

Description

The present invention relates to printing devices used as terminals for or built in parts of word processors, data processing devices, computers, etc., and more particularly to the frame structure of such printing devices.

FIG. 6 shows a partial side view of a prior art printing device, and more specifically it shows an example of the frame structure in a printing section of the printing device. The printing section mainly comprises a rigid main guide shaft 2 attached to a rigid metallic base frame 1 to extend in the transverse direction of the base frame. A print head 3 is slidably mounted on the main guide shaft and movable along it. A platen frame 5 is fixed to the base frame 1. A platen 51 formed as an integral part of the platen frame extends in parallel to the main guide shaft 2 and faces the print head 3. An ink ribbon 4 is disposed between the print head 3 and the platen. Paper 6 is fed to pass through the space between the platen and the ink ribbon. Dot matrix patterns are printed on paper 6 in response to character signals input from an external device said signals causing printing elements of the print head to impinge on the ink ribbon and to push the ink ribbon against the paper.

In the printing section of a printing device configured in this manner, it is important that the platen gap W, which is the gap between the print head 3 and the platen 51 of platen frame 5, be set to a suitable value to achieve a proper density of the characters, etc., printed on the paper 6 and to ensure that the paper 6 is fed smoothly and does not become jammed. If this gap W is too wide, the printing elements of the print head may not sufficiently press the ink ribbon 4 against the paper 6, resulting in character drop-out or no printing at all. If the gap W is too narrow, on the other hand, paper feeding may become irregular resulting in irregular line spacing, or even worse, printed characters may become unreadable due to paper jamming.

In prior art printing devices, the platen gap W is predetermined by the mounting positions of the main guide shaft 2 and the platen frame 5 on the base frame 1 which is formed from metal or another rigid material and has a low thermal expansion coefficient and sufficient rigidity against external forces and vibrations. The platen gap may be adjustable to allow adaption to various paper thicknesses. This is accomplished by mounting the main guide shaft 2 by means of eccentric extensions 2a to the base frame 1. Because of these eccentric extensions or attachment ends 2a of the main guide shaft, the position of the print head 3 in the base frame can be changed by an angular rotation of the main guide shaft 2, and as a result,

with the platen frame 5 fixed to the base frame 1 the platen gap W can be adjusted. US-A-4 676 675 and EP-A-0 391 829 disclose similar gap adjustment mechanisms.

In recent years, such printing devices are often located in offices and other places near people, thus making it necessary to take measures to prevent disturbing noise and vibration. Further, demand is increasing for frames formed in complex shapes to achieve printing devices with greater compactness and to make it possible to build them into various devices. Base frames made from a thin metal plate which can easily be configured to various shapes together with vibration and sound prevention devices attached to such printing devices have been considered in response to these demands, and it has also been proposed that the base frame be formed from a synthetic resin, i.e., a material which provides some damping effect by itself and which can be easily molded into complex shapes.

However, there are mainly two problems involved in using a base frame made from a material which is light and can be easily formed to rather complex shapes like a resin material or thin sheet metal. One problem is that such base frame may be easily deformed in response to external forces as they are for instance applied when the base frame is fixed to a printer casing. If such deformation influences the platen gap, high quality printing may not be achieved. The other problem is a deformation of the base frame due to a thermal expansion or contraction of a material like resin having a relatively high thermal expansion coefficient substantially greater than that of metal. Since the linear thermal expansion coefficient of such resin is an order greater than that of metal, etc., when the temperature in the printing device increases due to the heat generated by internal components inside the printing device, the platen gap will vary due to an expansion of the base frame. The same is true with a low rigidity sheet metal base frame mounted to a resin printer casing. In such case a thermal deformation of the printer casing will induce a deformation of the base frame. When the platen gap varies, due to influences as described above, it becomes impossible to obtain clear printing, and in some cases printing itself becomes impossible. Further, in resin frames and resin printer casings formed by extrusion molding, slight deformations are impossible to avoid, and if these deformations are not corrected, high quality printing cannot be achieved. Therefore, even though many advantages could be realized in printing devices by using a base frame made from a resin or a thin sheet metal, these frames could not actually be used because of the difficulty they presented in achieving high quality printing.

In view of the above-mentioned problems, the purpose of this invention is to provide a light-weight printing device in which the platen gap and, thus, the printing quality is substantially insusceptible to deformations of the base frame caused by manufacturing, external forces or temperature influences.

This purpose is achieved with a printing device as claimed.

According to one aspect, the invention provides a gap control means designed to maintain the distance between the platen frame and the main guide shaft and thus the print head constant irrespective of dimensional variations or inaccuracies of the base frame.

According to another aspect of the invention the print head and the guide shaft on which the print head is slidably mounted form one unit fixed to a base or mounting frame whereas the platen is part of a separate platen unit floatingly supported by the base or mounting frame. The platen frame further includes paper feed means, e.g. a step motor and paper feed rollers. Gap control means control the position of the floating platen unit so as keep the platen gap constant at a desired value. By additionally including the paper feed means the platen unit has a relatively high weight which in conjunction with its floating condition absorbs impacts due to printing elements of the print head hitting the platen. Thereby, not only is the platen gap held constant but also noise and vibration resulting from the print action of the print head are substantially reduced.

In a preferred embodiment of the invention the gap control means comprises means for mounting the platen to the base frame such that the platen is movable relative to the main guide shaft, elastic means for resiliently urging the platen towards the main guide shaft and clearance means disposed between the platen or a member rigidly fixed to the platen and the main guide shaft or a member rigidly fixed to the guide shaft. Preferably, the platen is supported by or part of a rocking platen frame, i.e., a platen frame pivotally mounted to the base frame. A spring can be used as elastic means to bias the platen frame into a position where the clearance means prevents any further movement towards the main guide shaft to thus establish the desired platen gap. The clearance means may comprise one clearance member or plural cooperating members. It should be noted, however, that any means may be used as clearance means capable of stopping the platen frame's movement towards the main guide shaft at a position corresponding to the desired platen gap.

In a preferred embodiment of the invention the clearance means is adjustable allowing to adjust the distance between the platen frame and the main guide shaft and, thus, the platen gap. To that

end, at least one end of a clearance member may contact either the end of the main guide shaft or the platen frame via a clearance adjustment member. Once adjusted, the platen gap will be kept constant by the gap control means. This clearance adjustment member may be a disk-shaped member eccentrically supported by either the end of the main guide shaft or the platen frame and settable into a desired angular position.

As described above, since the platen gap is maintained constant by the gap control means clear printing is performed even if the base frame should be deformed by heat, etc. Therefore, use of a base frame formed from either a resin having a large thermal expansion coefficient and a low rigidity or from a sheet metal also having a low rigidity against external forces does no longer involve disadvantages with respect to the printing quality. Further, even if minute deformations should occur in the base frame during production, these deformations may be easily compensated for by a clearance adjustment member.

Ways of carrying out the invention are described in detail below with reference to the drawings which illustrate only one specific embodiment and in which:

- Fig. 1 is a diagrammatic perspective view of a printing device according to an embodiment of the present invention,
- Fig. 2 is a side view of the printing device in the direction of arrow II in Fig. 1,
- Fig. 3 is a top view of the printing device in the direction of arrow III in Fig. 1,
- Fig. 4 is a bottom view of the printing device in the direction of arrow IV in Fig. 1,
- Fig. 5 is an exploded view showing in detail how the platen frame is attached to the base frame, and
- Fig. 6 is a side view of a prior art printing device.

As shown in Figs. 1 to 4, the printing device comprises a base frame 1 to which various other parts are attached. In this embodiment the base frame 1 is made from a synthetic resin having a relatively high thermal expansion coefficient and is molded as a single integral unit including a paper holder 11, a frame support 17 that supports the base frame, and a paper guide section 18 (Fig. 2). Supported between two opposing side walls 21a and 21b of base frame 1 is a main guide shaft 2, preferably a rigid metallic rod. The main guide shaft 2 slidably carries a print head 3. As best shown in Fig. 3, the print head 3 is movable along main guide shaft 2 by means of a head drive motor 15 via a toothed drive belt 16 so that it can be precisely positioned at various positions along the main guide shaft 2. A platen frame 5 is connected to the base frame 1 and comprises a platen 51 that

extends substantially in parallel to the main guide shaft 2 so as to face the print head 3. An ink ribbon cassette 7 housing an ink ribbon 4 is removably mounted on base frame 1. An exposed portion of the ink ribbon 4 extends along the platen 51 between the latter and print head 3. The paper holder 11 carries a paper roll 10. Paper from this paper roll 10 is fed by paper feeding means to pass between platen 51 and ink ribbon 4. The paper guiding section 18 guides the paper toward the platen using a bottom surface of the base frame as a guide. Printing on the paper is performed in a well-known manner by selectively activating printing elements of print head 3 that press ink ribbon 4 against the paper 6 backed by the platen 51 to thereby print characters and the like as dot matrix patterns on the paper. The printing elements in print head 3 are driven by electrical signals normally input from outside the printing device.

The paper feeding means comprises a feed roller 12 and a pressure roller 12a which are rotatably supported by the platen frame 5 to extend in parallel to the platen 51. Feed roller 12 and pressure roller 12a cooperate in a well-known manner to feed the paper by friction. The feed roller 12 is linked to a feed motor 13 via suitable transmission means shown as a gear train 14 in Fig. 3. The paper feed motor 13 and the gear train 14 are mounted to the platen frame 5 the platen frame, the platen and the paper feeding means thus forming a self-contained platen unit.

With reference especially to Figs. 2 and 5 the gap control means in this embodiment of the invention will now be described.

Fig. 5 shows an exploded view of a portion V encircled in Fig. 1 and illustrates in more detail the structure of the platen frame and how it is attached to the base frame. Fig. 5 shows the left side of the platen frame and the base frame only. It should be noted that as far as the gap control means is concerned, the right side preferably has the same structure.

The platen frame 5 is formed from a rigid metal plate and comprises the plate-like platen 51 both ends of which being bent at right angles to form attachment plates 52a and 52b. The platen 51 is formed so as to guide the paper 10 parallel to the main guide shaft 2. The attachment plates 52a and 52b are for mounting the platen frame to the side walls 21a and 21b of the base frame 1, respectively. A clearance gauge 53 protruding from the platen 51 towards the main guide shaft 2 is formed on at least one, preferably both of these attachment plates 52a and 52b. A scale is provided on the clearance gauge 53 to make it easy to determine the distance between the platen 51 and the front end of the print head 53.

A notch 57 opening to the front edge is cut into the lower portion of each attachment plate 52a, 52b for engagement by a protruding pin 22 integrally formed on the outer side of each side wall 21a and 21b of base frame 1. The paper feed roller 12 and the pressure roller 12a are rotatably supported by the attachment plates 52a and 52b to extend therebetween in parallel to and below the platen 51 as shown in Fig. 5.

On the outside of these attachment plates 52a and 52b, i.e., on the side opposite to the platen 51, there is a clearance member 54 having an abutment face 54a. The clearance member 54 is seen to form the outer leg of a U-shaped structure obtained by bending the lower end of the attachment plate 52a (52b) upward. The clearance member 54 is roughly a triangular solid plate member that protrudes out toward the main guide shaft 2 and regulates the gap between the platen 51 and the main guide shaft 2. A protruding part or hook 56 is formed on the clearance member for attachment of one end of a spring 55 whose other end is attached to a protruding part or peg 23 formed on the side wall 21a (21b) of the platen frame 5 at a location opposite to the hook 56.

A disc-shaped clearance adjustment member 30 is attached to each end 24 of the main guide shaft 2, which extends outside the side wall 21a (21b) of the base frame 1. This clearance adjustment member 30 comprises an anchor disc 31 and an adjustment disc 32 the latter having a diameter smaller than that of the former and being eccentrically secured to it. For attachment to the end 24 of the main guide shaft 2 a hole 33 is formed in these discs 31 and 32 and positioned in the center of disc 31 and thus eccentric with respect to disc 32. A toothing is formed in the outer circumferential surface of disc 31.

A substantially rectangular anchor member 25 is protrudingly provided on the outer surface of each side wall 21a and 21b. The anchor member 25 may be an integral part of the base frame. The anchor member has only its one end 26 fixed to the respective side wall 21a, 21b while its free end 27 extends below the protruding end 24 of the main guide shaft 2. A toothing is formed in a portion of the anchor member facing the end of the main guide shaft. When the clearance adjustment members 30 have been mounted on the ends of the main guide shaft the peripheral surface of the anchor disc 31 presses against the end 27 of the anchor member, and the toothing formed on the end 27 engages that of the anchor disc 31 to lock the clearance adjustment member 30 at a selectable angular position. Despite the locking function provided by the toothings engaging each other the anchor disc 31 can be rotated or indexed because of the elasticity of the anchor member 25. When

the anchor disc 31 is indexed a click sound is generated each time the toothings of the anchor disc and the anchor member are moved relative to each other by one tooth. Since each click sound corresponds to an increment or decrement of the rotational angle of the anchor disc by the same amount, by counting the number of click sounds generated while rotating the anchor disc one knows the amount of change of the rotational angle of the anchor disc. By suitably designing the adjustment disc 32 each increment or decrement of the rotational angle of the anchor disc may result in a constant increment or decrement, respectively, of the platen gap.

Further, notches 34 are formed in the anchor disc 31 at constant angle intervals. The notches extend radially inward from the outer circumferential surface of the disc. These notches 34 are intended for insertion of a screwdriver or similar means used as tool for rotating the anchor disc.

With this embodiment, first the platen frame 5 is attached to the base frame 1 so that the notches 57 of the platen frame 5 and the protruding pins 22 of the base frame 1 engage each other. Since these notches 57 have a diameter that is slightly larger than that of the pins 22 and one end of each notch 57 is open, the platen frame 5 is attached to the base frame 1 in a way that allows rotation and slight parallel displacement. In other words the platen unit is floatingly supported by the base frame.

The platen frame 5 is pulled toward the main guide shaft 2 by the spring 55 stretched between the hook 56 on the platen frame 5 and the peg 23 on the base frame 1. The clearance member 54 fixed to the platen frame 5 is formed so that its abutment face 54a comes into contact with the adjustment disc 32 of the clearance adjustment member 30. Therefore, a constant distance between the platen frame 5 and the main guide shaft 2 is achieved by the spring 55 pressing the clearance member 54 against the adjustment disc 32 the latter being supported by the main guide shaft.

When the temperature of the resin base frame 1 increases due to heat generated inside or outside the printing device and undergoes thermal expansion, the distance between the main guide shaft 2 and the pin 22 to which the platen frame 5 is attached increases. However, since the platen frame 5 is pulled toward the main guide shaft 2 by the spring 55 so that the clearance member 54 is pressed against the adjustment disc 32, the platen frame 5 either rotates on the pins 22 or undergoes parallel displacement along the pins 22, thus maintaining a constant gap between the platen frame 5 and the main guide shaft 2. When the temperature drops and the base frame 1 contracts, however, the platen frame 5 is pushed away from the main guide

shaft 2 by the clearance member 54 pressed against the adjustment disc 32, and the gap between the platen frame 5 and the main guide shaft 2 is also kept constant.

In this way, whether the base frame 1 undergoes thermal expansion or thermal contraction, the gap between the platen frame 5 and the main guide shaft 2 and, thus, the platen gap is maintained constant by means of the gap control means. That is, thermal expansion or thermal contraction of the resin base frame 1 is prevented from affecting the printing quality. It should be noted that deformations of the base frame other than those caused by thermal expansion or contraction of the base frame will be compensated for in the very same manner so as to maintain the platen gap constant.

Further, by using the eccentric clearance adjustment member 30, adjustment of the platen gap W becomes possible, and therefore even if there should be a deformation in the resin base frame 1 resulting from production, that deformation can also be easily compensated for. It is also possible, of course, to use this clearance adjustment member 30 to adjust the platen gap W according to the thickness of the paper 10. In this case, if the clearance adjustment members are provided on both ends of the main guide shaft as in this embodiment, the platen gap W is adjusted by moving both of the clearance adjustment members at the same time. Further, the clearance gauge 53 is provided in the printing device of this embodiment to facilitate measurement of the gap between the platen frame 5 and the front end of the print head 3.

The gap W can also be adjusted by using the main guide shaft 2 attached eccentrically to the base frame 1 as explained above with reference to Fig. 6. In this case, the increment or decrement of the platen gap due to a rotation of the main guide shaft is constant within the whole region of the stroke of the print head. However, an adjustment method such as in this embodiment that uses two clearance adjustment members 30 capable of adjusting the gap W at each end of the main guide shaft 2 independent from each other can be said to be better suited to printing devices that use a base frame having a low rigidity such as a base frame made from resin, which is susceptible to deformation during molding and other nonuniform types of deformation. This is because such base frames may require different amounts of adjustment at the two ends of the main guide shaft in order to obtain a uniform platen gap over the length of the platen. Furthermore, the possibility of adjusting the platen gap on both sides of the main guide shaft independent from each other allows the manufacturing accuracy to be eased and the manufacturing cost of

this type of printers to be decreased correspondingly.

The gap control means according to the present invention allows to make printing devices using a base frame made from resin, which could not be used heretofore without problems as to the printing quality as mentioned before. Not only is the elasticity of the resin expected to suppress sound and vibration in the resin base frame of this embodiment, it will also be possible to mold complex shapes as a single unit that combines the paper holder 11, the frame support 17, the paper guide section 18, the pins 22, the pegs 23, the anchor members 25, etc. Therefore, it will be possible to reduce the number of parts that make up the printing device, shorten production periods, and realize low cost, highly reliable printing devices.

As shown in FIG. 4 four claws 61a-61d for attaching the head drive motor 15 are formed on the bottom surface 60 of the base frame 1. The motor 15 is attached to the base frame 1 by inserting a motor holder 15a having motor 15 mounted to it in the claws 61a-61d from the side. These claws 61a-61d are formed as a unit with the resin base frame 1, and it is possible to easily mold the claws in a variety of shapes depending on the part to be attached. Further, as with the motor 15, it is also possible to secure a printed circuit board 62 to the base frame 1 using claws 63a-63c.

Since the resin base frame 1 can be easily molded in complex shapes, a through-hole 65, through which a printed wiring 64 from the print head 3 passes, can be formed with a taper. This would serve to avoid broken wires due to bending of the printed wiring 64 at right angles. Below the holder 11 of the base frame 1 is a space 66 where the printed circuit board (not shown) that controls the printing device can be mounted.

In this embodiment, the platen gap is maintained by using a tension spring as the elastic means to pull the platen frame toward the main guide shaft, but the same gap control can be performed by changing the attachment position of the clearance member 54 and using a compression spring.

By using this kind of resin frame, it is possible to easily build in various kinds of complex shapes, thus facilitating the realization of a compact, lightweight printing device. It is also possible to select a color for the resin from among a variety of colors, and by selecting transparent resin, complicated mounting operations can be simplified. Further, a frame made from resin is ideal for printing devices that must satisfy demands for prevention of sound and vibration and reliability.

Frames molded in a single unit can be realized with a flexible structure, a rigid structure or with stoppers, guides, etc. Further, unlike metal frames,

these frames will not rust and will offer long-term reliability. Therefore, by molding frames from resin, various environmental measures such as vibration and noise prevention can be implemented, and low cost printing devices can be quickly realized that can flexibly accommodate demands for various devices.

In this kind of resin base frame, the base frame on which the platen frame is secured can have a partially flexible structure that absorbs displacement of the platen frame which follows the main guide shaft via the gap control means even if the platen frame were unmovably fixed to the base frame. However, it is desirable to employ a rocker platen so attached to the base frame that it can rotate or undergo parallel displacement in a direction that will absorb thermal expansion and distortion of the base frame, i.e., allow the platen frame to follow displacement of the main guide shaft, as in the above example. By employing this rocker platen, the base frame will not become deformed and material fatigue caused by internal stress can be prevented even when the platen frame moves to follow the main guide shaft. Also, deformation of the platen frame can also be prevented since no stress is generated in the platen frame itself. Therefore, clear printing can be achieved without special considerations such as reinforcement of the base frame and platen frame structures.

In the embodiment described above, a base frame made from a resin material is used. Even though specific advantages are achieved by using such resin base frames, the principle of the present invention applies to printing devices using a base frame made from other materials including relatively thin sheet metal, and having a low rigidity in the same way. As explained before, in all cases where dimensional variations or inaccuracies of the base frame caused by internal or external forces are apt to occur, gap control means according to the present invention can be employed to assure the platen gap being maintained constant at a desired value.

In a preferred embodiment the printing device according to the invention is configured with two units, namely the print head unit and the platen unit, these two units being movable with respect to each other. The paper feed means including a step motor and paper feed rollers form part of the platen unit increasing its weight. This structure provides the further advantage of decreasing generation of sound noise and vibrations when the platen is hit by the printing elements of the print head.

Several means can be employed as a gap control means, such as fixing the distance between the main guide shaft and the platen frame by having the platen frame supported by the main guide shaft via a rigid intermediate member. How-

ever, since the platen frame must support the paper, which receives pressure from the print head during printing, and the paper feed mechanism is built into it, its weight is large, and supporting this weight together with the print head on the main guide shaft would require that the base frame and main guide shaft be excessively strong. Therefore, it is desirable that a means be employed that comprises a rigid clearance member to regulate the gap between the end of the main guide shaft and the platen frame and an elastic member disposed between the base frame and the platen frame to keep the platen gap constant while lessening the weight on the main guide shaft. By means of the gap control means of this configuration, the pressure accompanying the elastic force of the elastic member constitutes the only pressure on the main guide shaft, because the weight of the platen frame and the load accompanying thermal deformation of the base frame need not be supported by the main guide shaft. Distributing load in this manner makes it possible to optimize the structures of the base frame, platen frame and main guide shaft.

In the embodiment explained above, the clearance means and the elastic means of the gap control means are provided at both ends of the main guide shaft, but depending on the size of the printing device, use conditions, etc., they need only be provided at one end of the main guide shaft.

Various combinations can be used as the clearance member and elastic member; i.e.,

- a) an elastic member urging the platen frame and the main guide shaft towards each other and a clearance member disposed such that it opposes the force exerted by the elastic member,
- b) an elastic member urging the platen frame and the main guide shaft away from each other and a clearance member disposed such that it opposes the force exerted by the elastic member,
- c) an elastic member disposed on the same side of the platen frame as the main guide shaft, or
- d) an elastic member disposed on the side of the platen frame opposite to the main guide shaft.

The elastic member may for instance be a tension spring as described above, a compression spring a spiral spring etc.

Further, the clearance member can be any member that regulates the gap between the main guide shaft and the platen frame, as long as it is capable of maintaining a constant gap. It must be attached so that it opposes the direction of elasticity of the elastic member which may be combined with the main guide shaft or the platen

frame. Therefore, the clearance member may be attached so that both ends come into contact with the main guide shaft and the platen frame, respectively, or either one of the ends may be fixed in place to the platen frame or the main guide shaft.

Further, the clearance adjustment member is not limited to the use of a disc-shaped member with an axis eccentric to the center of the clearance adjustment member and attached to the main guide shaft so that it can be locked at various angles to which it may be rotated around the eccentric axis as in this embodiment, in that the same kind of clearance adjustment member can also be attached to the platen frame. Also, a cam, etc., can be used in place of the eccentric disc-shaped member.

In the embodiment shown in the drawings the platen 51 forms an integral part of platen frame 5 and is a plane platen, roll paper is used for printing and frictional paper feeding means are employed. However as will be understood, the structure of the platen itself, the kind of paper and the principle of paper feeding are in no way essential to the present invention and have been explained and shown as examples only.

Claims

1. A printing device comprising:
 - a base frame (1),
 - a rigid guide shaft (2) attached to the base frame,
 - a print head (3) slidably guided by the guide shaft,
 - a platen (51) attached to the base frame (1) to extend in parallel to the guide shaft (2) and opposite to the print head (3) with a gap (W) formed between the platen (51) and the print head (3), and
 - gap control means for automatically adjusting said gap (W) to a desired value in response to a deformation of the base frame (1).
2. A printing device comprising:
 - a base frame (1),
 - a print head unit including a rigid guide shaft (2) fixed to the base frame, and a print head (3) slidably mounted on the guide shaft,
 - a platen unit including a platen (51) and paper feed means (12, 12a 13, 14) said platen unit being floatingly mounted to the base frame (1) with the platen (51) held to extend in parallel to the guide shaft (2) and opposite to the print head (3), and
 - gap control means for automatically adjusting the position of said floating platen unit such that a gap (W) formed between the platen (51) and the print head (3) is maintained constant.

ever, since the platen frame must support the paper, which receives pressure from the print head during printing, and the paper feed mechanism is built into it, its weight is large, and supporting this weight together with the print head on the main guide shaft would require that the base frame and main guide shaft be excessively strong. Therefore, it is desirable that a means be employed that comprises a rigid clearance member to regulate the gap between the end of the main guide shaft and the platen frame and an elastic member disposed between the base frame and the platen frame to keep the platen gap constant while lessening the weight on the main guide shaft. By means of the gap control means of this configuration, the pressure accompanying the elastic force of the elastic member constitutes the only pressure on the main guide shaft, because the weight of the platen frame and the load accompanying thermal deformation of the base frame need not be supported by the main guide shaft. Distributing load in this manner makes it possible to optimize the structures of the base frame, platen frame and main guide shaft.

In the embodiment explained above, the clearance means and the elastic means of the gap control means are provided at both ends of the main guide shaft, but depending on the size of the printing device, use conditions, etc., they need only be provided at one end of the main guide shaft.

Various combinations can be used as the clearance member and elastic member; i.e.,

- a) an elastic member urging the platen frame and the main guide shaft towards each other and a clearance member disposed such that it opposes the force exerted by the elastic member,
- b) an elastic member urging the platen frame and the main guide shaft away from each other and a clearance member disposed such that it opposes the force exerted by the elastic member,
- c) an elastic member disposed on the same side of the platen frame as the main guide shaft, or
- d) an elastic member disposed on the side of the platen frame opposite to the main guide shaft.

The elastic member may for instance be a tension spring as described above, a compression spring a spiral spring etc.

Further, the clearance member can be any member that regulates the gap between the main guide shaft and the platen frame, as long as it is capable of maintaining a constant gap. It must be attached so that it opposes the direction of elasticity of the elastic member which may be combined with the main guide shaft or the platen

frame. Therefore, the clearance member may be attached so that both ends come into contact with the main guide shaft and the platen frame, respectively, or either one of the ends may be fixed in place to the platen frame or the main guide shaft.

Further, the clearance adjustment member is not limited to the use of a disc-shaped member with an axis eccentric to the center of the clearance adjustment member and attached to the main guide shaft so that it can be locked at various angles to which it may be rotated around the eccentric axis as in this embodiment, in that the same kind of clearance adjustment member can also be attached to the platen frame. Also, a cam, etc., can be used in place of the eccentric disc-shaped member.

In the embodiment shown in the drawings the platen 51 forms an integral part of platen frame 5 and is a plane platen, roll paper is used for printing and frictional paper feeding means are employed. However as will be understood, the structure of the platen itself, the kind of paper and the principle of paper feeding are in no way essential to the present invention and have been explained and shown as examples only.

Claims

1. A printing device comprising:

- a base frame (1),
- a rigid guide shaft (2) attached to the base frame,
- a print head (3) slidably guided by the guide shaft,
- a platen (51) attached to the base frame (1) to extend in parallel to the guide shaft (2) and opposite to the print head (3) with a gap (W) formed between the platen (51) and the print head (3), and
- gap control means for automatically adjusting said gap (W) to a desired value in response to a deformation of the base frame (1).

2. A printing device comprising:

- a base frame (1),
- a print head unit including a rigid guide shaft (2) fixed to the base frame, and a print head (3) slidably mounted on the guide shaft,
- a platen unit including a platen (51) and paper feed means (12, 12a 13, 14) said platen unit being floatingly mounted to the base frame (1) with the platen (51) held to extend in parallel to the guide shaft (2) and opposite to the print head (3), and
- gap control means for automatically adjusting the position of said floating platen unit such that a gap (W) formed between the platen (51) and the print head (3) is maintained constant.



3. The printing device of claim 1, wherein said gap control means comprises means (52a, 52b, 57, 22) for attaching the guide shaft (2) and the platen (51) to the base frame (1) such that they are displaceable with respect to each other, and means (54, 54a, 31, 32, 55) for coupling the platen (51) and the guide shaft (2) so as to keep a constant distance therebetween.
4. The printing device of claim 2, wherein said gap control means comprises means (54, 54a, 31, 32, 55) for coupling the platen (51) and the guide shaft (2) so as to keep a constant distance therebetween.
5. The printing device of claim 3 or 4, wherein the platen (51) is supported by a platen frame (5) the platen frame being attached to the base frame.
6. The printing device of claim 5, wherein the platen frame is a rocking platen frame (5) following the guide shaft (2) via said coupling means (54, 54a, 31, 32, 55).
7. The printing device of any of claims 3 to 6, wherein said coupling (54, 54a, 31, 32, 55) includes means (31, 32, 25) for adjusting the distance between the platen (51) and the guide shaft (2).
8. The printing device of any of claims 3 to 7, wherein said coupling means comprises elastic means (55) for urging the platen (51) and the guide shaft (2) towards or away from each other, and clearance means (54, 54a, 31, 32) interposed between the platen (51) and the guide shaft (2) for maintaining a constant distance therebetween against the force of the elastic means.
9. The printing device of claim 8, wherein the clearance means comprises a rigid clearance member (54) connected to at least one side of one of platen frame (5) and guide shaft (2) so as to abut against the other of platen frame (5) and guide shaft (2) under the influence of the elastic means (55) disposed between the base frame (1) and the platen frame (5).
10. The printing device of claim 9, wherein the clearance member (54) abuts against the circumferential surface of a disk-shaped clearance adjustment member (30) attached to said other of platen frame (5) and guide shaft (2) and adjustable in its angular position about an

eccentric axis.

11. The printing device of any of claims 1 to 10 wherein a clearance gauge (53) is employed for measuring the gap between the platen (51) and the print head (3).
12. The printing device of any of the preceding claims, wherein the base frame (1) is made from a resin material.
13. The printing device of any of claims 1 to 11, wherein the base frame (1) is made from a thin sheet metal.

Patentansprüche

1. Druckvorrichtung, umfassend:
einen Grundrahmen (1),
eine an dem Grundrahmen angebrachte starre Führungswelle (2),
einen von der Führungswelle gleitend geführten Druckkopf (3),
eine an dem Grundrahmen (1) so angebrachte Schreibwalze (51), daß sie sich parallel zur Führungswelle (2) und gegenüber dem Druckkopf (3) erstreckt, wo bei ein Spalt (W) zwischen der Schreibwalze (51) und dem Druckkopf (3) gebildet wird, und
Spaltsteuermittel zur automatischen Einstellung des Spalts (W) auf einen gewünschten Wert in Reaktion auf eine Deformation des Grundrahmens (1).
2. Druckvorrichtung, umfassend:
einen Grundrahmen (1),
eine Druckkopfeinheit, die eine starre an dem Grundrahmen fixierte Führungswelle (2) und einen gleitend auf der Führungswelle montierten Druckkopf (3) enthält,
eine Schreibwalzeneinheit, die eine Schreibwalze (51) und Papierzuführmittel (12, 12a, 13, 14) enthält, wobei die Schreibwalzeneinheit schwebend an dem Grundrahmen (1) montiert ist und die Schreibwalze (51) so gehalten wird, daß sie sich parallel zur Führungswelle (2) und dem Druckkopf (3) gegenüberliegend erstreckt, und
Spaltsteuermittel zum automatischen Einstellen der Position der schwebenden Schreibwalzeneinheit derart, daß ein zwischen der Schreibwalze (51) und dem Druckkopf (3) gebildeter Spalt (W) konstant gehalten wird.
3. Druckvorrichtung nach Anspruch 1, bei der die Spaltsteuermittel umfassen
Mittel (52a, 52b, 57, 22) zum Anbringen der Führungswelle (2) und der Schreibwalze



(51) an dem Grundrahmen (1) derart, daß sie in Bezug zueinander verstellbar sind, und

Mittel (54, 54a, 31, 32, 55) zum Koppeln der Schreibwalze (51) und der Führungswelle (2) derart, daß ein konstanter Abstand zwischen ihnen aufrechterhalten wird.

4. Druckvorrichtung nach Anspruch 2, bei der die Spaltsteuermittel umfassen:

Mittel (54, 54a, 31, 32, 55) zum Koppeln der Schreibwalze (51) und der Führungswelle (2) derart, daß ein konstanter Abstand zwischen ihnen aufrechterhalten wird.

5. Druckvorrichtung nach Anspruch 3 oder 4, bei der die Schreibwalze (51) von einem Schreibwalzenrahmen (5) getragen wird, der an dem Grundrahmen angebracht ist.

6. Druckvorrichtung nach Anspruch 5, bei der der Schreibwalzenrahmen ein der Führungswelle (2) mittels der Kupplungsmittel (54, 54a, 31, 32, 55) folgender kippbarer Schreibwalzenrahmen (5) ist.

7. Druckvorrichtung nach einem der Ansprüche 3 bis 6, bei der die Kupplung (54, 54a, 31, 32, 55) Mittel (31, 32, 25) zur Einstellung des Abstands zwischen der Schreibwalze (51) und der Führungswelle (2) einschließt.

8. Druckvorrichtung nach einem der Ansprüche 3 bis 7, bei der die Kupplungsmittel umfassen: elastische Mittel (55), durch die Schreibwalze (51) und die Führungswelle (2) aufeinander zu oder voneinander weg gedrängt werden, und

Spaltmittel (54, 54a, 31, 32), die zwischen die Schreibwalze (51) und die Führungswelle (2) gesetzt sind, um einen konstanten Abstand zwischen ihnen gegen die Kraft der elastischen Mittel aufrechtzuhalten.

9. Druckvorrichtung nach Anspruch 8, bei der die Spaltmittel ein starres Spaltglied (54) umfassen, das mit wenigstens einer Seite einer der Komponenten, Schreibwalzenrahmen (5) und Führungswelle (2), so verbunden ist, daß es unter dem Einfluß der zwischen dem Grundrahmen (1) und dem Schreibwalzenrahmen (5) angeordneten elastischen Mittel (55) an die andere der Komponenten, Schreibwalzenrahmen (5) und Führungswelle (2) anstößt.

10. Druckvorrichtung nach Anspruch 9, bei der das Spaltglied (54) an die Umfangsfläche eines scheibenförmigen Spalteinstellglieds (30) anstößt, das an der anderen der Komponenten,

Schreibwalzenrahmen (5) und Führungswelle (2), angebracht ist und in seiner Winkelstellung um eine exzentrische Achse einstellbar ist.

11. Druckvorrichtung nach einem der Ansprüche 1 bis 10, bei der ein Spaltmaß (53) zum Messen des Spalts zwischen der Schreibwalze (51) und des Druckkopfes (3) verwendet wird.

12. Druckvorrichtung nach einem der vorhergehenden Ansprüche, bei der der Grundrahmen (1) aus einem Harzmaterial hergestellt ist.

13. Druckvorrichtung nach einem der Ansprüche 1 bis 11, bei der der Grundrahmen (2) aus dünnem Blech hergestellt ist.

Revendications

1. Un dispositif d'impression comprenant :
un châssis de base (1),
une barre de guidage rigide (2) fixée au châssis de base,
une tête d'impression (3) guidée de façon coulissante par la barre de guidage,
une plaque d'impression (51) fixée sur le châssis de base (1) de façon à s'étendre parallèlement à la barre de guidage (2) et face à la tête d'impression (3), avec un écartement (W) formé entre la plaque d'impression (51) et la tête d'impression (3), et
des moyens de commande d'écartement pour régler automatiquement l'écartement (W) à une valeur désirée, sous l'effet d'une déformation du châssis de base (1).

2. Un dispositif d'impression comprenant :
un châssis de base (1),
une unité de tête d'impression comprenant une barre de guidage rigide (2) fixée au châssis de base, et une tête d'impression (3) montée de façon coulissante sur la barre de guidage,
une unité de plaque d'impression, comprenant une plaque d'impression (51) et des moyens de transport de papier (12, 12a, 13, 14), cette unité de plaque d'impression étant montée de façon flottante sur le châssis de base (1), avec la plaque d'impression (51) maintenue de façon à s'étendre parallèlement à la barre de guidage (2) et face à la tête d'impression (3), et
des moyens de commande d'écartement pour régler automatiquement la position de l'unité de plaque d'impression flottante, de façon qu'un écartement (W) qui est formé entre la plaque d'impression (51) et la tête d'impression (3) soit maintenu constant.



3. Le dispositif d'impression de la revendication 1, dans lequel les moyens de commande d'écartement comprennent
des moyens (52a, 52b, 57, 22) pour, fixer la barre de guidage (2) et la plaque d'impression (51) au châssis de base (1), de manière qu'elles puissent être déplacées mutuellement,
et des moyens (54, 54a, 31, 32, 55) pour accoupler la plaque d'impression (51) et la barre de guidage (2) de façon à maintenir une distance constante entre elles. 5
4. Le dispositif d'impression de la revendication 2, dans lequel les moyens de commande d'écartement comprennent
des moyens (54, 54a, 31, 32, 55) pour accoupler la plaque d'impression (51) et la barre de guidage (2) de façon à maintenir une distance constante entre elles. 10
5. Le dispositif d'impression de la revendication 3 ou 4, dans lequel la plaque d'impression (51) est supportée par un châssis de plaque d'impression (5), le châssis de plaque d'impression étant fixé au châssis de base. 15
6. Le dispositif d'impression de la revendication 5, dans lequel le châssis de plaque d'impression est un châssis de plaque d'impression basculant (5) qui suit la barre de guidage (2) par l'intermédiaire des moyens d'accouplement (54, 54a, 31, 32, 55). 20
7. Le dispositif d'impression de l'une quelconque des revendications 3 à 6, dans lequel les moyens d'accouplement (54, 54a, 31, 32, 55) comprennent des moyens (31, 32, 25) pour régler la distance entre la plaque d'impression (51) et la barre de guidage (2). 25
8. Le dispositif d'impression de l'une quelconque des revendications 3 à 7, dans lequel les moyens d'accouplement comprennent
des moyens élastiques (55) pour solliciter la plaque d'impression (51) et la barre de guidage (2) d'une manière tendant à les rapprocher ou à les éloigner l'une de l'autre, et
des moyens d'établissement de dégagement (54, 54a, 31, 32) intercalés entre la plaque d'impression (51) et la barre de guidage (2), pour maintenir une distance constante entre elles, contre la force des moyens élastiques. 30
9. Le dispositif d'impression de la revendication 8, dans lequel les moyens d'établissement de dégagement comprennent une pièce d'établissement de dégagement rigide (54) qui est re- 35

liée à au moins un côté d'un élément parmi le châssis de plaque d'impression (5) et la barre de guidage (2), de façon à porter contre l'autre élément parmi le châssis de plaque d'impression (5) et la barre de guidage (2), sous l'influence des moyens élastiques (55) qui sont disposés entre le châssis de base (1) et le châssis de plaque d'impression (5).

10. Le dispositif d'impression de la revendication 9, dans lequel la pièce d'établissement de dégagement (54) porte contre la surface périphérique d'un élément de réglage de dégagement en forme de disque (30) qui est fixé à l'autre élément parmi le châssis de plaque d'impression (5) et la barre de guidage (2), et dont la position angulaire est réglable autour d'un axe excentrique. 40

11. Le dispositif d'impression de l'une quelconque des revendications 1 à 10, dans lequel un indicateur de dégagement (53) est employé pour mesurer l'écartement entre la plaque d'impression (51) et la tête d'impression (3). 45

12. Le dispositif d'impression de l'une quelconque des revendications précédentes, dans lequel le matériau constituant le châssis de base (1) est une résine. 50

13. Le dispositif d'impression de l'une quelconque des revendications 1 à 11, dans lequel le matériau constituant le châssis de base (1) est un métal sous forme de tôle mince. 55

