

PRINTER HEAD FOR USE IN A DOT IMPACT PRINTER

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The present invention relates to a printer head for use in a dot impact printer.

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A dot impact printer head of the so-called wire-direct-connection type has been suggested in which impression wires are respectively directly fixed to distal ends of corresponding driving elements by, for example, welding. In such a printer head, the driving elements are driven to undergo pivoting movement in response to attraction and release of an electro-magnetic driving means so that the impression wires are reciprocated in the forward and rearward directions to effect dot printing.

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Various guide members can be used in such a printer head for guiding the impression wires. However, most of the guide members which have been proposed are formed with a plurality of approximately circular guide apertures whose positions correspond to those of a plurality of the impression wires, and each of the impression wires extends slidably through a corresponding guide aperture so as to be guided thereby. In another guide member, as disclosed in Japanese Utility Model Application No. 131838/1984, the guide member is formed with a pair of arcuate guide apertures in opposed relationship and each of the guide apertures receives therethrough a plurality of impression wires so as to guide the latter.

Since, however, each of the impression wires is fixed to the distal end of the corresponding driving

5 element in the case of the wire-direct-connection type
printer head, the impression wire is bent in a direction
perpendicular to the reciprocating movement thereof in
response to the pivoting movement of the corresponding
driving element. Therefore, due to this bending, the
impression wire is pressed against the inner side wall
of the guide aperture to increase frictional resistance
and thus thereby impair slidability.

10 In order to avoid the increase of frictional
resistance, the diameter of the guide aperture could be
dimensioned to take account of the degree of bending of
the impression wire. However, in the case of the
15 approximately circular guide aperture, the diameter
thereof would have to be quite considerable relative to
that of the impression wire with the result that the
guide aperture would not be able to suppress vibration of
the impression wire. In the case of the pair of arcuate
20 guide apertures formed in the guide member in opposed
relationship, the impression wire would vibrate in the
arcuate direction of the guide apertures and this would
impair the response of the impression wire and would
thus prevent high speed printing.

25 When the printer head is operated for a long
period, such vibration of the impression wire can result
in disconnection between the impression wire and the
driving element.

30 Accordingly, one object of the present invention
is to reduce the vibration of the impression wire to a
minimum without impairing the slidability thereof so as
to improve the response of the impression wire and
thereby achieve high speed printing. Another object of

the present invention is to reduce the risk of disconnection between the impression wire and the driving element.

According to the present invention, there is therefore provided a printer head for use in a dot impact printer comprising a guide member having a plurality of guide apertures therein; a plurality of impression wires each of which is slidably mounted in a respective guide aperture and each of which is connected to a movable portion of a respective driving element; and driving means for effecting pivotal or flexural movement of each said movable portion and consequential bending of the respective impression wire in the guide member; each of the guide apertures being elongated in the direction in which the respective impression wire is so bent, and being arranged so that, when the respective driving element is not operated, the respective impression wire bears against a first sidewall at one end of the respective guide aperture so as to reduce or suppress vibration thereof, and so that when, the respective driving element is operated, the respective impression wire is disposed adjacent to but is spaced from a second sidewall at the other end of the respective guide aperture so as to allow for free movement thereof.

In such a construction the force with which each impression wire bears against its guide aperture can be reduced while at the same time the vibration of the impression wire can be reduced to a minimum without impairing the slidability thereof.

Preferably, the front ends of the impression wires

are slidably supported by front guide means arranged so as to effect bending of an intermediate portion of each impression wire when the respective driving element is operated, and in which the intermediate portion passes through a respective guide aperture.

Preferably, each of the of the elongated guide apertures has a width which is slightly greater than the diameter of the respective impression wire.

Each driving element preferably comprises a plate spring having a fixed part and a movable part which can be pivoted or flexed with respect to the fixed part.

The said movable part may be connected to an impression lever which constitutes the said movable portion of the driving element.

The driving means may be electro-magnetic driving means, the impression lever being connected to the movable part of the plate spring by way of an armature which is adapted to be magnetically attracted towards and released from the electro-magnetic driving means.

The invention also comprises a dot impact printer provided with the printer head referred to above.

The invention is illustrated, merely by way of example, in the accompanying drawings in which:-

5 Figure 1 is a plan view of a guide member which forms part of a printer head shown in Figure 3;

Figure 2 is an enlarged plan view of a part of the guide member shown in Figure 1;

10 Figure 3 is a sectional view of the main portion of a printer head according to the present invention in the rest or ready state; and

Figure 4 is a sectional view of the structure shown in Figure 3 in the released state.

15 Figures 3 and 4 are sectional views of a main portion of an embodiment of a printer head according to the present invention. As shown in Figures 3 and 4, a permanent magnet 1 is sandwiched by and fixed between a front yoke 2 and a rear yoke 3. The rear yoke 3 has an approximately U-shaped portion in section, and a magnetic cancelling coil 4 is engaged around a core portion 3a of the yoke 3. A
20 plate spring 8 has a proximal end part 8a which is interposed between and fixed to the front yoke 2 and a head frame 5 through spacers 6 and 7. A movable yoke or magnetic armature 9 is fixed to a distal end part
25 8b of the plate spring 8, and constitutes, together with

the permanent magnet 1, front yoke 2, rear yoke 3
and magnetic cancelling coil 4, an electro-magnetic driving
means A. The electro-magnetic driving means A is arranged
to effect pivotal or flexural movement of the distal end
part 8b with respect to the fixed proximal end part 8a
by reason of the fact that the armature 9 is adapted to
be magnetically attached towards and released from the
electro-magnetic driving means A. An impression lever 10 is
fixed to the movable yoke 9 such that the impression lever
10 is pivotable by means of the plate spring 8. The plate
spring 8, the impression lever 10, and the movable yoke 9
constitute a driving element B, the impression lever 10
constituting a movable distal end portion of the driving
element B. An impression wire 11 is fixed at its rear end
portion to the distal end portion of the impression lever
10 by means of, for example, silver welding.

Although not shown in the figure, a plurality of the
plate springs 8 are integrated with a ring support and extend
radially inwardly from the ring support. There are also a
plurality of the impression wires 11 each of which is fixed
to the distal end of its respective impression lever 10 and
thus to its respective plate spring 8. The rear yoke 3 is,
moreover, formed with a plurality of the said U-shaped portions
which extend radially inwardly from a ring support integrated
with the U-shaped portions. The magnet 1, front yoke 2, and
spacers 6 and 7 are formed into a ring shape.

5 An intermediate guide plate 12 is disposed in a hollow portion 5a of the head frame 5 so as to slidably guide a plurality of the impression wires 11 and thus act as a guide member therefor. A plurality of guide apertures 13 are formed in the intermediate guide plate 12 for receiving therethrough the respective impression wires 11. A front guide 14 is disposed on a front end of the head frame 5 to align the impression wires 11 in a given arrangement.

10 Figure 3 shows the rest or ready state of an impression wire 11. The movable yoke 9 is attracted by the rear yoke 3 and the plate spring 8 is bent rearwardly so that the impression lever 10 is pivoted rearwardly and the impression wire 11 is bent in a direction perpendicular to the wire 11 and towards the centre of the printer head. Figure 4 shows the driving state of the impression wire 11 in which the magnetic cancelling coil 4 is supplied with electric current to cancel the magnetic force of the magnet 1. As a result, the movable yoke 9 is released to pivotably advance the impression wire 11 forward. In this state, the impression wire 11 is bent outwardly of the printer head in a direction perpendicular to the movement of the impression wire 11.

20 As shown in Figure 1, each of the guide apertures 13 of the immediate guide plate 12 is elongated in a direction towards the centre of the guide plate 12. Further, as shown in Figure 2, each of the guide apertures 13 is dimensioned so that, when the impression lever 10 is held in the rest or ready state (as shown in Figure 3), the impression wire 11 (as shown by the solid

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line) comes into contact with the inner sidewall 13a of the guide aperture 13 which is positioned radially inwardly of the guide plate 12. Moreover, each of the guide apertures 13 is dimensioned so that, when the impression lever 10 is held in the released state (as shown in Figure 4), the impression wire 11 (as shown by the broken line) is positioned with a slight clearance adjacent to another inner sidewall 13b which is arranged radially outwardly of the guide plate 12. In addition, each of the elongated guide apertures 13 has a width which is slightly greater than the diameter of the respective impression wire 11.

The printer head is driven by selectively applying a pulsed electric current to each magnetic cancelling coil 4 according to a given image or character information so as to selectively release respective movable yokes or armatures 9 and thereby pivotably actuate the corresponding impression levers 10.

Further, during the driving of the printer head, the impression wires 11 are reciprocated and undergo bending repeatedly at high speed so that they vibrate

irregularly in all directions. Since the guide apertures 13 are arranged on the intermediate guide plate 12 as described above, the impression wires 11 are prevented from being pressed against the sidewalls of guide apertures 13 due to the bending of the wires during the actuation thereof. The sidewalls of the guide apertures 13 which are spaced apart in the widthwise direction can suppress the vibration of the impression wires 11 so as to reduce the vibration to a minimum without impairing the slidability of the

impression wires 11.

5 As described above, since the impression wires 11
make contact with the radially inner sidewalls 13a of
the elongated guide apertures 13 when the impression
levers 10 are held in the rest state, the vibration of
the impression wires 11 is instantly suppressed when the
same are held in the rest state so as to facilitate high
10 speed printing.

In the above described embodiment, the
intermediate guide plate 12 is provided with the
elongated apertures 13. However, an additional guide
member formed with similar guide apertures may be
15 positioned forwardly or rearwardly of the intermediate
guide plate 12.

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As described above in detail, in the above described embodiment, since the vibration of the impression wires can be suppressed to the minimum without impairing their slidability, high speed printing is facilitated.

- 5 Further, the impression wires and the driving elements are not decoupled from each other even when the printer head is used for a long period, whereby the durability of the printer head is improved.

CLAIMS

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1. A printer head for use in a dot impact printer comprising a guide member having a plurality of guide apertures therein; a plurality of impression wires each of which is slidably mounted in a respective guide aperture and each of which is connected to a movable portion of a respective driving element; and driving means for effecting pivotal or flexural movement of each said movable portion and consequential bending of the respective impression wire in the guide member; each of the guide apertures being elongated in the direction in which the respective impression wire is so bent, and being arranged so that, when the respective driving element is not operated, the respective impression wire bears against a first sidewall at one end of the respective guide aperture so as to reduce or suppress vibration thereof, and so that when, the respective driving element is operated, the respective impression wire is disposed adjacent to but is spaced from a second sidewall at the other end of the respective guide aperture so as to allow for free movement thereof.

2. A printer head as claimed in claim 1, in which the front ends of the impression wires are slidably supported by front guide means arranged so as to effect bending of an intermediate portion of each impression wire when the respective driving element is operated, and in which the intermediate portion passes through a respective guide aperture.

3. A printer head as claimed in claim 1 or 2 in which



each of the elongated guide apertures has a width which is slightly greater than the diameter of the respective impression wire.

4. A printer head as claimed in any preceding claim in which each driving element comprises a plate spring having a fixed part and a movable part which can be pivoted or flexed with respect to the fixed part.

5. A printer head as claimed in claim 4 in which the said movable part is connected to an impression lever which constitutes the said movable portion of the driving element.

6. A printer head as claimed in claim 5 in which the driving means is an electro-magnetic driving means, the impression lever being connected to the movable part of the plate spring by way of an armature which is adapted to be magnetically attracted toward and released from the electro-magnetic driving means.

7. A printer head for use in a dot printer substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

8. A dot impact printer provided with a printer head as claimed in any preceding claim.
