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(71) Applicant: **NEC CORPORATION**
33-1, Shiba 5-chome, Minato-ku
Tokyo 108(JP)

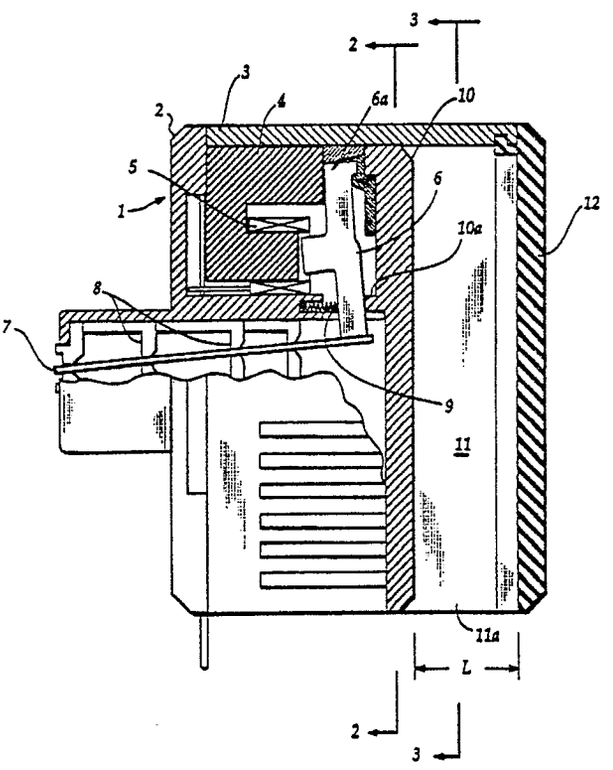
(72) Inventor: **Itazu, Kishiharu c/o NEC Corporation**
33-1, Shiba 5-chome
Minato-ku Tokyo(JP)

(74) Representative: **Vossius & Partner**
Siebertstrasse 4 P.O. Box 86 07 67
D-8000 München 86(DE)

(54) Low-noise printer head assembly.

(57) A printer head assembly comprises a plurality of print heads radially mounted within a heat sink in thermal contact relation. Each print heads includes a print wire, an armature connected to the print wire, a stopper plate, a return spring for biasing the armature into contact with the stopper plate, and an electromagnetic which drives the armature against the spring in response to energization of the magnet so that the print wire is moved from a non-print position to a print position and causes the spring to restore the armature to the non-print position in response to deenergization of the magnet. The heat sink has a rear part extending beyond the stopper plate to an elastic rear panel to form a sound absorption air chamber therebetween.

Fig. 1



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Low-Noise Printer Head Assembly

The present invention relates generally to dot matrix printer heads, and more specifically to a low-noise dot matrix printer head.

With prior art dot matrix printer heads, print wires are arranged in a matrix array and each wire is driven by an armature when it is pulled against the action of a return spring by an electromagnet in response to a drive pulse applied thereto. Upon deenergization of the magnet, the energy stored in the return spring is released, causing the armature to return to the normal position and hit a stopper with a substantial amount of impact. Since the printers of this type are used in low-noise environment, noise suppression is important. Approaches to the noise problem include enclosing a printer in a sound-insulation box or developing a noise-absorptive printer mechanism. However, the cost of these approaches and their effects are not still satisfactory for wide acceptance.

It is therefore an object of the present invention to provide an inexpensive, low noise printer head.

According to the present invention, the printer head comprises a print wire movable between a non-print position and a print position, an armature connected to the print wire, a stopper plate, a return spring for biasing the armature into contact with the stopper plate, and an electromagnet which drives the armature against the spring in response to energization of the electromagnet so that the print wire is moved from the non-print position to the print position and causes the spring to restore the armature to the non-print position in response to deenergization of the magnet. In thermal contact with the electromagnet is a heat sink having a rear part that extends beyond the stopper plate to an elastic rear panel to form a sound absorption air chamber therebetween.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described in further detail with reference to the accompanying drawings, in which:

Fig. 1 is a side cross-sectional view of a dot matrix printer head assembly of the present invention;

Fig. 2 is a cross-sectional view taken along lines 2-2 of Fig. 1;

Fig. 3 is a cross-sectional view taken along lines 3-3 of Fig. 1; and

Fig. 4 is a graphic representation of noise level generated by the printer head assembly of the invention, with the noise being plotted as a function of distance between the stopper plate and rear panel of the printer head assembly of Fig. 1.

DETAILED DESCRIPTION

Referring to Figs. 1 to 3, a dot matrix printer head assembly according to the present invention is illustrated. The head assembly is composed of a plurality of print heads 1. In a typical example, 24 print heads are radially arranged and mounted on a front panel structure 2 within an aluminum heat sink 3 at 15° annular intervals. Each print head 1 comprises a magnetic core 4, a coil 5, an armature 6, and a print wire 7 which extends through guides 8 to the front end of the assembly. Armature 6 has its lower end firmly secured to the rear end of print wire 7 and is normally biased by a spring 9 to the right into contact with a stopper 10a of a stopper plate 10. All print wires 7 are arranged on the front end of the assembly in a 4 x 6 matrix array.

Heat sink 3 has an annular inner wall which is in intimate contact with the cores 2 to extract heat therefrom and extends rearward beyond the stopper plate 10 to define an air chamber 11 with a rubber rear panel 12. The air chamber 11 is open to the outside through an opening 11a formed on the bottom of the assembly to allow heat produced in the cores 4 to escape to the outside.

Upon energization of the coil 5, the armature 6 rotates clockwise about a pivot point 6a against the spring 9 so that the print wire 7 moves forward from a non-print position to a print position. When each coil is deenergized, the energy stored in the spring 9 is liberated, causing the associated armature 6 to return to the normal position and hit the stopper 7a with a substantial amount of force.

The impact force on the stopper 10 causes stopper plate 10 and the air in the chamber 11 to vibrate, generating noise in the air chamber 11. However, the noise is insulated by the heat sink 3 and absorbed by the elastic rear panel 12.

Experiments showed that, by the provision of the elastic rear panel 12, the noise level of the printer head assembly can be reduced by approximately 1.5 dB and by the provision of the air chamber 11 behind the stopper plate 10, the noise level can be further reduced in proportion to the distance "L" between it and the rear panel 12. As shown in Fig. 4, the noise level was reduced by more than 3 dB with a distance of 3 mm in comparison with a printer head without the elastic rear panel and a noise reduction of about 4 dB was

achieved with a distance of 10 mm. Since the air chamber 11 can be communicated with the interior of a printer through opening 11a when the head assembly is installed, the noise energy generated by the printer head can be further reduced by aborption by the printer housing.

Claims

1. A printer head comprising a print wire movable between a non-print position and a print position, an armature connected to said print wire, a stopper plate, spring means for biasing said armature into contact with said stopper plate, electromagnetic drive means for driving said armature against said spring means in response to energization thereof so that said print wire is moved from said non-print position to said print position and causing said spring means to return said armature to said non-print position in response to deenergization thereof, an elastic rear panel spaced a distance from said stopper plate, and a heat sink in thermal contact with said electromagnetic drive means, said heat sink extending beyond said stopper plate to said rear panel to define an air chamber behind said stopper plate.

2. A printer head as claimed in claim 1, wherein said air chamber is open to the outside through an opening formed on a bottom portion of said printer head.

3. A printer head as claimed in claim 1 or 2, wherein a dimension of said air chamber between said stopper plate and said rear panel is in the range between 3 mm and 10 mm.

4. A matrix printer head assembly comprising:
a stopper plate;
a plurality of printer heads each including a print wire movable between a non-print position and a print position, an armature connected to said print wire, spring means for biasing said armature into contact with said stopper plate, electromagnetic drive means for driving said armature against said spring means in response to energization thereof so that said print wire is moved from said non-print position to said print position and causing said spring means to return said armature to said non-print position in response to deenergization thereof, the print wires of said printer heads forming an array of matrix on a front end of said printer head assembly;
an elastic rear panel spaced a distance from said stopper plate; and
a heat sink in thermal contact with said electromagnetic drive means of each said printer heads, said heat sink extending beyond said stopper plate to said rear panel to define an air chamber between said stopper plate and said elastic rear panel.

5. A matrix printer head assembly as claimed in claim 4, wherein said air chamber is open to the outside through an opening formed on a bottom portion of said printer head assembly.

6. A printer head as claimed in claim 4 or 5, wherein a dimension of said air chamber between said stopper plate and said rear panel is in the range between 3 mm and 10 mm.

Fig. 1

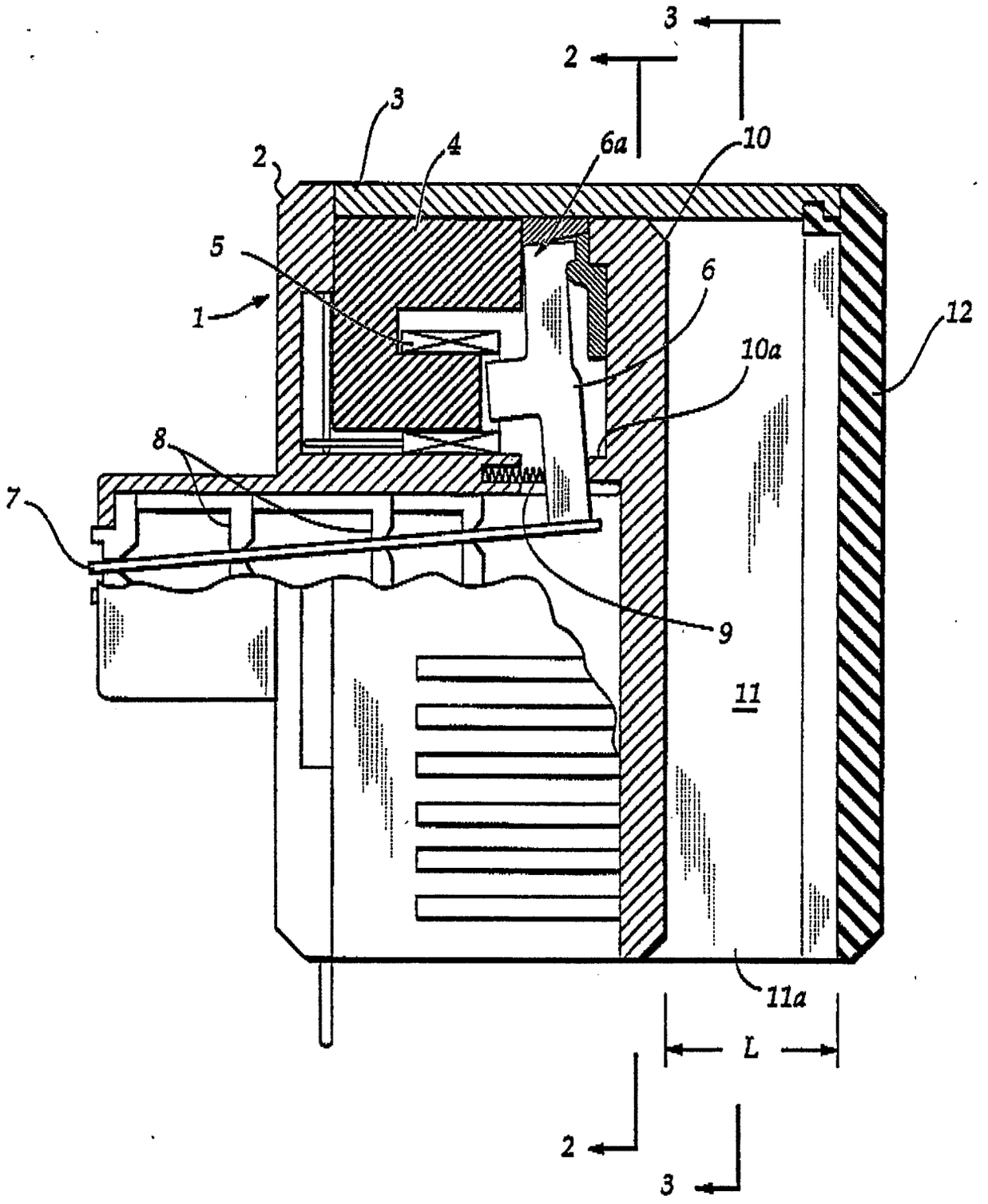

Fig. 2

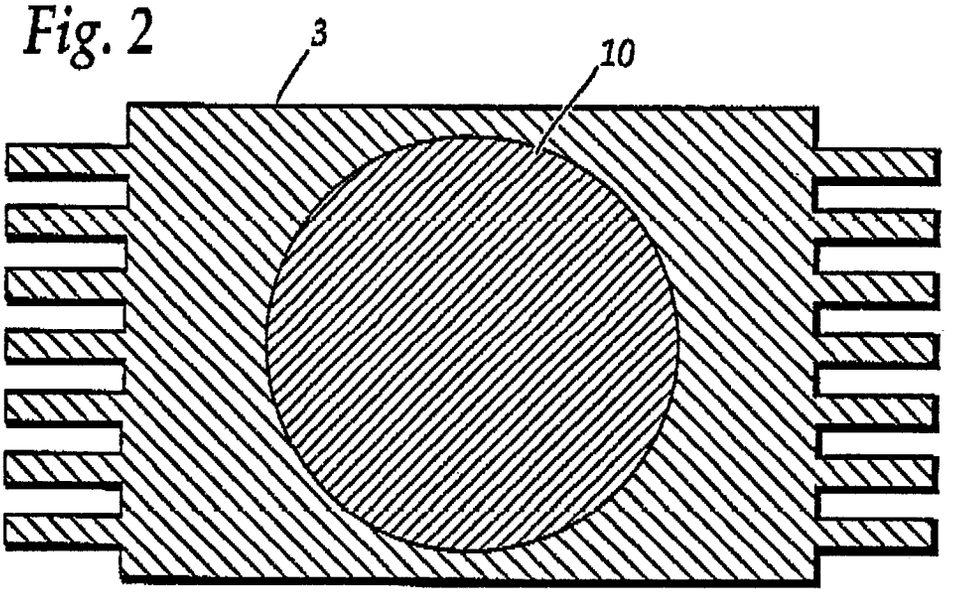

Fig. 3

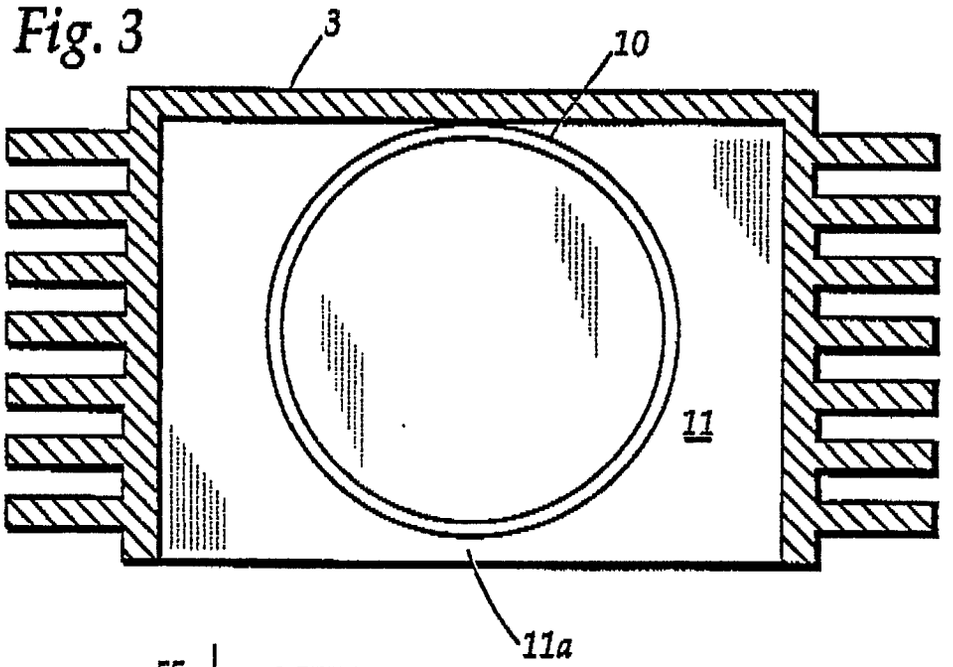

Fig. 4