmetrical positions with respect to the center line of the sheet feeding cassette 10 in the width direction and have bilaterally symmetrical shapes. Each of the non-slip pads 14a and 14b is made of a member having a plane shape of approximately L or its reversed shape and having a high coefficient of friction, for example, rubber.

The present embodiment is characterized in that the non-slip pads 14a and 14b are affixed to such a position that they do not come into direct contact with the feed roller 11, as shown in Fig. 3. In other words, the non-slip pads 14a and 14b are affixed to a portion excluding a portion with which the feed roller 11 comes into direct contact.

Although in the present embodiment, the non-slip pads 14a and 14b are affixed to the dents 13a and 13b, the non-

slip pads may be affixed to the upper surface of the forward portion of the mounting plate 13 with no dents being formed thereon.

Fig. 4 is an enlarged fragmentary sectional view showing the state of sheets, the feed roller 11 and the non-slip pad 14 in a case where there remain a few sheets on the mounting plate 13. The existence of the non-slip pad 14 prevents a plurality of sheets P1, P2 and P3 from being simultaneously fed in a case where the number of sheets is reduced. In this case, a small step is formed between the position where the sheets P1, P2 and P3 are nipped and a front edge of the non-slip pad 14 positioned in its vicinity. However, this small step is useful for preventing the last sheet P3 from being fed together with the sheet P2 thereon when there remain a few sheets.

More specifically, the last sheet P3 is pressed against the front edge of the non-slip pad 14 due to the above described step and the toughness of the sheet P3 when the sheet P2 on the last sheet P3 is fed by the feed roller 11. Consequently, the friction force is produced between the last sheet P3 and the front edge of the non-slip pad 14, so that the last sheet P3 is not fed together with the sheet P2 thereon.

As in the present embodiment, if the non-slip pad 14 is provided in such a position that it does not come into

direct contact with the feed roller 11, the last sheet P3 is not directly nipped strongly by the feed roller 11 and the non-slip pad 14 when the last sheet P3 is fed, so that buzz sound which has been conventionally produced by the strong nip is not produced. On the other hand, the non-slip pad 14 is not directly pressed against the feed roller 11. However, the last sheet P3 comes into full contact with an upper surface of the non-slip pad 14. In particular, the last sheet P3 is strongly pressed against the vicinity of the front edge of the non-slip pad 14. Accordingly, the non-slip pad 14 performs its inherent function, that is, the function of not feeding the last sheet P3 together with the remaining sheets P1 and P2. Consequently, when there remain a few sheets in the sheet feeding cassette 10, the remaining sheets are not fed at one time.

Figs. 5A and 5B are plan views showing other examples of the non-slip pad. As shown in Figs. 5A and 5B, non-slip pads 14a and 14b can be made in an arbitrary shape provided that they do not come into direct contact with a feed roller 11. More specifically, the non-slip pads 14a and 14b may be in such a shape that they are affixed to a mounting plate on the forward side and on the sides of the feed roller 11 in a direction A1 in which sheets are fed (see Fig. 5A) or in such a shape that they are affixed to

the mounting plate on the backward and forward sides as well as on the sides of the feed roller 11 in the direction A1 in which sheets are fed (see Fig. 5B).

It is needless to say that the non-slip pads may be in such an arbitrary shape (for example, a square shape or a round shape) that they are affixed to the mounting plate only on the backward or forward side of the feed roller, which are not shown. In addition, the non-slip pads need not be necessarily a right-and-left pair. For example, the number of non-slip pads may be only one or plural.

That is, it is necessary that a non-slip pad is affixed to such a position that it does not come into direct contact with a feed roller.

Although description was made of one embodiment by taking a sheet feeding cassette as an example, it should be noted that the present invention is not limited to the sheet feeding cassette. For example, the present invention can be also applied to a sheet feeding device having as a mounting plate a deck which can be raised and lowered by power.

Fig. 6 is a diagrammatical cross sectional view showing a sheet feeding device 20 according to another embodiment of the present invention. Referring to Fig. 6, the sheet feeding device 20 is provided with a sheet container 22. The container 22 is so adapted that it can

be guided to rails 25a and 25b respectively connected to the front side of the sheet feeding device 20 (on the right in Fig. 6) and the rear side thereof (on the left in Fig. 6) and can be pulled out on this side perpendicular to Fig. 6. The sheet container 22 is provided with a deck 23. The deck 23 is a plate-shaped member for mounting sheets. The deck 23 is connected to urging means (not shown) for raising and lowering it in a horizontal state by driving of, for example, a motor included in the urging means.

Although the construction of the sheet feeding device 20 to which the present invention can be applied is not limited to the above described construction, the sheet feeding device 20 may be of another construction.

The sheet feeding device 20 according to the present embodiment is characterized in that a non-slip pad 24 affixed to the surface of the deck 23 on its forward side is arranged in such a position that it does not come into direct contact with a feed roller 21. More specifically, the sheet feeding device 20 can be mounted on, for example, a copying machine, and the feed roller 21 in the copying machine is engaged with the deck 23 in a position represented by a one dot and dash line in a state where it is mounted. Sheets mounted on the deck 23 are fed one at a time in a direction represented by an arrow A3 by the

rotation of the feed roller 21 and are accepted in the copying machine.

In the sheet feeding device 20 according to the present embodiment, an auxiliary surface 23b lower than a major surface 23a of the deck 23 by one step is formed on its forward side and a non-slip pad 24 is affixed to the auxiliary surface 23b. More specifically, the non-slip pad 24 is affixed to the auxiliary surface 23b along a side of the step between the major surface 23a and the auxiliary surface 23b. The height of the surface of the non-slip pad 24 is made equal to that of the major surface 23a.

In place of such construction, the surface of the deck 23 may be made flat and the non-slip pad 24 may be so affixed as to be projected from the surface by its thickness.

The present invention is not limited to a sheet feeding device for an image forming apparatus. For example, the present invention can be widely applied to a sheet feeding device utilized when sheets must be continuously or intermittently fed.



Claims:

1. A sheet feeding device comprising:
 - a feed roller;
 - a sheet containing section for containing a plurality of sheets;
 - a mounting member for mounting the sheets arranged in the sheet containing section, wherein at least a forward portion of the mounting member in the direction in which sheets are to be fed is movable up and down;
 - urging means for urging at least the forward portion of the mounting member upward at least when the sheets are to be fed, such that the sheets can be brought into contact with the feed roller and such that the forward portion comes into direct contact with the feed roller when the sheet containing section is empty of sheets;
 - and
 - a non-slip pad arranged on an upper surface of the forward portion of the mounting member in such a position that the pad will not come into direct contact with the feed roller even when the sheet containing section is empty of sheets.
2. A sheet feeding device as claimed in claim 1, wherein an edge of the non-slip pad is positioned in the vicinity of a position where the feed roller will nip the sheets in feeding the sheets.
3. A sheet feeding device as claimed in claim 2,



wherein a step is formed between the said position and the edge of the non-slip pad when a few sheets remain on the mounting member.

4. A sheet feeding device as claimed in any preceding claim, wherein the non-slip pad comprises a sheet-shaped member having an arbitrary plane shape and having a predetermined thickness.

5. A sheet feeding device as claimed in claim 4, wherein two said non-slip pads arranged in bilaterally symmetrical positions in a direction at right angles to the direction in which sheets are fed.

6. A sheet feeding device as claimed in claim 5, wherein the sheet-shaped members arranged in bilaterally symmetrical positions have plane shapes which are bilaterally symmetrical.

7. A sheet feeding cassette mounted on apparatus including a feed roller, comprising:

a sheet containing section for containing a plurality of sheets;

a mounting member for mounting the sheets arranged in the sheet containing section, wherein at least a forward portion of the mounting member in the direction in which sheets are to be fed is movable up and down;

urging means for urging at least the forward portion of the mounting member upward at least when the sheets are to be fed, such that the sheets can be brought into contact with the feed roller and such that the forward



portion comes into direct contact with the feed roller when the sheet containing section is empty of sheets; and

a non-slip pad arranged on an upper surface of the forward portion of the mounting member in such a position that the pad will not come into direct contact with the feed roller even when the sheet containing section is empty of sheets.

8. A sheet feeding cassette as claimed in claim 7, wherein the non-slip pad has an edge positioned in the vicinity of a position where the feed roller will nip the sheets and is affixed to the mounting member with a step being formed therebetween such that the surface of the non-slip pad is slightly higher than the surface of the mounting member.

9. A sheet feeding cassette as claimed in claim 7 or 8, wherein the non-slip pad comprises a sheet-shaped member having an arbitrary plane shape and having a predetermined thickness.

10. A sheet feeding device substantially as described with reference to any of the embodiments illustrated in Figures 2 to 6 of the accompanying drawings.
