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(54) Paper feeding cassette with adjustable pressing means

(57) A paper pick-up device in a paper feeding cassette has a knock-up plate (13) and a compressed coil spring under the knock-up plate for pressing up the knock-up plate and providing a paper pick-up force.

To enable papers of different sizes and, thus, different weights to be reliably picked up at least one adjustable pressing means is installed inside the frontal section of the paper feeding cassette for adding an adjustable pressure to the upward pressure exerted by the compressed coil spring.

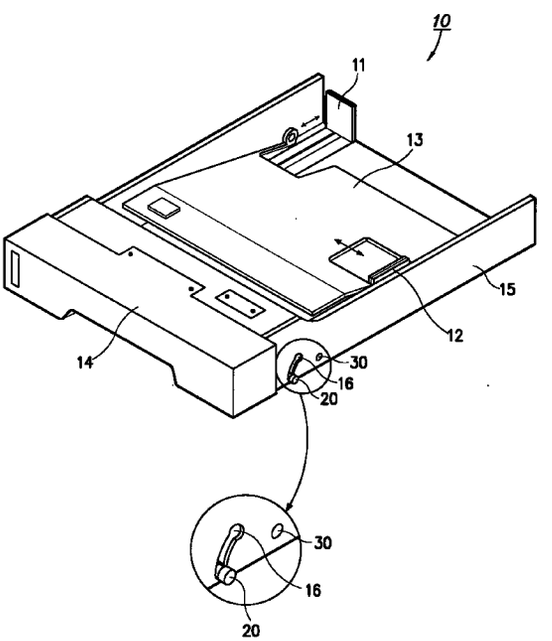

FIG. 2

EP 0 908 405 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a paper feeding cassette in a laser beam printer (LBP) using an electrophotographic developing method, and in particular, to a paper pickup device installed to keep plural sheets of paper in a pickup position.

2. Description of the Related Art

[0002] Electrophotographic development is generally used for a printer, copier, LBP, facsimile or the like. Such a device is equipped with a paper feeding cassette to accommodate plural sheets of paper, and the paper feeding cassette has a paper pickup device for keeping the paper pile in a pickup position.

[0003] FIG. 1 is a perspective view of a conventional paper feeding cassette. As shown in FIG. 1, the conventional paper feeding cassette is a universal type including at least one of guides 201 and 202 for regulating placement of papers with different lengths and widths to accommodate papers of different sizes. The paper feeding cassette 200 is comprised of a knock-up plate 203 elastically supported by one or more compressed coil springs 204, for loading a plurality of paper sheets. The compressed coil springs 204 press up against the knock-up plate 203 to keep the paper pile of the knock-up plate 203 in a pickup position. The paper is fed sheet by sheet from the knock-up plate 203 to a register roller (not shown) by a pickup roller (not shown) and a finger (not shown). The uppermost paper sheet of the paper pile is kept in contact with the pickup roller and transferred by the friction force between the paper and the pick up roller when the pickup roller rotates.

[0004] In the above structure, the paper feeding cassette 200 feeds papers of different sizes (e.g., A4 size, letter size, and OHP (OverHead Projector) film size) as a recording medium. The papers differ in weight as well as in size and thickness.

[0005] The mechanism of setting the pickup position of paper by use of one or two compressed coil springs under a knock-up plate cannot cope with the weight difference in paper. Further, different loads are imposed on a universal type of cassette capable of containing 500 sheets of paper at maximum depending on the kinds of paper. In comparison of A4-size paper and A6-size paper, a paper tray receives a much larger load from the latter than the former. The resulting difference in pickup force makes paper feeding unreliable.

SUMMARY OF THE INVENTION

[0006] It is therefore an object of the present invention to provide a paper pickup device in a paper feeding cassette, which enables papers of different sizes and thus different weights to be reliably picked up.

[0007] It is another object of the present invention to provide a paper pickup device capable of controlling application of pickup force to paper in a paper feeding cassette.

[0008] It is still another object of the present invention to provide a paper pickup device in a paper feeding cassette, which allows a user to control application of pickup force to paper with simple manipulation.

[0009] To achieve these and other objects, there is provided a paper pickup device in a paper feeding cassette having a knock-up plate. In the paper pickup device, a compressed coil spring is provided under the knock-up plate, for pressing up the knock-up plate and providing paper pickup force, a hinge shaft is rotatably connected to both sidewalls of the paper feeding cassette by a hinge, a sub-plate is extended from a portion of the hinge shaft, under the knock-up plate, and means for pressing up the sub-plate is installed inside a frontal section of the paper feeding cassette to add to the upward pressure of the compressed coil spring.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The above objects and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1 is a perspective view of a conventional paper feeding cassette;

FIG. 2 is a perspective view of a paper feeding cassette according to an embodiment of the present invention;

FIG. 3 is a schematic perspective view of a paper pickup device according to the embodiment of the present invention;

FIG. 4 is a partial side view of the paper pickup device according to the embodiment of the present invention, illustrating the position of a shaft when a tension coil spring is not strained;

FIG. 5 is a partial side view of the paper pickup device according to the embodiment of the present invention, illustrating the position of the shaft when the tension coil spring is strained;

FIG. 6 is a perspective view of a paper feeding cassette according to another embodiment of the present invention;

FIG. 7 is a schematic perspective view of a paper pickup device according to the second embodiment of the present invention;

FIG. 8 is a partial side view of the paper pickup device according to the second embodiment of the present invention, illustrating the positions of a shaft and a lever when neither a first tension coil spring nor a second tension coil spring is strained;

FIG. 9 is a partial side view of the paper pickup

device according to the second embodiment of the present invention, illustrating the positions of the shaft and the lever when only the first tension coil spring is strained; and

FIG. 10 is a partial side view of the paper pickup device according to the second embodiment of the present invention, illustrating the positions of the shaft and the lever when both the first and second tension coil springs are strained.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] A detailed description of preferred embodiments of the present invention will hereinbelow be given with reference to the attached drawings. It is to be noted that like reference numerals denote the same components in the drawings and a detailed description of a known related function or structure of the present invention is omitted if it is deemed to obscure the subject matter of the present invention.

[0012] FIG. 2 is a perspective view of a paper feeding cassette according to a preferred embodiment of the present invention, and FIG. 3 is a schematic perspective view of a paper pickup device in the paper feeding cassette.

[0013] Referring to FIG. 2, the paper pickup device is provided inside a front section 14 of the paper feeding cassette 10, and a knock-up plate 13 is installed on the bottom of the paper feeding cassette 10 to be rotatable with respect to a side thereof. One or more guide members 11 and 12 are installed in the paper feeding cassette 10 movably in a paper feeding direction to regulate placement of papers with different lengths and in the direction perpendicular to the paper feeding direction to regulate placement of papers with different widths, respectively.

[0014] A curved slot 16 is formed on a frontal portion of each side wall 15 of the paper feeding cassette 10 to movably insert a shaft 20 thereinto. A hinge hole is formed at one side of each slot 16, for inserting a hinge shaft 30 thereinto. Both end portions of the slot 16 are shaped into circles of a larger diameter than the width of the slot 16 so as to keep the shaft 20 in position.

[0015] Turning now to FIG. 3, both ends of the hinge shaft 30 are rotatably extended through the hinge holes in the paper pickup device. Under the knock-up plate 13 is a sub-plate 31 extended from a portion of the hinge shaft 30 in the paper feeding direction. A connecting member 32 is vertically extended from each of both end portions of the hinge shaft 30, for acting as a lever to apply an upward pressure to the sub-plate 31, and has an engaging portion 33 formed at an end of the connecting member 32. That is, the sub-plate 31, the connecting member 32, and the engaging portion 33 are all integrated with the hinge shaft 30.

[0016] The shaft 20 of a predetermined length is inserted into the slots 16 on both the side walls 15 of the paper feeding cassette 10 shown in FIG. 2, with both ends of the shaft 20 extending through the slots 16. To prevent the shaft 20 from getting out of position in the slots 16, a mounting groove 21 is formed around the outer circumference of each end portion of the shaft 20 to a predetermined depth to be caught in the slot 16. Therefore, the shaft 20 may move along the curved slots 16 by user manipulation.

[0017] A resilient member connects an end portion of the shaft 20 with the engaging portion 33 of each connecting member 32 so that the shaft 20 and the connecting member 32 exert tensile force on each other. In the present invention, a tension coil spring 40 is used as the resilient member.

[0018] In the thus-constituted paper pickup device, user displacement of the shaft 20 along the slots 16 in a direction indicated by arrow A of FIG. 3 changes the tensile force of the tension coil springs 40 applied to the connecting members 32. Hence, the upward pressure which the sub-plate 31 applies to the knock-up plate 13 is varied in a direction indicated by arrow B of FIG. 3 with respect to the hinge shaft 30 integrally formed with the lower end of the connecting member 32.

[0019] FIG. 4 is a partial side view of the paper pickup device according to the first embodiment of the present invention, illustrating the position of the shaft when the tension coil spring is not strained.

[0020] As shown in FIG. 4, with the shaft 20 in a position **a** of the slots 16 on the sidewalls of the paper feeding cassette, a paper pile lowers the knock-up plate 13, but the tension coil spring 40 is not strained while only the upward pressure of a pressure spring (not shown) under the knock-up plate 13 is applied to the knock-up plate 13. In this case, the load of the paper pile is small.

[0021] FIG. 5 is a partial side view of the paper pickup device according to the first embodiment of the present invention, illustrating the position of the shaft when the tension coil spring is strained.

[0022] As shown in FIG. 5, with the shaft 20 in a position **b** of the slots 16, a paper pile lowers the knock-up plate 13. In so doing, the connecting member 32 moves around the hinge shaft 30 and the tension coil spring 40 is strained with a predetermined tensile force. Thus, the pressure spring presses up the knock-up plate 13 with the aid of the sub-plate 31. In this case, the load of the paper pile is large.

[0023] In the first embodiment of the present invention, the sub-plate presses up the knock-up plate in a single stage.

[0024] In a second embodiment of the present invention, the sub-plate works in two stages by use of at least two resilient members, preferably tension coil springs.

[0025] FIG. 6 is a perspective view of a paper feeding cassette according to the second embodiment of the present invention, and FIG. 7 is a perspective view of a paper pickup device in the paper feeding cassette according to the second embodiment of the present invention.

[0026] As shown in FIG. 6, the paper pickup device is provided inside a front section 114 of the paper feeding cassette 100, and a knock-up plate 113 is installed on the bottom of the paper feeding cassette 100 to be rotatable with respect to a side thereof. One or more guide members 111 and 112 are installed in the paper feeding cassette 100 movably in a paper feeding direction to regulate placement of papers with different lengths and in the direction perpendicular to the paper feeding direction to regulate placement of papers with different widths, respectively.

[0027] A first slot 116 of a predetermined curvature is formed on a frontal portion of each side wall 115 of the paper feeding cassette 110 to movably insert a shaft 120 thereinto. A hinge hole is formed at one side of each slot 116, for inserting one end of a hinge shaft 130 thereinto. Both end portions of the slot 116 are shaped into circles of a larger diameter than the width of the slot 116 so as to keep the shaft 120 in position. In addition, a second slot 117 of a predetermined curvature is formed just above the first slot 116 on one of the sidewalls 115 of the paper feeding cassette 100 and also shaped into circles in both ends thereof.

[0028] A locker 170 of a predetermined shape is installed above the second slot 117 in such a manner that it can rotate around a hinge shaft 171 to cover the lower portion of the second slot 117, and a stopper 173 protrudes from below the second slot 117 to limit the rotation of the locker 170 at the time the locker 170 covers the lower portion of the locker 170. That is, the locker 170 is so installed that it freely moves around the hinge shaft 171, and is set in a stationary state by the stopper 173, while partially covering the second slot 117. A knob 172 protrudes from the outer surface of the locker 170 to allow convenient user manipulation.

[0029] Turning now to FIG. 7, both ends of the hinge shaft 130 are rotatably extended through the hinge holes in the paper pickup device. Under the knock-up plate 13 is a sub-plate 131 extended from a portion of the hinge shaft 130 in the paper feeding direction. A connecting member 132 is vertically extended from each of both end portions of the hinge shaft 130, for acting as a lever to apply an upward pressure to the sub-plate 131, and has a first engaging portion 133 formed at an end of the connecting member 132 and a second engaging portion 134 extended from the first engaging portion 133. That is, the hinge shaft 130, the sub-plate 131, and the first and second engaging portions 133 and 134 are all integrally formed.

[0030] Both ends of the shaft 120 of a predetermined length are inserted to extend through the first slots 116 on both the side walls 115 of the paper feeding cassette 100 shown in FIG. 6. To prevent the shaft 120 from getting out of position in the first slots 116, a mounting groove 121 is formed around the outer circumference of each end portion of the shaft 120 to a predetermined depth to be caught in the first slot 116. Therefore, the shaft 120 may move along the curved first slots 116 by user manipulation.

[0031] A first resilient member connects an end portion of the shaft 120 with the first engaging portion 133 of each connecting member 132 so that the shaft 120 and the connecting member 132 exert tensile force on each other. In the present invention, a tension coil spring 140 is used as the first resilient member.

[0032] At one side of the sub-plate 131 is provided a lever 150 bent at the right angle in two portions. An end 151 of the lever 150 is protrusively inserted into the second slot 117 and the other end 152 thereof is rotatably connected to a fixing member 160. Hence, the lever end 151 is rotatable upon the other lever end 152. Both ends 151 and 152 of the lever 150 have a circular section to easily move or rotate.

[0033] A second resilient member connects the second engaging portion 134 of one of the connecting members 132 to a portion of the lever end 151 so that the connecting member 132 and the lever 150 exert tensile force on each other. The second resilient member is preferably a tension coil spring, and referred to as a second tension coil spring 141 hereinafter.

[0034] In the thus-constituted paper pickup device, user displacement of the shaft 120 along the first slots 116 in a direction indicated by arrow A of FIG. 7 changes the tensile force of the first tension coil springs 40 applied to the connecting members 32. Simultaneously when the lever end 151 protruded through the second slot 117 is moved in a direction indicated by arrow C of FIG. 7, the tensile force applied to the connecting member 132 is changed again. In this manner, the upward pressure which the sub-plate 131 applies to the knock-up plate 113 can be varied in a direction indicated by arrow B of FIG. 7 in two stages.

[0035] FIG. 8 is a partial side view of the paper pickup device according to the second embodiment of the present invention, illustrating the positions of the shaft and the lever when neither the first tension coil spring nor the second tension coil spring is strained.

[0036] As shown in FIG. 8, with the shaft 120 in a position **a** of the first slots 116 on the sidewalls of the paper feeding cassette and the lever end 151 in a position **c** of the second slot 117, a paper pile lowers the knock-up plate 113, but neither the first tension coil spring 140 nor the second tension coil spring 141 is strained while only the upward pressure of a pressure spring (not shown) under the knock-up plate 113 is applied to the knock-up plate 113. In this case, the load of the paper pile is small.

[0037] FIG. 9 is a partial side view of the paper pickup device according to the second embodiment of the present invention, illustrating the positions of the shaft and the lever when only the first tension coil spring is strained.

[0038] As shown in FIG. 9, with the shaft 20 in a position **b** of the first slots 116 and the lever end 151 in the position **c** of the second slot 117, a paper pile lowers the knock-up plate 113. In so doing, the connecting mem-

ber 132 moves around the hinge shaft 130 and only the first tension coil spring 140 is strained with a predetermined tensile force. Thus, the sub-plate 131 adds a predetermined force to the upward pressure of the pressure spring on the knock-up plate 113. In this case, the load of the paper pile is larger than that in FIG. 8.

[0039] FIG. 10 is a partial side view of the paper pickup device according to the second embodiment of the present invention, illustrating the positions of the shaft and the lever when both the first and second tension coil springs are strained.

[0040] As shown in FIG. 10, with the shaft 120 in the position **b** of the first slots 116 and the lever end 151 in a position **d** of the second slot 117, a paper pile lowers the knock-up plate 113. In so doing, the first and second tension coil springs 140 and 141 concurrently exert tensile force on the connecting member 132. Thus, the sub-plate 131 applies a larger force than that in FIG. 9 to the knock-up plate 113. In this case, the load of the paper pile is larger than that in FIG. 9.

[0041] In FIG. 10, when the lever end 151 moves toward the position **d** of the second slot 117, the lever end 151 pushes an end of the locker 170 and then the locker 170 rotates around the hinge shaft 171. Finally, the lever end 151 is set in the position **d** of the second slot 117, and the locker 170 returns to the original position where its motion is limited by the stopper 173. The lever end 151 is kept in position while receiving the tensile force of the second tension coil spring 141by the locker 170 and the stopper 173. To move the lever end 151 to the position **c** of the second slot 117, on the other hand, a user rotates the locker 170 at a predetermined angle counterclockwise with the knob 172. Then, the tensile force of the second tension coil spring 141 moves the lever end 151 to the position **c** of the second slot 117 and is released.

[0042] In the second embodiment of the present invention, the upward pressure applied to the knock-up plate 113 is increased by user manipulation of the shaft 120 protrusively inserted into the first slots 116 and the lever end 151 protruded through the second slot 117.

[0043] As described above, the present invention is advantageous in that a user can control pickup force to paper depending on the loads of papers different in size and amount in a paper feeding cassette of an LBP, which contains papers of different sizes.

[0044] While the present invention has been described in detail with reference to the specific embodiments, they are mere exemplary applications. Thus, it is to be clearly understood that many variations can be made by anyone skilled in the art within the scope and spirit of the present invention.

Claims

1. A paper pick-up device in a paper feeding cassette having a knock-up plate and a compressed coil spring under the knock-up plate, for pressing up the knock-up plate and providing paper pickup force, **characterised in that** at least one adjustable pressing means is installed inside a frontal section of the paper feeding cassette for adding an adjustable pressure to the upward pressure exerted by the compressed coil spring.

2. The paper pickup device according to claim 1, **characterised in that** the adjustable pressing means is at least adjustable between two pressure values.

3. The paper pickup device according to claim 2, **characterised in that** the two pressure values are a zero pressure and a positive pressure of predetermined value.

4. The paper pickup device according to claim 1 or 2, **characterised in that** said adjustable pressure means at least comprises

   a hinge shaft rotatably connected to both sidewalls of the paper feeding cassette by a hinge;

   a sub-plate extending from a portion of the hinge shaft under the knock-up plate, and

   means for pressing up the sub-plate, installed in a front section of the paper feeding cassette to add pressure to the upward pressure of the compressed coil spring.

5. The paper pickup device according to claim 4, **characterised in that** the means for pressing up comprises at least:

   a first curved slot formed on a frontal portion of each sidewall of the paper feeding cassette;

   a shaft having both ends protrusively inserted into the curved slots inside a frontal section of the paper feeding cassette;

   a connecting member extending from each of the hinge shafts to a predetermined length in a direction perpendicular to the sub-plate and having at least a first engaging portion at one end thereof, and

   a resilient member having one end connected to each end of the shaft and the other end connected to the first engaging portion of each first connecting member, for making the shaft and the connecting member exert tensile force on each other.

6. The paper pickup device according to claim 5, **characterised in that** the resilient members are

tension coil springs.

7. The paper pickup device according to one of the previous claims, **characterised in that** a mounting groove of a predetermined depth is formed in each end portion of the shaft around the outer circumference, for preventing the shaft from getting out of position in the first curved slots.

8. The paper pickup device according to one of the previous claims, **characterised in that** both end portions of the first curved slots are shaped in circle of the diameter larger than the width of the first slots, for enabling the shaft to easily move and keeping in shaft the position in the first slots.

9. The paper pickup device according to one of the previous claims, **characterised in that** the connecting member has a second engaging portion at another end thereof;

a second curved slot is formed on a portion of at least one side wall of the paper feeding cassette;

a fixing member is inside the paper feeding cassette;

a lever is bent in two positions and has one end protrusively inserted into the second slot and the other end rotatably connected to the fixing member by a hinge, and

a second resilient member has one end connected to the second engaging portion of the connecting member and the other end connected to the lever end, for making the shaft and the connecting member exert tensile force on each other.

10. The paper pickup device according to one of the previous claims, **characterised in that** a stopping means is arranged nearby the second slot for stopping movement of the end of the lever.

11. The paper pickup device according to one of the previous claims, **characterised in that** the second resilient members are tension coil springs.

12. The paper pickup device according to one of the previous claims, **characterised in that** a locker is installed just above the second slot on the sidewall of the paper feeding cassette by a hinge, for partially covering the second slot, and a stopper protrudes below the second slot for limiting the rotation of the locker.

13. The paper pickup device according to claim 12, **characterised in that** the locker includes a knob protruding outward from the outer surface thereof for facilitating user manipulation.

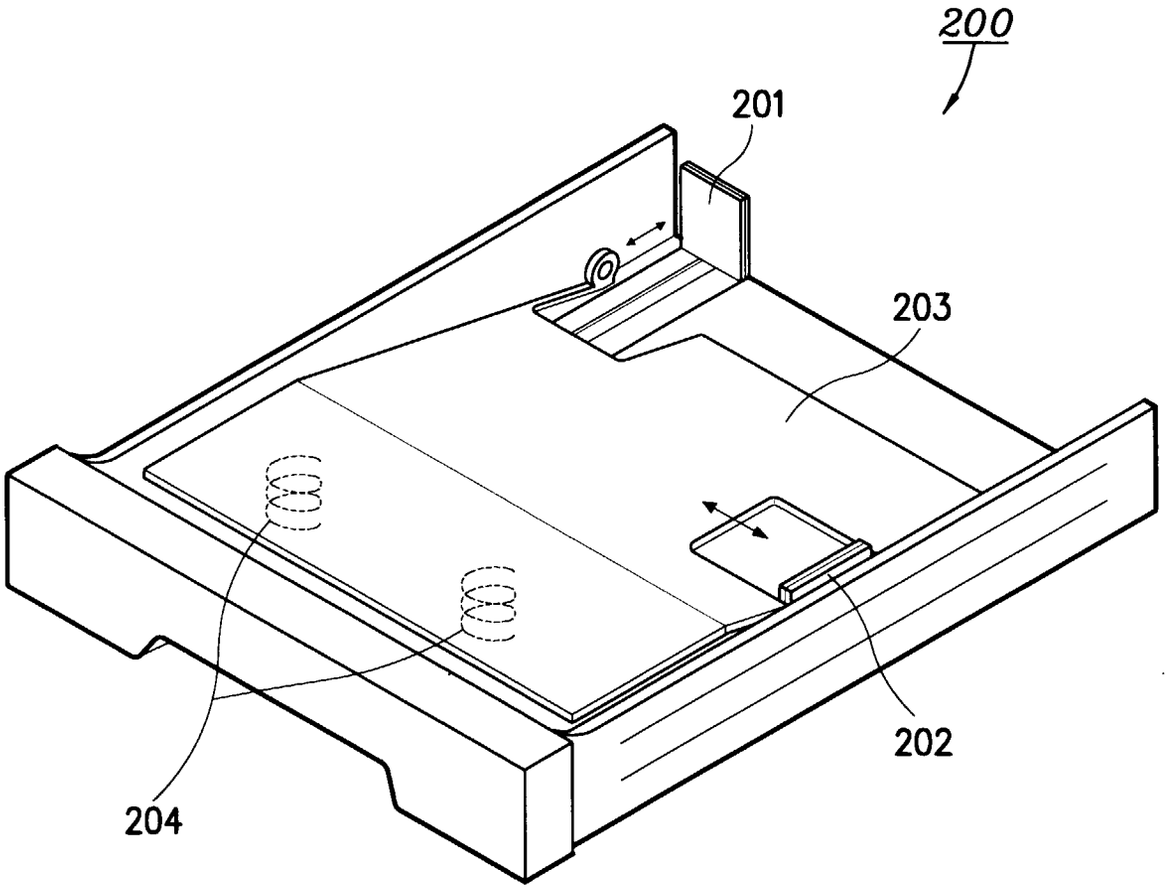

FIG. 1

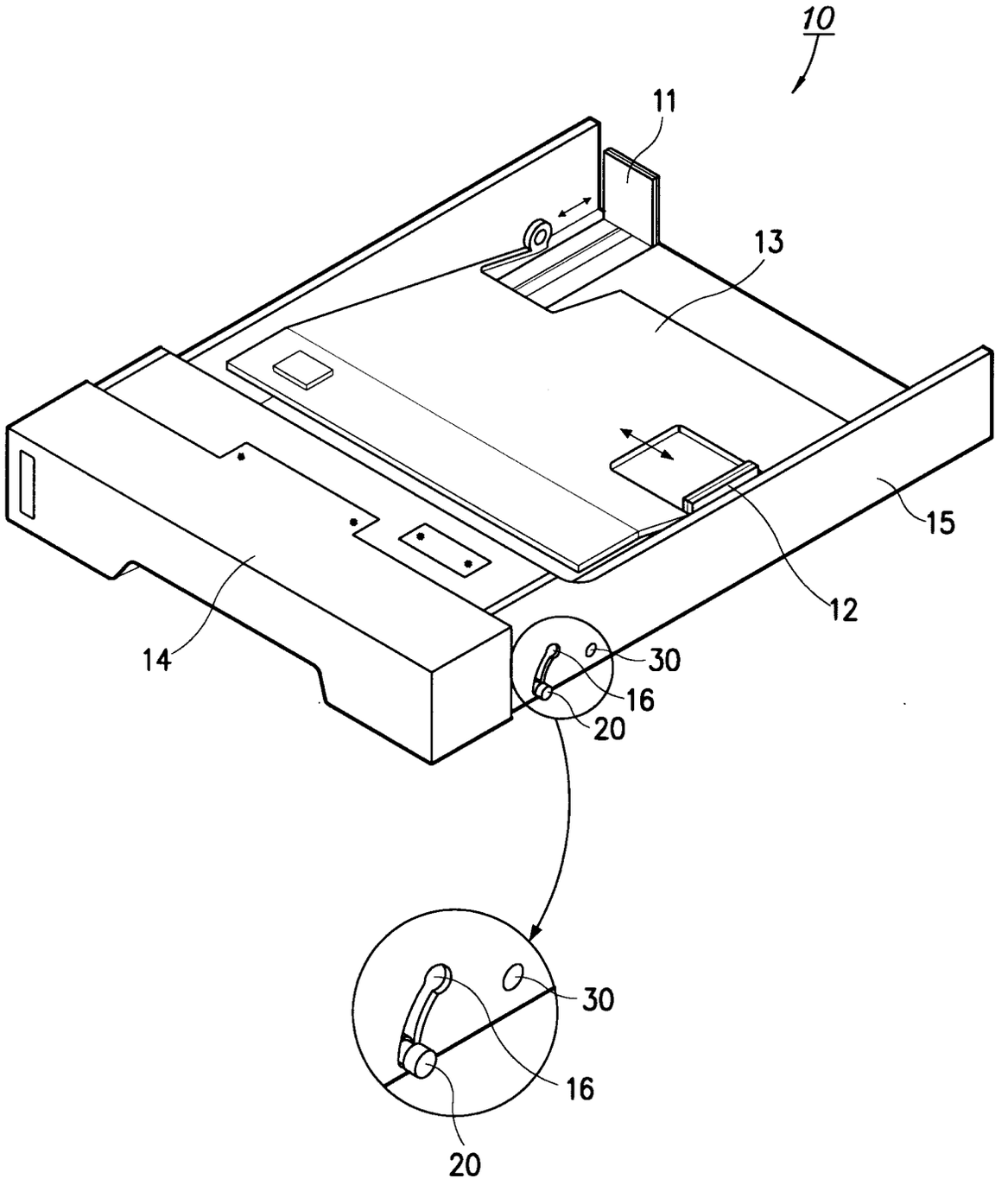

FIG. 2

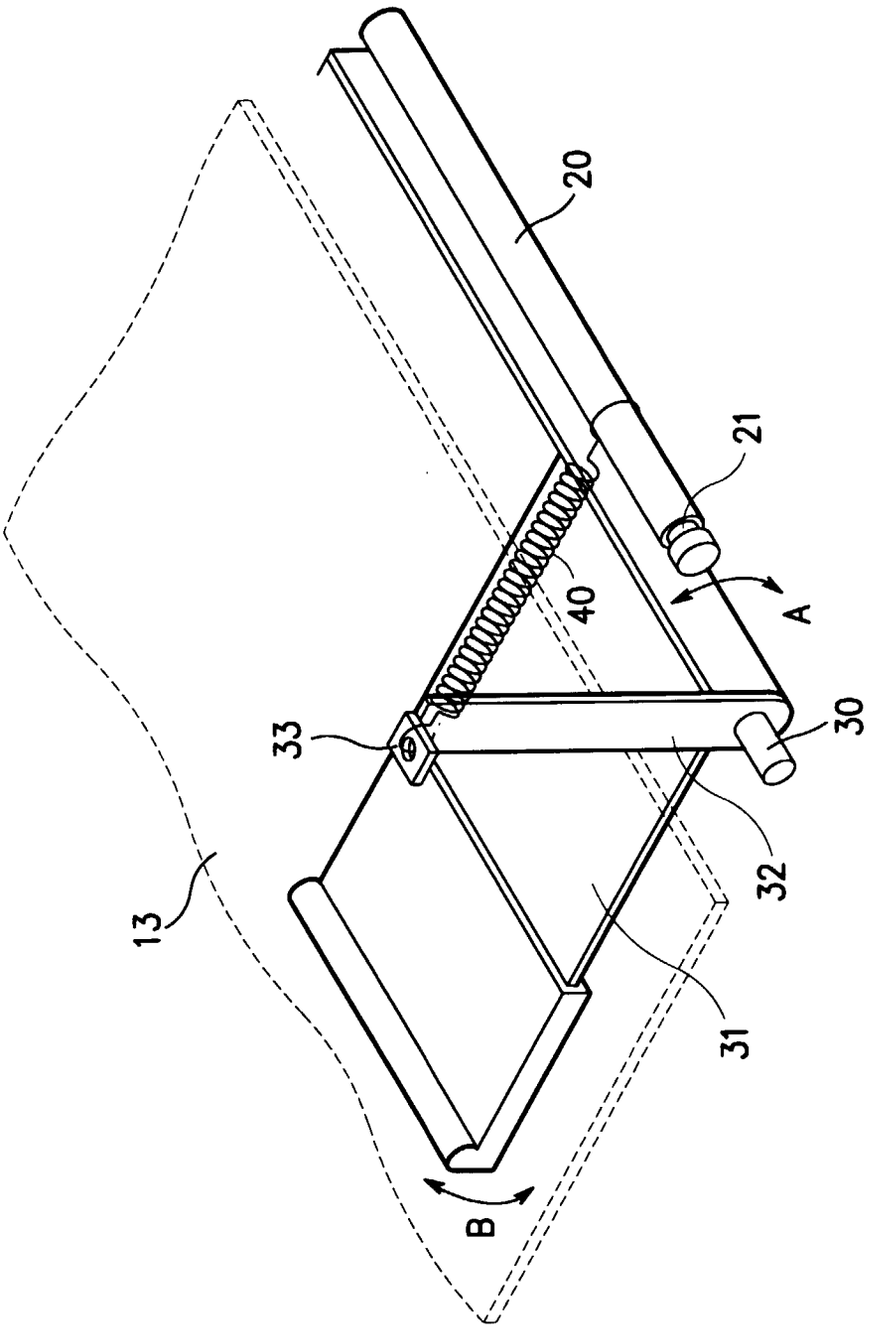

FIG. 3

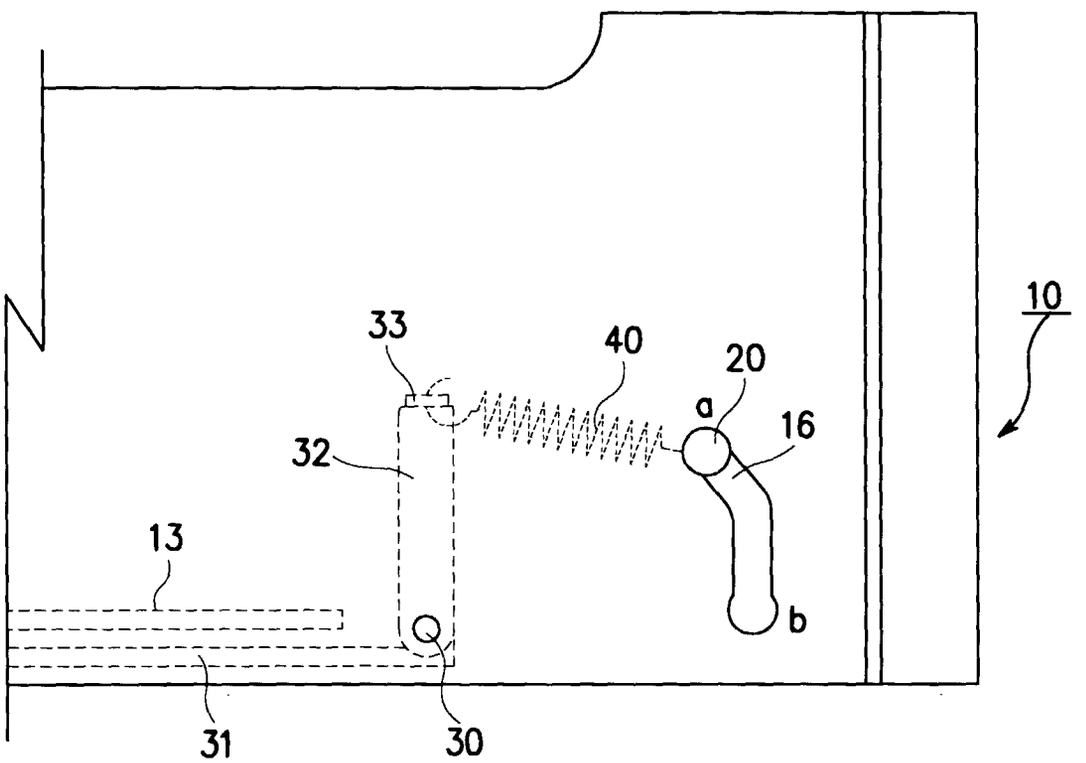

FIG. 4

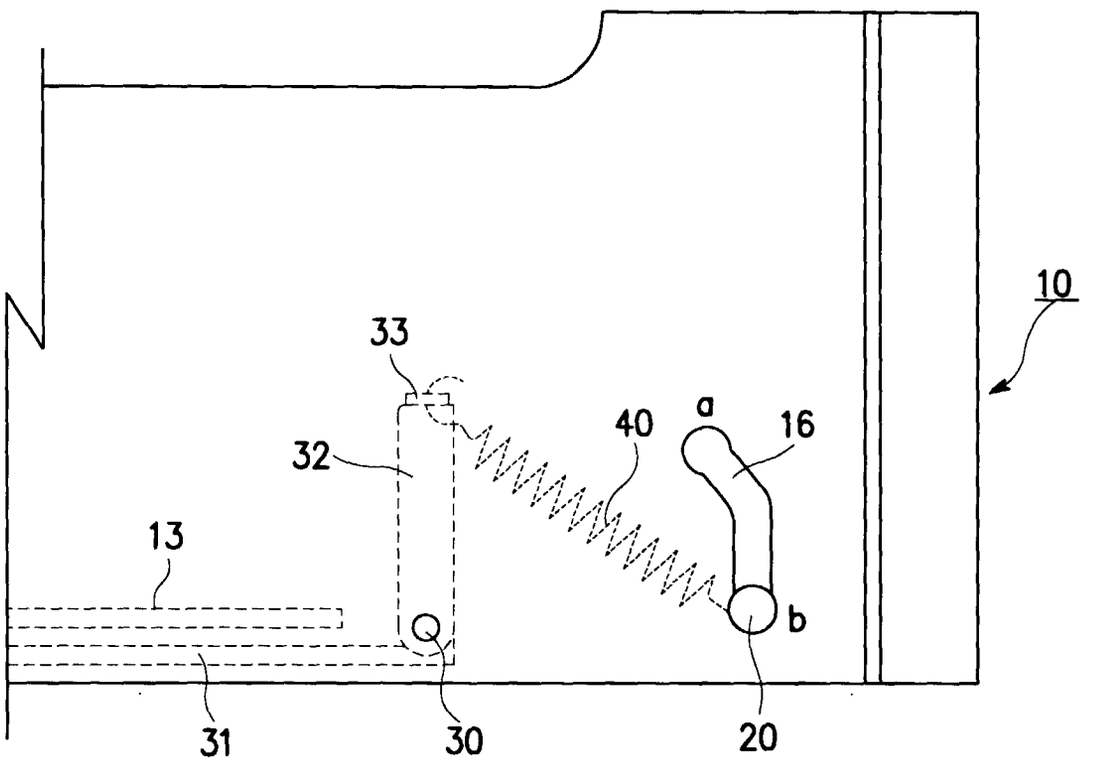

FIG. 5

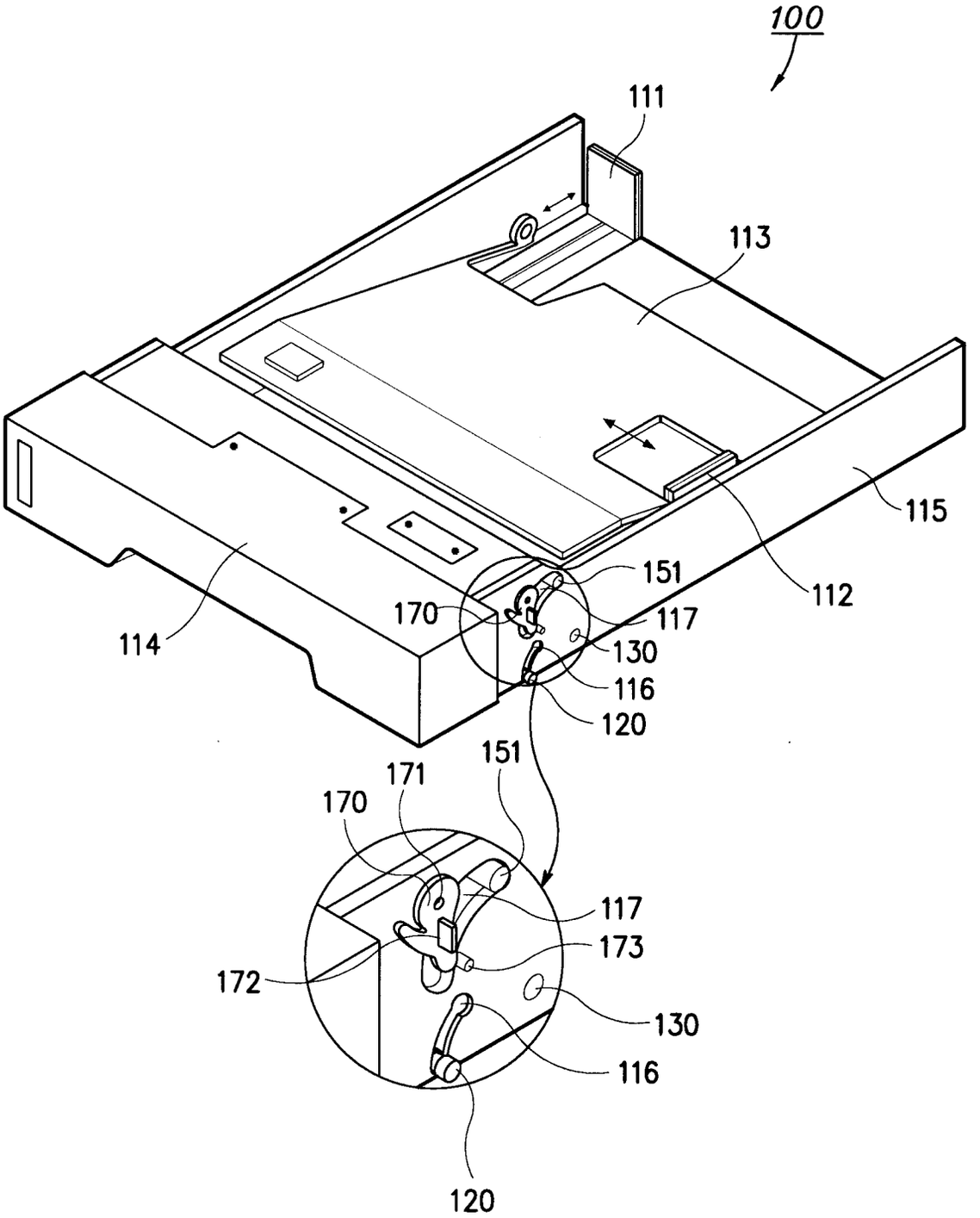

FIG. 6

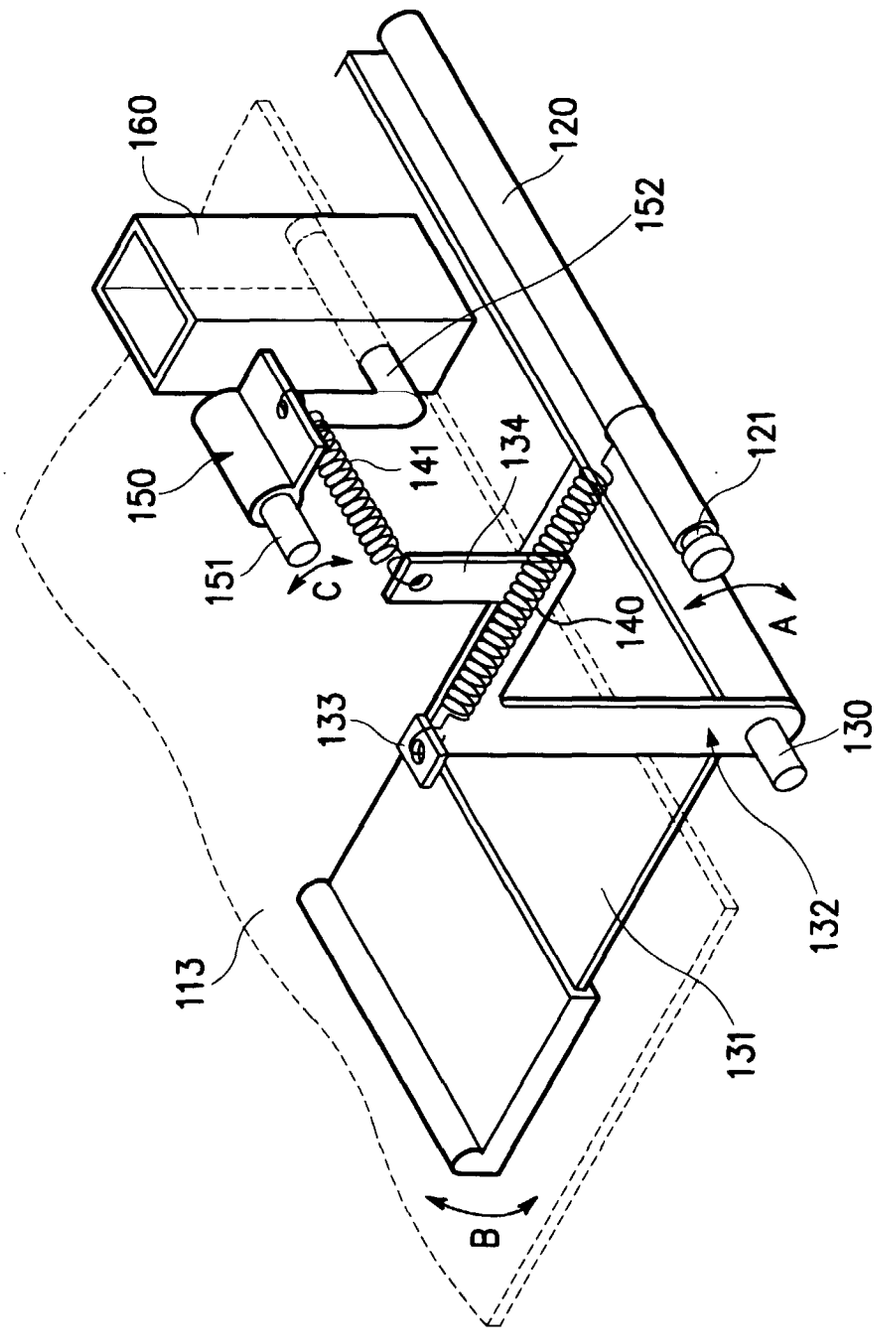

FIG. 7

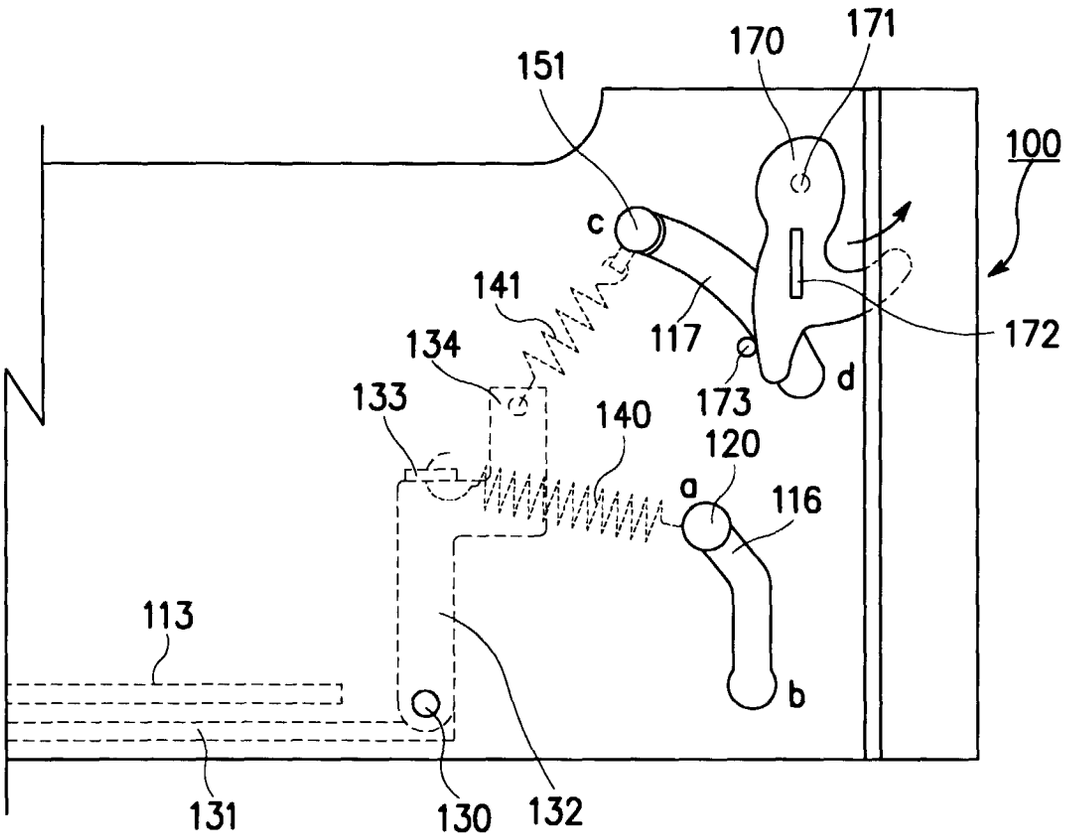
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FIG. 8

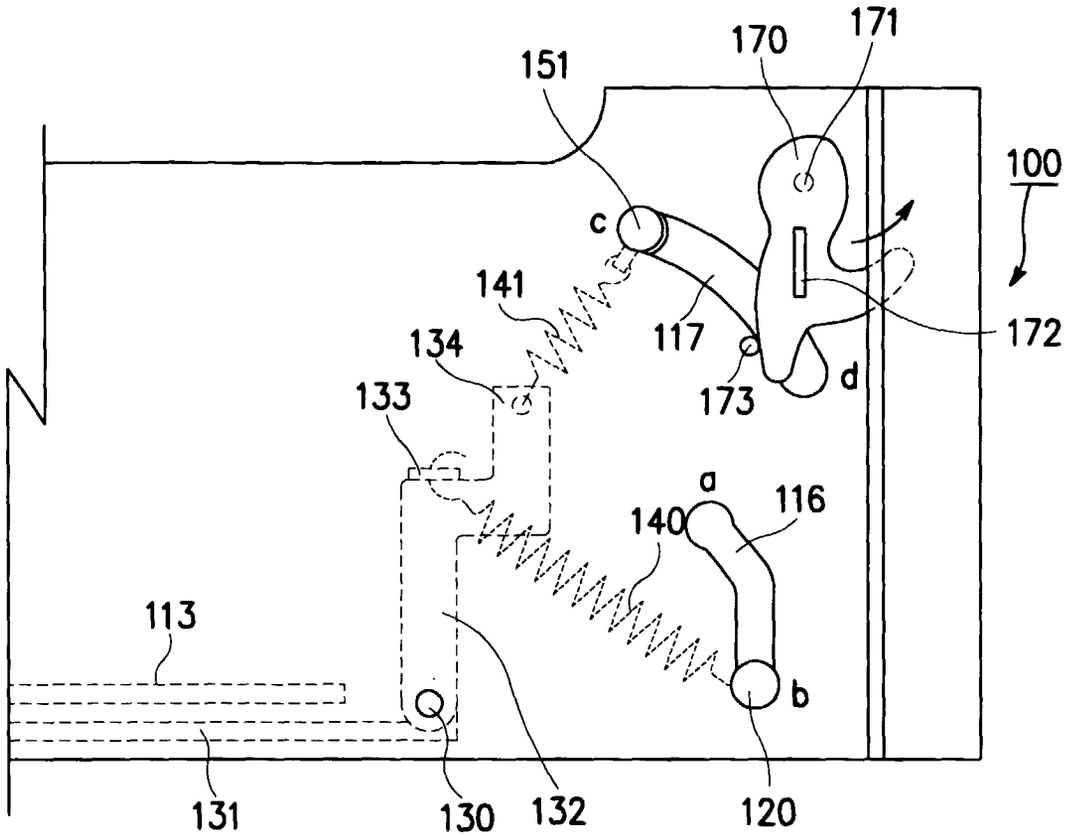
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FIG. 9

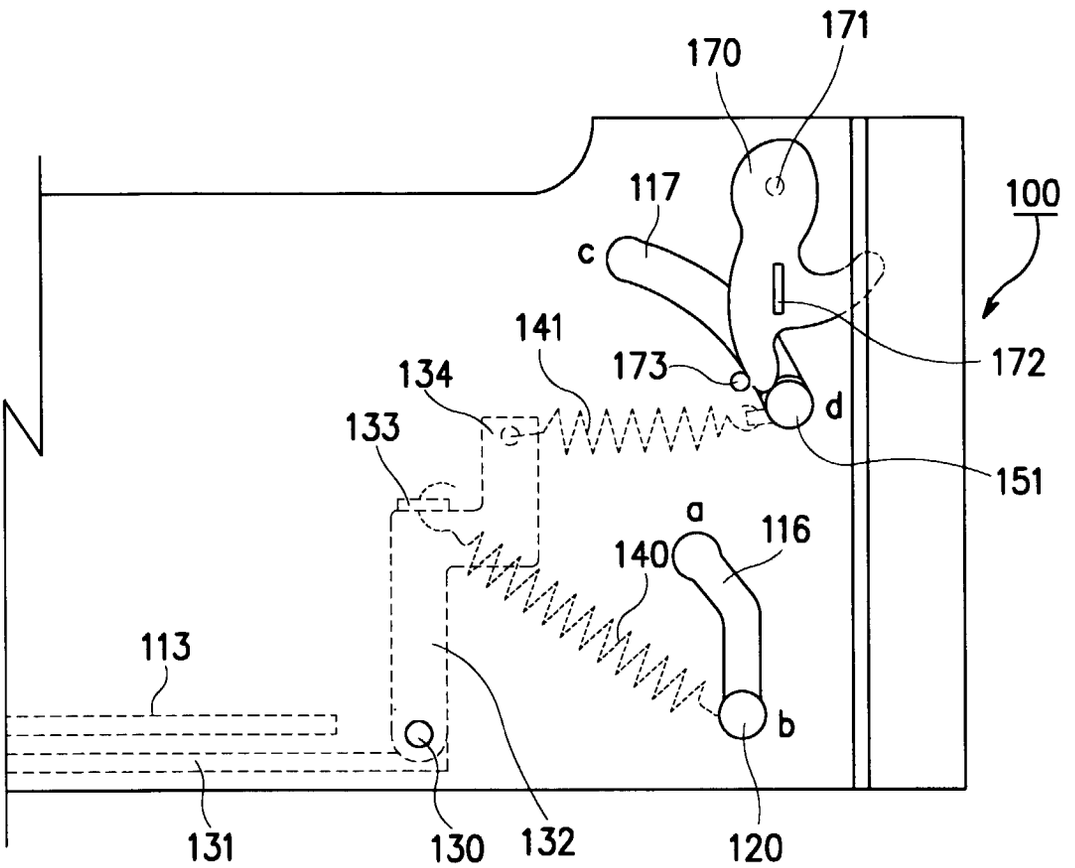
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FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 11 9052

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y A	US 5 443 252 A (MORINAGA KAZUYUKI ET AL) 22 August 1995 * column 9, line 33 - column 10, line 13; figures 1-32 *	1-6,10, 11 9,12,13 7,8	B65H1/26 B65H1/12
Y	PATENT ABSTRACTS OF JAPAN vol. 095, no. 011, 26 December 1995 & JP 07 206180 A (CANON INC), 8 August 1995 * abstract *	9,12,13	
E	US 5 823 525 A (MIKI KATSUHIKO) 20 October 1998 * the whole document *	1-13	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 January 1999	Henningsen, O

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 11 9052

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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19-01-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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