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(54) Printing Apparatus

(57) A printing apparatus (1) including: a printing head (10) for printing characters on a printing medium (100) ; and a platen (60) placed on an opposite side of the printing head (10), the printing medium (100) being placed between the platen (60) and the printing head (10), characterized in that the printing apparatus (1) further includes:

a gap guide (20) moving in a transportation width direction (D2) of the printing medium (100) together with the printing head (10) and including a plane portion (20b, 20c) that holds the printing medium (100) in cooperation with the platen (60), the gap guide (20) being for ensuring a gap (G) between the printing head (10) and the printing medium (100); and

a biasing mechanism (70) for biasing at least one of the platen (60) and the gap guide (20) in a direction in which the platen (60) and the gap guide (20) approach each other.

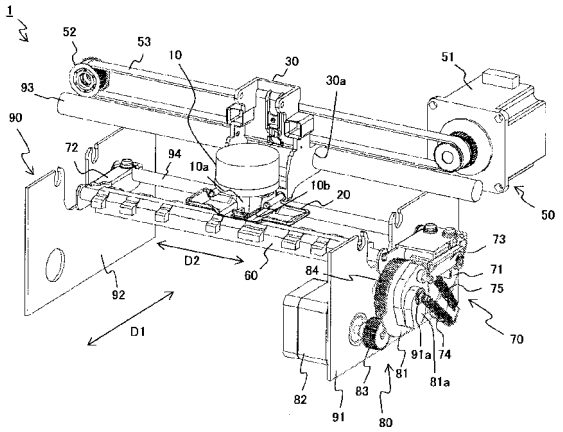

FIG. 1

EP 2 353 876 A2

Description

FIELD

[0001] The present invention relates to a printing apparatus that prints characters on a printing medium.

BACKGROUND

[0002] Conventionally, when for example a printing apparatus is used to print characters on multiple pieces of printing media each of which has a different thickness, the gap between the printing head and a printing medium is made larger or smaller if the positions of the printing head and the printing medium are not adjusted. If the gap between a printing head and a printing medium is made larger or smaller like this, the printing quality is lowered.

[0003] Accordingly, as an example, three types of gap management, described later, are performed.

[0004] The first type of gap management is a gap management type using an automatic gap management mechanism.

[0005] In this first gap management type, a platen is raised; the platen is pushed onto a printing medium; the thickness of the printingmedium is detected by a pressure sensor or a mechanism that detects slippage of a platen driving mechanism; and the platen is moved to an appropriate platen position (e.g., a position a little lower than the position at which the platen is in contact with the printing medium).

[0006] The second gap management type is a gap management type using a gap roller.

[0007] In this second gap management type, using a platen, a printing medium is pushed onto a gap roller attached to the printing head side; in this way, the gap between the printing head and a printing medium is always kept constant.

[0008] The third gap management type is a gap management type using a platen stopper technique.

[0009] In this third gap management type, using the pressure of a platen, a thick printing medium is pushed onto a medium guide attached to the printing head. For a thin printing medium such as a cut sheet, the printing medium will be twisted if it is directly pushed onto the medium guide while maintaining the same pressure as that used for a thick printing medium; therefore, the movement range of the platen is adjusted by a stopper so that a space for the printing medium can be maintained between the platen and the medium guide.

[0010] As apparatuses that press on a platen, the apparatuses described in, for example, patent documents 1 to 3 are suggested. In the printing apparatus described in patent document 1, a platen and a base guide against which a printing medium is pressed by the platen are placed so that they cover the entirety of the transportation width of the printing medium.

[0011] The three gap management types above have the following problems.

[0012] In regard to the first gap management type, using an automatic gap management mechanism, a pressure sensor, a mechanism for detecting slippage, or the like is needed; therefore, the configuration tends to be complicated and expensive to achieve. The adjustment task will be difficult to perform. In addition, a printing medium such as a bankbook cannot be dealt with since its thickness differs in different portions due to the magnetic stripe, seal sticker, and the like.

[0013] In regard to the second gap management type, using a gap roller, concentrated loads are applied to a printing medium since platen pressure is applied by the gap roller. In addition, a gap roller is usually made of rubber; therefore, only limited pressure can be applied, and further, fading easily occurs when printing is performed for a book-typed medium such as a bankbook.

[0014] In regard to the third gap management type, using a platen stopper technique, high accuracy adj ustment needs to be performed since the movement range of a platen is adjusted using a stopper so that a space for a thin printing medium can be maintained. In addition, since the third gap management type is easily affected by the setting state and the like of the apparatus, it is difficult to maintain the space for a printing medium.

[0015] If, as in the case of the printing apparatus described in patent document 1 above, a base guide against which a printing medium is pressed by a platen is placed so that it covers the entirety of the transportation width of the printing medium, then it is very difficult to keep, for the entirety of the transportation width, the gap between the printing head and the platen within the allowable range; therefore, expensive high-accuracy parts and high-accuracy adjustments are needed. In addition, since the printing apparatus described in patent document 1 is easily affected by the setting state of the apparatus and the like, it is difficult to keep the gap constant.

Patent Document 1: Japanese Patent Publication No. 2732416

Patent Document 2: Japanese Laid-open Patent Publication No. H08-337022

Patent Document 3: Japanese Patent Publication No. 2731022

SUMMARY

[0016] It is considered desirable to provide a printing apparatus that has a simple configuration and that can simplify the adjustment of the gap between a printing head and a printing medium and can prevent concentrated loads from being applied to a printing medium.

[0017] According to one aspect of the present invention, a printing apparatus includes a printing head for printing a character on a printing medium, and a platen placed on the opposite side of the printing head, the printing medium being placed between the platen and the

printing head, wherein the printing apparatus further comprises: a gap guide which moves in the transportation width direction of the printing medium together with the printing head, on which a plane portion is formed that holds the printing medium in cooperation with the platen, and which ensures the gap between the printing head and the printing medium; and a biasing mechanism for biasing at least one of the platen and the gap guide in the direction in which they approach each other.

[0018] Thus, using a simple configuration, it may be possible to simplify the adjustment of the gap between a printing head and a printing medium and to prevent concentrated loads from being applied to a printing medium.

BRIEF DESCRIPTION OF DRAWINGS

[0019]

Fig. 1 is a perspective view showing a printing apparatus according to one embodiment of the present invention.

Fig. 2 is an exploded perspective view for illustrating the connection state of a printing head, gap guide, and carriage according to one embodiment of the present invention.

Fig. 3 is a side view for illustrating a gap adjustment performed by a gap adjustment mechanism according to one embodiment of the present invention.

Fig. 4 is a perspective view for illustrating a first spring of a biasing mechanism according to one embodiment of the present invention, with a portion of the printing apparatus being omitted.

Fig. 5 is a side view for illustrating a first spring of a biasing mechanism according to one embodiment of the present invention, with a portion of the printing apparatus being omitted.

Fig. 6 is a perspective view for illustrating a second spring of a biasing mechanism according to one embodiment of the present invention, with a portion of the printing apparatus being omitted.

Fig. 7A is a side view A for illustrating a second spring of a biasing mechanism according to one embodiment of the present invention, with a portion of the printing apparatus being omitted.

Fig. 7B is a side view B for illustrating a second spring of a biasing mechanism according to one embodiment of the present invention, with a portion of the printing apparatus being omitted.

DESCRIPTION OF EMBODIMENT

[0020] In the following, printing apparatuses according to embodiments of the present invention will be described with reference to the drawings.

Fig. 1 is a perspective view showing a printing apparatus 1 according to one embodiment of the present invention.

Fig. 2 is an exploded perspective view for illustrating the connection state of a printing head 10, a gap guide 20, and a carriage 30 according to one embodiment of the present invention.

Fig. 3 is a side view for illustrating a gap adjustment performed by a gap adjustment mechanism 40.

Figs. 4 and 5 are a perspective view and a side view for illustrating a first spring 74 of a biasing mechanism 70, with a portion of the printing apparatus 1 being omitted.

Figs. 6, 7A and 7B are a perspective view and side views A and B for illustrating a second spring 75 of a biasing mechanism 70, with a portion of the printing apparatus 1 being omitted.

[0021] The printing apparatus 1 shown in Fig. 1 comprises a printing head 10, a gap guide 20, a carriage 30, a gap adjustment mechanism 40 (see Figs 2 to 4), a head moving unit 50, a platen 60, a biasing mechanism 70, a biasing force adjustment mechanism 80, and a frame 90.

[0022] As shown in Figs. 1 to 3, the printing head 10 prints characters on a printing medium 100 (shown in Figs. 5, 7A and 7B) using a printing surface 10b that is the bottom face of a head pin 10a projecting downward. As shown in Fig. 2, two connection bores 10c (only one of which is shown) which penetrate the printing head 10 in the transportation direction D1 are respectively formed in the two areas that extend in the transportation width direction D2 of the printing medium 100 and that are separated by the head pin 10a.

[0023] In regard to the printing apparatus 1 of the present embodiment, it is suitable to use a paper medium, suchasabankbook or a cut sheet, as the printing medium 100. However, a printing medium 100 of another type can also be used.

[0024] The gap guide 20 is composed of, for example, a metal, and is interconnected to the printing head 10 and the carriage 30 at the space below the printing head 10 (this will be described later in detail) . The gap guide 20 assumes a patelliform shape that is longer in the transportation width direction D2 than in the transportation direction D1, and assumes an approximately rectangular shape when it is seen in a planar view.

[0025] A through bore 20a, which assumes a rectangular shape when it is seen in a planar view, is formed at the center of the transportation-width-direction-D2 side of the gap guide 20. When the gap guide 20 is interconnected to the printing head 10 and the carriage 30, the through bore 20a is formed between the printing surface 10b of the printing head 10 and a portion of the printing medium 100 facing the printing surface 10b.

[0026] Plane portions 20b and 20c are formed on the bottom face of the gap guide 20. As a first region and a second region separated by the printing surface 10b of the printing head 10, the plane portions 20b and 20c are formed on the two bottom faces arranged in the transportation width direction D2 and separated by the through bore 20. In the present embodiment, the plane portions

20b and 20c are formed at positions adjacent to (continuous with) the through bore 20a.

[0027] The plane portions 20b and 20c are placed at the lowest end of the gap guide 20, and hold the printing medium 100 in cooperation with the platen 60 composed of, for example, rubber resin. Therefore, depending on the relative positions of the printing head 10 and the gap guide 20, a gap G between the printing head 10 and the printing medium 100 (see Fig. 3) will be determined.

[0028] A bracket part 20d, which projects upward from the top face of the periphery, is formed on the gap guide 20. The bracket part 20d is formed on one of two portions of the periphery that face each other at the center of the transportation-width-direction-D2 side of the gap guide 20.

[0029] As shown in Figs. 2 and 4, connection bores 20e and 20f, which penetrate the bracket part 20d in the transportation direction D1, are formed on the bracket part 20d. The connection bores 20e and 20f together with the connection bore 10c of the printing head 10 are used for the connection to the carriage 30.

[0030] As shown in Figs. 2, 4 and 6, a hooking part 20g for hooking onto the gap adjustment mechanism 40 (this will be described later) is formed on the bracket part 20d. In the present embodiment, the hooking part 20g is formed at the bottom of the bracket part 20d at the approximate mid-point of the transportation width direction D2 side of the bracket part 20d, in such a way that it penetrates the bracket part 20d in the transportation direction D1.

[0031] In regard to the carriage 30, as shown in Figs. 1 to 3, the guide shaft 93 of the frame 90 (this will be described later) is placed in such a way that it passes through, in the transportation width direction D2, the two coaxially arranged through bores 30a and 30b.

[0032] As shown in Fig. 2, the carriage 30 is provided with two connection pins 30c and 30d extending in the transportation direction D1. The connection pins 30c and 30d are inserted into the two connection bores 20e and 20f of the gap guide 20 and into the two connection bores 10c (only one of the two is shown) of the printing head 10. Via connection screws 30e and 30f from the opposite side of the insertion direction of the connection pins 30c and 30f being screwed into the connection pins 30c and 30d, the printing head 10, the gap guide 20, and the carriage 30 are collectively interconnected.

[0033] In the present embodiment, the gap adjustment mechanism 40 is a flat spring. The bottom end of the gap adjustment mechanism 40 is hooked onto the hooking part 20g of the bracket part 20d of the gap guide 20.

[0034] As shown in Figs. 2, 4 and 5, the gap adjustment mechanism 40 vertically extends along the internal perimeter surface side of the gap guide 20 from the hooking part 20g of the bracket part 20d (vertical part 40a), extends from the upper end of the bracket part 20d and bends toward the carriage 30 so as to extend in the horizontal direction (i.e. transportation direction D1) (horizontal part 40b), and turns downward so as to extend to the position before the bracket part 20d (turning part 40c).

[0035] In regard to the gap adjustment mechanism 40, when the printing head 10, the gap guide 20, and the carriage 30 are collectively interconnected, the turning part 40c is pushed upward by the bottom face of a well 30 provided inside the carriage 30 (as shown in Fig. 2) and goes upward together with the gap guide 20.

[0036] In this way, the gap guide 20 is knocked against the printing head 10 while receiving pressure from the height direction intersecting with the insertion direction of the connection screws 30e and 30f (in the present embodiment, the direction orthogonal to the insertion direction) . The connection screws 30e and 30f also cause the gap guide 20 to be knocked against the printing head 10 while applying pressure in the insertion direction of the connection screws 30e and 30f, and this means that the gap guide 20 is knocked against the printing head 10 while receiving pressure from two intersecting directions.

[0037] As described above, by adjusting the relative positions of the printing head 10 and the gap guide 20 to be predetermined positions, the gap adjustment mechanism 40 adjusts the gap G between the printing surface 10b (printing head 10) of the printing head 10 and the plane portions 20b and 20c of the gap guide 20 (printing medium 100) to be a predetermined amount, as shown in Fig. 3.

[0038] As described above, while the connection pins 30c and 30d are inserted into the connection bores 10c (only one of these is shown) of the printing head 10 and into the connection bores 20e and 20f of the gap guide 20, the relative positions of the printing head 10 and the gap guide 20 are adjusted. Therefore, the cross section of at least one of the connection bore 10c of the printing head 10 and the connection bores 20e and 20f of the gap guide 20 is formed to be larger than the cross sections of the connection pins 30c and 30d.

[0039] The head moving unit 50 includes a motor 51, a pulley 52, and a belt 53.

[0040] The motor 51 is, for example, a steppingmotor. By rotating the belt 53 stretching between the motor 51 and the pulley 52, the motor 51 moves the carriage 30 in the transportation width direction D2 along the guide shaft 93.

[0041] Accordingly, the printing head 10 and gap guide 20 connected to the carriage 30 also move in the transportation width direction D2; and while securing, via the gap guide 20, a desired gap G between the printing medium 100 and the printing surface 10b that is the bottom face of the head pin 10a, the printing head 10 prints characters on the printing medium 100 transported in the transportation direction D1.

[0042] The platen 60 for holding the printing medium 100 in cooperation with the plane portions 20b and 20c of the gap guide 20 extends between the side frames 91 and 92 of the frame 90 so that it covers essentially the entirety of the transportation-width-direction-D2 side.

[0043] The platen 60 is composed of, for example, rub-

ber resin and the gap guide 20 is composed of, for example, metal. Therefore, the frictional coefficient (i.e., dynamic frictional coefficient and static frictional coefficient) of the plane portions 20b and 20c are lower than the frictional coefficient of the portions of the platen 60 facing the plane portions 20b and 20c.

[0044] The biasing mechanism 70 biases at least one of the platen 60 and the gap guide 20 (in the present embodiment, the platen 60 is biased) in the direction in which the platen 60 and gap guide 20 approach each other (in the present embodiment, the platen 60 is biased upward).

[0045] As shown in Figs. 6, 7A and 7B, the biasing mechanism 70 includes a first link 71, a second link 72, a third link 73, and first and second springs 74 and 75 as a plurality of elastic members.

[0046] As shown in Fig. 5, the first link 71 can rotate (swing) about a supporting-point shaft (rotating shaft) 94 penetrating the side frame 90 (rotation direction R1). One end of the platen 60 is fixed on the first link 71.

[0047] As shown in Fig. 4, the second link 72 can rotate (swing) about a supporting-point shaft (rotating shaft) 94. The other end (i.e., the end that is not fixed on the first link 71) of the platen 60 is fixed on the second link 72.

[0048] As described above, both ends of the platen 60 are fixed on the first and second links 71 and 72; therefore, via the first and second links 71 and 72 rotating about the supporting-point shaft (rotating shaft) 94, the platen 60 also rotates about the supporting-point shaft (rotating shaft) 94.

[0049] The rotation angles of the first and second links 71 and 72 are limited to being within a certain range, and the height of the platen 60 is similar to that of the supporting-point shaft 94. Therefore, when the platen 60 rotates, it in fact hardly moves in the transportation direction D1 but essentially has vertical motion only.

[0050] The platen 60 is connected to the first and second links 71 and 72 via the rotation shaft of the platen 60. As shown in Fig. 5, the platen 60 is configured so that it can rotate about the rotation supporting point Z.

[0051] When the thickness of the printing medium 100 changes, the links 71 and 72 rotate about the supporting-point shaft 94 so that the height of the platen 60 changes. Even in such a situation, since the platen 60 rotates about the rotation supporting point Z placed at the portion of the first and second links 71 and 72 at which they connect, the top surface of the platen 60 can always be kept parallel to the plane portions 20b and 20c of the gap guide 20 even if the platen 60 is pressed against the printing medium 100.

[0052] As shown in Fig. 4, the upper end of the first spring 74 is fixed on a stud 91a extending from the outside face of the side frame 91 in the transportation width direction D2, and the lower end is fixed on the first link 71.

[0053] The first spring 74 is straightened and fixed to be longer than its free length while the platen 60 holds the printing medium 100 in cooperation with the plane portions 20b and 20c of the gap guide 20.

[0054] Therefore, since the first spring 74 is allowed to contract so as to return to its free length, the first link 74 rotates itself so as to raise the platen 60. In this way, the first spring 74 biases the platen 60 in the direction in which it approaches the gap guide 20 (i.e., the upper direction).

[0055] One end of the third link 73 shown in Figs. 6, 7A and 7B (the illustration is omitted in Figs. 4 and 5) can rotate (swing) about the stud 71a extending from the first link 71 in the transportation width direction D2 (i.e., outward) (rotation direction R2). The third link 73 is locked via, for example, a stopper 71b provided at the first link 71 hooking the third link 73.

[0056] The second spring 75 is fixed on the free end of the third link 73 and on the first link 71.

[0057] The biasing force adjustment mechanism 80 includes a cam 81, a motor 82, and a gear 83.

[0058] The cam 81 rotates about the stud 91a of the side frame 91 via gears 83 and 84 being rotated by the motor 82 (e.g., a stepping motor).

[0059] The cam 81 is provided with a lever part 81a. As shown in Fig. 7B, via the cam 81 rotating in the counterclockwise direction in Fig. 7B, the lever part 81a pushes the third link 73 up from the position at which it is locked by the stopper 71b and unlocks the stopper 71b.

[0060] When the third link 73 is pushed up, the second spring 75 fixed on the third link 73 is stretched, and this causes the first link 71 to rotate in the clockwise direction in Fig. 7B.

[0061] Therefore, a biasing force is applied to the platen 60 from not only the first spring 74 but also from the second spring 75. In this way, the biasing force adjustment mechanism 80 moves the second spring 75, which acts as at least one elastic member, to a position at which the second spring 75 biases the platen 60 and to a position at which the second spring 75 is removed from the position above (i.e., the position at which the third link 73 is locked by the stopper 71b).

[0062] The biasing force adjustment mechanism 80 can be made to move the second spring 75 to a plurality of positions at which it biases the platen 60, so that the biasing force of the second spring 75 toward the platen 60 can be adjusted in a plurality of steps.

[0063] For example, when the printing medium 100 is a cut sheet (i.e. , a thin medium), the second spring 75 will be made to not apply a biasing force; when the printing medium 100 is a bankbook (not including the thick seam portion), the second spring 75 will be stretched a little so that an additional small biasing force is obtained; and when the printing medium 100 is the seam portion of a bankbook, the second spring 75 will be stretched greatly so that an additional great force is obtained. In this way, an optimum biasing force can be obtained.

[0064] In the present embodiment described above, the gap guide 20 moves in the transportation width direction D2 of the printing medium 100 together with the printing head 10; the plane portions 20b and 20c, which hold the printing medium 100 in cooperation with the plat-

en 60, are formed; and the gap G between the printing head 10 and the printing medium 100 is secured. The biasing mechanism 70 biases at least one of the platen 60 and the gap guide 20 (in the present embodiment, the platen 60 is biased) in the direction in which the platen 60 and gap guide 20 approach each other.

[0065] Therefore, the configuration can be made to be simple by omitting expensive high-accuracy parts for maintaining the parallelism of the gap guide 20 and the platen 60 in the transportation width direction D2. In addition, the adjustment of the gap G can be simplified since high-accuracy adjustment for maintaining the parallelism above can be omitted. Further, since the plane portions 20b and 20c of the gap guide 20 hold the printing medium 100 in cooperation with the platen 60, loads are also applied to the plane portions 20b and 20c; therefore, the loads applied on the printing medium 100 are reduced.

[0066] Therefore, according to the present embodiment, using a simple configuration, it is possible to simplify the adjustment of the gap G between the printing head 10 and the printing medium 100 and to prevent concentrated loads from being applied to the printing medium 100.

[0067] In the present embodiment, the plane portions 20b and 20c of the gap guide 20 are formed in the first and second regions, which are separated by the printing surface 10b of the printing head 10 (in the present embodiment, these two regions are two bottom faces arranged in the transportation width direction D2 and separated by the through bore 20a) . Therefore, the gap G can be ensured with a higher degree of accuracy.

[0068] In the present embodiment, the gap guide 20 has the through bore 20a formed between the printing surface 10b of the printing head 10 and the portion of the printing medium 100 facing the printing surface 10b, and the plane portions 20b and 20c are formed at positions adj acent to the through bore 20a. Therefore, the gap G can be ensured with a higher degree of accuracy.

[0069] In the present embodiment, the biasing force adjustment mechanism 80 moves the second spring 75, which acts as at least one of a plurality of elastic members, to a position at which the second spring 75 biases the platen 60 and to a position at which the second spring 75 is removed from the position above (i.e. , the position at which the third link 73 is locked by the stopper 71b). This allows the number of springs (i.e., elastic members) for biasing platen 60 to be changed. Therefore, depending on the printing medium 100, it is possible to greatly change the biasing force in a simple manner.

[0070] In the present embodiment, when the printing head 10, the gap guide 20, and the carriage 30 are collectively interconnected, the gap adjustment mechanism 40 adjusts the relative positions of the printing head 10 and the gap guide 20 to be predetermined positions. Therefore, the gap G between the printing head 10 (the printing surface 10b) and the printing medium 100 (the plane portions 20b and 20c of the gap guide 20) can be easily ensured.

[0071] The frictional coefficient of the plane portions 20b and 20c is lower than the frictional coefficient of the portions of the platen 60 facing the plane portions 20b and 20c. Therefore, it is possible to prevent an especially thin printing medium 100 from being twisted.

[0072] In the present embodiment, the plane portions 20b and 20c are formed in two places, i.e., the first and second regions separated by the printing surface 10b. However, the plane portions 20b and 20c can also be formed in only one place. In addition, it is also possible for a plane portion formed in one place to extend over the first and second regions above.

[0073] In the present embodiment, the gap adjustment mechanism 40 is a flat spring. However, it can also be another elastic body. As an example, if an inclined plane is formed on the gap adjustment mechanism 40 so that it slides on the inclined plane on the printing head 10, automatic adjustment of the gap G at the time of the connecting can also be performed; therefore, an elastic body is not needed.

[0074] In the present embodiment, the gap guide 20 and the carriage 30 are different matters; however, they can be unified.

[0075] In the present embodiment, the platen 60 is biased by the force that is generated by the stretched first and second springs 74 and 75 attempting to return to their free lengths. In contrast, it is also possible for the platen 60 to be biased by the force that is generated by the compressed springs attempting to return to their free lengths.

[0076] In the present embodiment, an example has been described in which the platen 60, which acts as at least one of the platen 60 and gap guide 20, is biased toward the gap guide 20. However, it is also possible for the gap guide 20 to be biased toward the platen 60.

Claims

1. A printing apparatus (1) comprising: a printing head (10) for printing characters on a printing medium (100) ; and a platen (60) placed on an opposite side of the printing head (10), the printing medium (100) being placed between the platen (60) and the printing head (10), **characterized in that** the printing apparatus (1) further comprises:

a gap guide (20) moving in a transportation width direction (D2) of the printing medium (100) together with the printing head (10) and including a plane portion (20b, 20c) that holds the printing medium (100) in cooperation with the platen (60), the gap guide (20) being for ensuring a gap (G) between the printing head (10) and the printing medium (100); and

a biasing mechanism (70) for biasing at least one of the platen (60) and the gap guide (20) in a direction in which the platen (60) and the gap

guide (20) approach each other.

2. The printing apparatus (1) according to claim 1, wherein
the plane portions (20b, 20c) of the gap guide (20) are formed in a first region and a second region separated by a printing surface (10b) of the printing head (10).

3. The printing apparatus (1) according to claim 1 or 2, wherein:

on the gap guide (20), a through bore (20a) is formed between the printing surface (10b) of the printing head (10) and a portion of the printing medium (100) facing the printing surface (10b) ; and
the plane portion (20b, 20c) of the gap guide (20) is formed at a position adjacent to the through bore (20a).

4. The printing apparatus (1) according to claim 1, 2 or 3, further comprising
a biasing force adjustment mechanism (80) for adjusting a biasing force of the biasing mechanism (70), wherein:

the biasing mechanism (70) includes a plurality of elastic members (74, 75); and
the biasing force adjustment mechanism (80) moves at least one of the plurality of elastic members (74, 75) to a position at which the at least one of the plurality of elastic members (74, 75) biases at least one of the platen (60) and the gap guide (20) and to a position removed from the position at which the at least one of the plurality of elastic members (74, 75) biases the at least one of the platen (60) and the gap guide (20).

5. The printing apparatus (1) according to any preceding claim, further comprising:

a carriage (30) holding the printing head (10) and the gap guide (20); and
a gap adjustment mechanism (40) for adjusting a gap (G) between the printing head (10) and the printing medium (100) by adjusting relative positions of the printing head (10) and the gap guide (20) to be predetermined positions, wherein:

the printing head (10), the gap guide (20), and the carriage (30) are collectively interconnected; and
when the printing head (10), the gap guide (20), and the carriage (30) are collectively interconnected, the gap adjustment mechanism (40) adjusts the relative positions of the printing head (10) and the gap guide (20) to be the predetermined positions.

6. The printing apparatus (1) according to any preceding claim, wherein
a frictional coefficient of the plane portion (20b, 20c) of the gap guide (20) is lower than a frictional coefficient of a portion of the platen (60) facing the plane portion (20b, 20c).

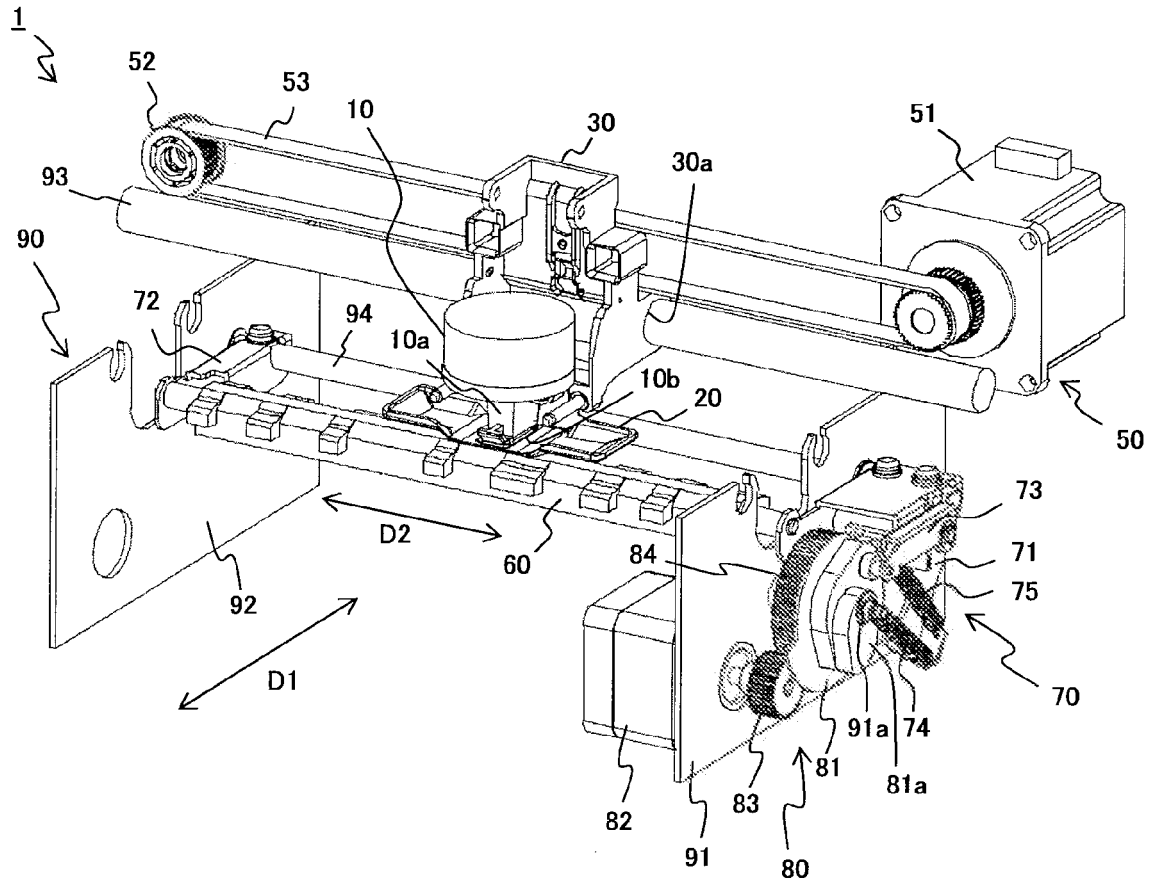
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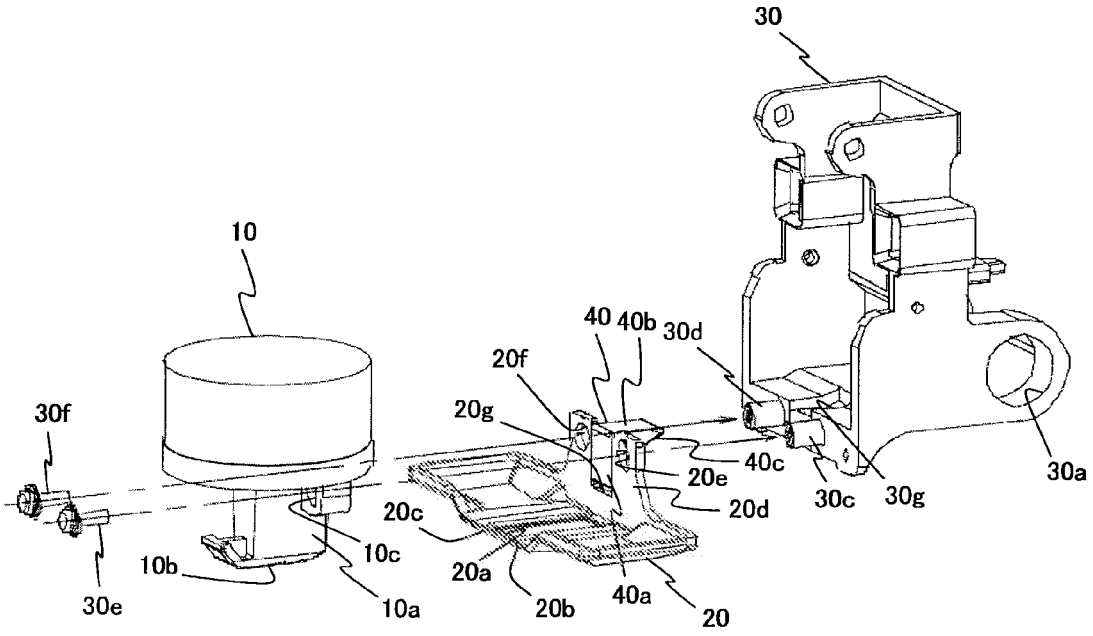
FIG. 1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20d
30c
30g
20c
10c
20a
10b
40a
20
30e
10a
20b

FIG. 2

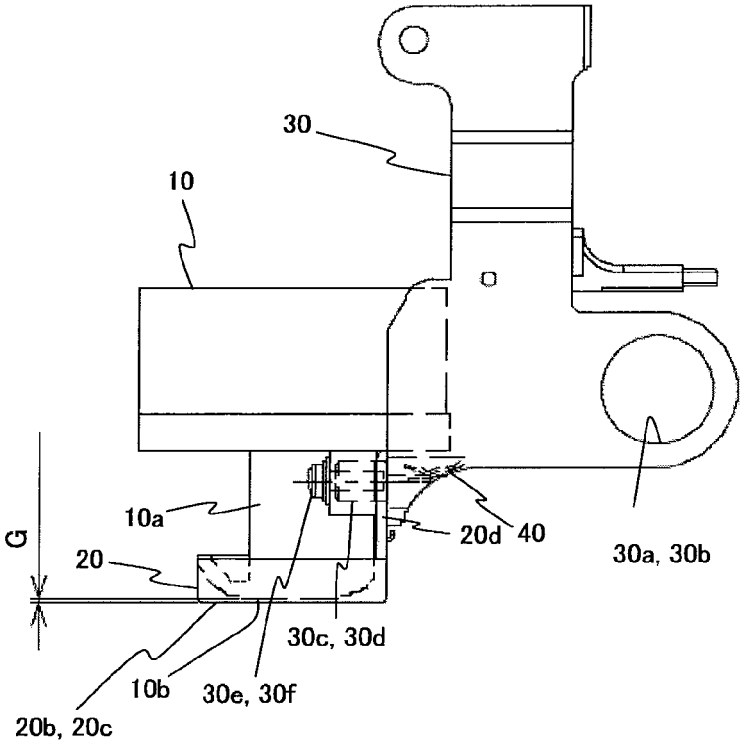

FIG. 3

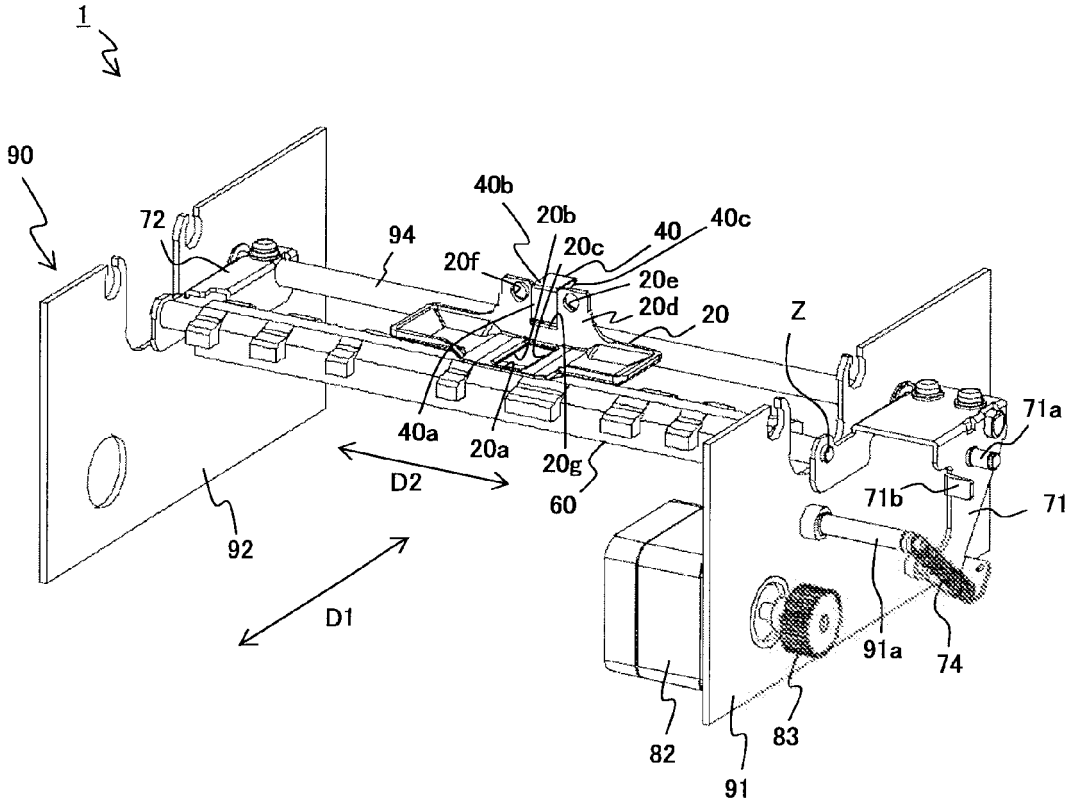
1
90
72
94
40b
20b
20c
40
40c
20f
20e
20d
20
Z
71a
71
71b
40a
20a
20g
60
D2
92
D1
91a
74
82
83
91

FIG. 4

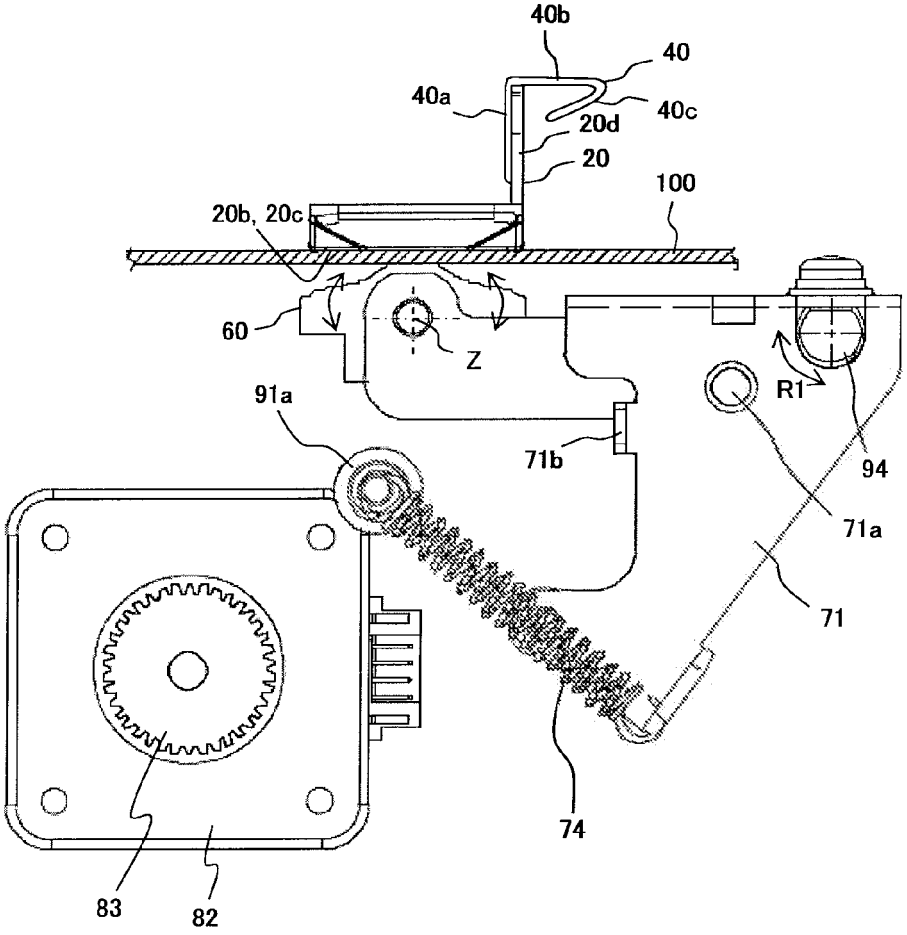

FIG. 5

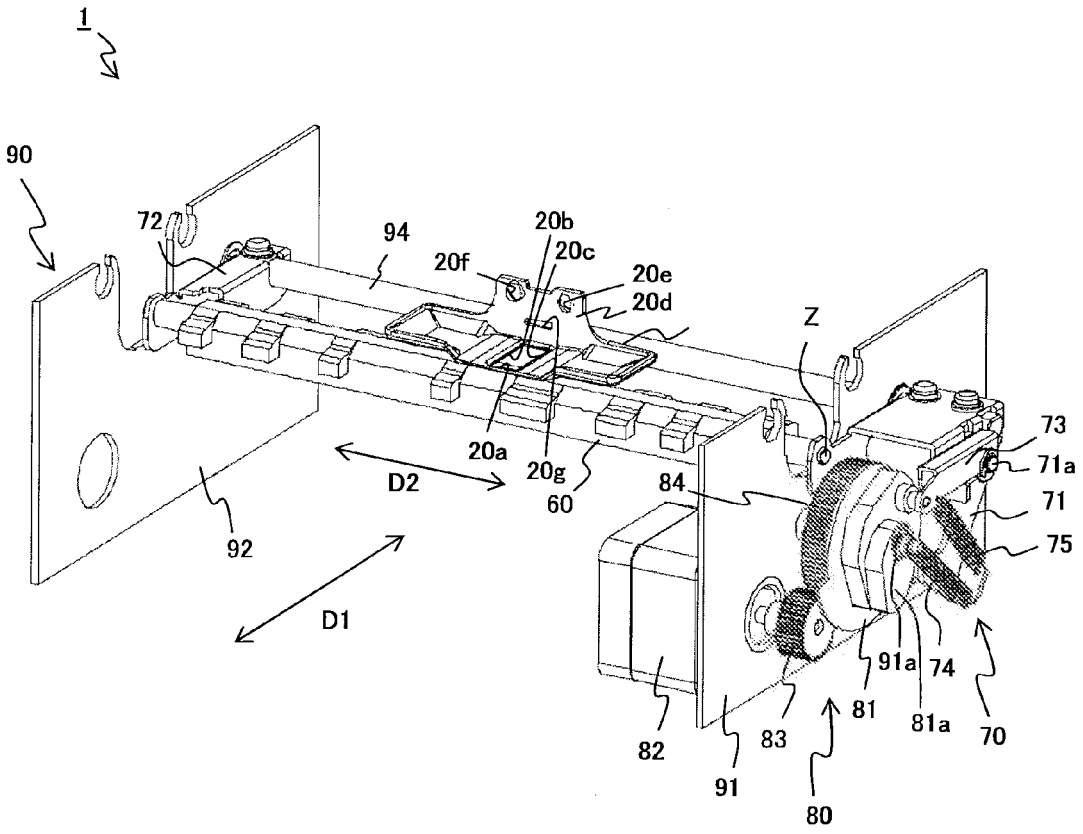
1
90
72
94
20b
20c
20f
20e
20d
Z
73
71a
71
75
20a
20g
60
84
D2
92
D1
91a
74
81
81a
70
82
83
91
80

FIG. 6

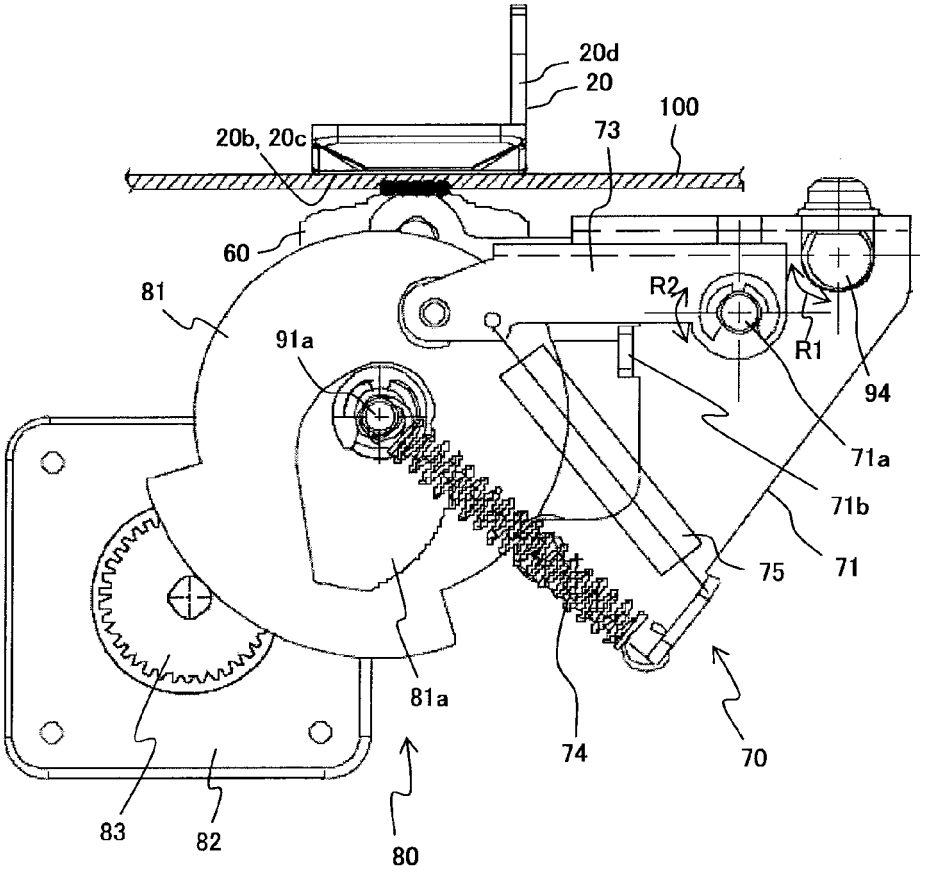
20d
20
100
73
20b, 20c
60
81
91a
R2
R1
94
71a
71b
71
75
81a
74
70
83
82
80

FIG. 7A

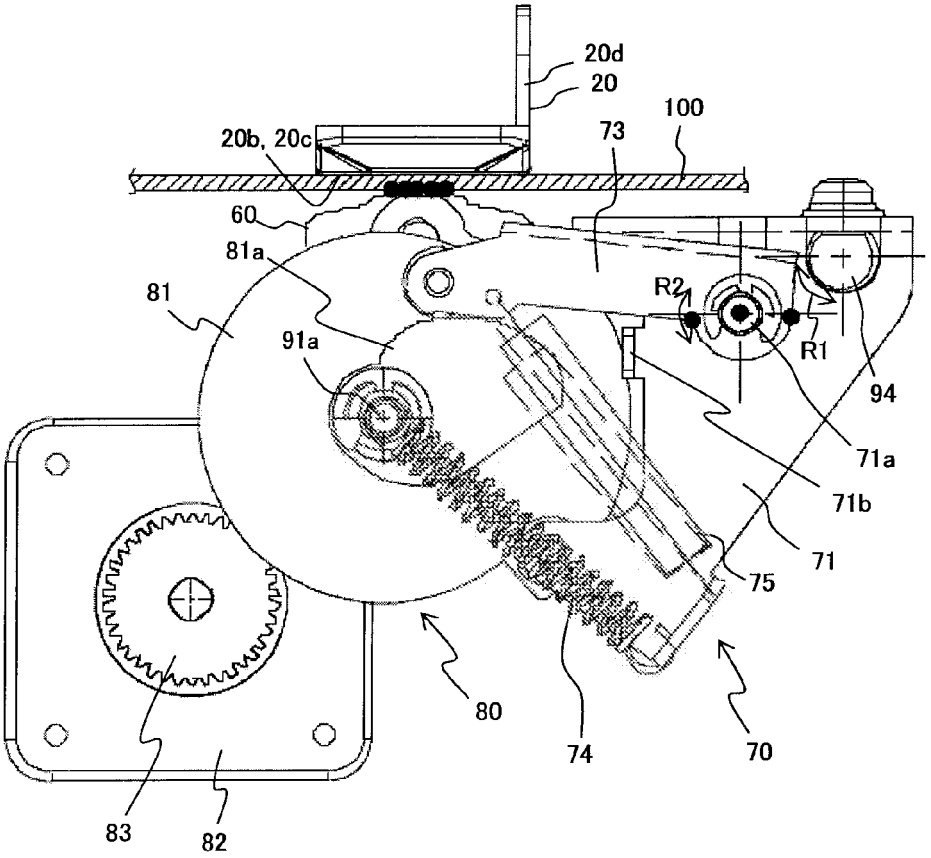
20d
20
100
73
20b, 20c
60
81a
81
91a
R2
R1
94
71a
71b
71
75
80
74
70
83
82

FIG. 7B

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2732416 B **[0015]**
- JP H08337022 B **[0015]**
- JP 2731022 B **[0015]**