

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11)

Publication number:

**0 228 589
B1**

(12)

EUROPEAN PATENT SPECIFICATION

(45)

Date of publication of the patent specification:
21.03.90

(51)

Int. Cl.⁴: **B41J 2/28**

(21)

Application number: **86116768.2**

(22)

Date of filing: **02.12.86**

(54)

Needle printing head.

(30)

Priority: **06.12.85 IT 2313485**

(43)

Date of publication of application:
15.07.87 Bulletin 87/29

(45)

Publication of the grant of the patent:
21.03.90 Bulletin 90/12

(84)

Designated Contracting States:
DE FR GB

(56)

References cited:
FR-A- 2 469 288
JP-A-60 079 966
US-A- 4 222 674
US-A- 4 225 250
US-A- 4 531 848
US-A- 4 553 864

(73)

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EP 0 228 589 B1

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Description

The present invention relates to a needle printing head and more specifically to an improvement of the actuation armatures of the printing needles.

It is known that among the various kinds of impact matrix printing heads the permanent magnet printing heads have recently been introduced on the market.

These printing heads offer the advantage of requiring a lower electrical feedint power and allow more compact embodiments and higher performances.

However more sophisticated manufacturing technologies and a more complex product design are needed to produce them.

In said printing heads a plurality of magnetic circuits (each of which comprises a magnetic core with a permanent magnet and a demagnetizing coil) are radially arranged round a centre.

For each one of said circuits, a leaf spring which is radially arranged round the same centre, constitutes a movable armature that closes the magnetic circuit.

The leaf spring is cantilever fixed in the outer area, with respect to the centre, and it extends radially inwards, almost right to the centre, with an actuator arm.

A printing needle is fixed to the end of said actuator arm, substantially perpendicular to the leaf spring plane.

Normally the magnetic circuit is magnetized owing to the effect of the permanent magnet so that the leaf spring is normally attracted by the magnetic circuit in a bent position and therefore the spring is elastically biased.

When the demagnetizing coil is energized the magnetic field generated by the coil neutralizes the field generated by the permanent magnet thus causing the leaf spring to be released.

Due to this release a printing stroke is applied to the needle in the direction of the same and the needle performs a print on a print media.

The leaf springs, or armatures, are a critical element of said printing heads because, in time, they under go relevant and repeated stress which leads to fatigue failure.

Furthermore in order to be able to work at high frequencies they must have a suitable stiffening and, at the same time, a minimal inertia. In practice, it is appropriate that said armatures have an adequate elasticity near the cog so as to bend in the plane that is perpendicular to the leaf plane, whereas in correspondence with the actuator arm they must be very stiff so as to avoid deformation to occur in the plane that is perpendicular to the leaf plane.

Generally this result is obtained by fixing on one of the faces of the actuator arm, through resistance welding or brazing, a stiffening rib arranged perpendicularly to the leaf spring plane.

An embodiment of this kind is described, for example, in the US Patent 4 225 250. An other embodiment of this kind is described in JP-A 6 007 966 in which the actuator arm has a groove for engaging the leaf spring and an extending portion as a rein-

forcement plate. The free end portion of the leaf spring is engaged with the groove. The actuator arm has a hole and is secured to the leaf spring by brazing of filler metal preplaced in said hole. Near the free end of the leaf is arranged a hole which corresponds to the hole of the actuator arm. However this solution is not quite satisfactory because the alternate stress applied to the armature causes, in time, the detachment of the stiffening rib and, as a result of this, the printing head failure. This drawback is overcome by the needle printing head, which is the object of the present invention where the stiffening of the armature is obtained by means of a stiffening rib extending radially inwards to constitute the actuator arm. This stiffening rib is fixed by means of a cogging groove at the free end of the leaf spring so as to obtain a clamp active on both spring faces.

This and other features will appear more clearly from the following description of a preferred embodiment of the invention and from the enclosed drawings where:

Fig. 1 shows, in a partial sectional view, a preferred embodiment of the printing head according to the present invention.

Fig. 2 and 3 show, in top and sectional view respectively, an actuation armature of the printing head shown in Fig. 1.

Fig. 4 shows in front view a stiffening rib for the armature.

Fig. 5, shows in front view, the armature depicted in Fig. 2 assembled with the stiffening rib shown in Fig. 4.

Fig. 6 shows in perspective view the armature depicted in Fig. 5.

Fig. 1 shows, in partial sectional view, a preferred embodiment of a printing head according to the present invention.

The printing head comprises a base circular plate 1 made of magnetic material which is axially magnetized, a toroidal ring 3 made of magnetic material, a plurality of cylindrical magnetic cores which are radially arranged round the central axis of the printing head. A coil is inserted on each one of these magnetic cores.

One of these cores and the corresponding coil are shown in Fig. 1, where they are indicated by reference numbers 4 and 5 respectively. The printing head comprises also a thin circular ring 6 made of magnetic material and a further circular ring 7 made of a material as elastic and magnetic as steel, which is provided with a plurality of elastic leaves that extend inwards towards the central axis of the printing head. Their number is equal to that of the cylindrical magnetic cores and each one of these leaves is radially aligned with a corresponding cylindrical core.

Fig. 1 shows one of these elastic leaves which is indicated by reference number 8.

Furthermore the printing head comprises a circular ring 9 that retains ring 7 and a closing LID (10) which is provided with a nose on the end of which a ruby needle guide (12) is mounted.

The various elements 1,2,3,6,7,9,10 are so rigidly

packed as to constitute a single assembly which is held together by means of screw set in suitable seats, two of which, 13 and 14, are shown with dashed lines in Fig. 1.

Each of the elastic leaves, as 8, is provided with a post 15 made of magnetic material which is axially aligned with a corresponding cylindric core (as 4).

The various cores, as 4, board 1, and rings 2,3,6,7 form a plurality of magnetic circuits, each of which is closed by a movable armature formed by an elastic leaf and by a post.

When there is no stress, the elastic leaves 8 extend in a plane which is perpendicular to the axis of the printing head and a small gap, in the order of 0,3 mm, is present between the lower faces of the post as 15 and the top of cores as 4.

However the magnetic field developed by the permanent magnet 3 normally causes the elastic leaves as 8 to be bent and attracted towards the cores as 4, so that the posts are in contact with cores as 4.

The selective energization of the various coils as 5 permits the various magnetic circuits to be selectively demagnetized and the various armatures constituted by leaves as 8 to be selectively release too.

At the free end each leaf as 8 is provided with an actuation arm which is constituted by a stiffening rib 16 which extends radially towards the printing head axis and is perpendicular to the leaf plane.

At the end of each stiffening rib a printing needle as 17 is fixed which inserts its tip in the needle guide 12.

When a strip as 8 is released, the corresponding needle 17 protrudes with its tip from the needle guide 12 thus permitting a dot to be printed on a printing support.

Fig. 2 and 3 show in plan and sectional view, and in greater detail, the shape and structure of one of the various armatures. As already mentioned the armature consists of a leaf 8 made of elastic and magnetic material that extends radially from an external ring 7 towards the centre of ring 0.

In correspondence with the connection to ring 7, leaf 8 is suitably radiused to the ring through radiuses 18, 19.

The free end of the leaf is suitably rounded.

Near its free end leaf 8 has a circular opening into which a magnetic post 15 is inserted and fixed.

To this end the magnetic post is provided with a stop collar 18 having the same diameter as the circular opening and a height equal to the thickness of the leaf, which is inserted in the circular opening of the leaf.

The diameter of the post is much greater than that of the stop collar, so as to offer the leaf, when these two elements are assembled, a stop ledge.

The two elements can be fixed to each other by calking of the stop collar.

Besides the stop collar and on the same side of stop collar 18, post 15 has a cylindrical appendix whose diameter is slightly lesser than that of stop collar 18.

In said appendix a diametral groove 20 having a suitable width is provided, with orientation towards axis 0 of the printing head. It is designed to receive stiffening rib 16 which acts as an actuation arm.

Fig. 4 shows in detail, in front view, stiffening rib 16.

A stiffening rib consists of a small plate made of a material as resistant as steel, having a suitable thickness (for instance 0,5 mm) and a generically elongated and rectangular shape.

Stiffening rib 16 has a straight edge 21 which has been designed to rest on one of the faces of strip 8 and a terminal portion 22 for insertion into groove 20 of Appendix 19.

In addition this stiffening rib has a groove 23 which separates straight edge 21 from a retaining tooth 24.

Groove 23 is intended to receive the distal end of strip 8 which is clogged therein.

At the end of rib 16, which is opposite to the terminal portion 22, a printing needle 17 is fixed through brazing or laser welding.

Fig. 5 shows in front view stiffening rib 16 which is set on the armature formed by strip 8 and post 15.

In this position rib 16 is fixed and rigidly held in place through either brazing or laser welding.

Fig. 6 shows in perspective view the armature completed with the printing needle actuation arm which is constituted by stiffening rib 16 and evidences the various areas along which either brazing or welding of the composing elements can be carried out.

The use of a stiffening rib of the describe form ensures a strong structural bond resistant to alternate stress.

In fact, with reference to Fig. 5 it can be noticed that whenever the armature is released and as a result of this needle is projected upwards, the welding areas undergo stress which is caused by a clockwise movement that is determined by inertial mass of both the needle and the rib. This inertia tends to make said rib 16 to rotate clockwise round clogging and to detach terminal portion 22 from the leaf 8.

This stress is easily absorbed by a wide welding area which practically extends along the whole terminal portion 22 embedded in Appendix 19 which, in its turn, is an integral part of post 15.

Conversely, when the armature is recalled in the biases position, the welding areas undergo the stress that is caused by a counter clockwise movement which tends to make the rib rotate round its distal point B leaning on the leaf.

Missing tooth 24 such rotation would be obstructed mainly by the limited welding area, near point A, which undergoes tensile stress with the possibility of rapid fatigue failure.

Vice versa the presence of tooth 24 determines the following two effects: on the one hand it allows the realization of a wider and more winding welding area in correspondence with the clogging, on the other hand it allows the stress to be transmitted directly to rib 16 through tooth 24.

The weld material that might be present between tooth 24 and the end of strip 8 undergoes a compression stress rather than a tension stress.

Therefore the maximum stress it allows is much higher and also much less affected by fatigue.

Claims

1. Needle printing head wherein a plurality of magnetic circuits, each having a permanent magnet (4), a demagnetizing coil (5) and a movable armature in form of resilient and magnetic leaf cantilever (8) fixed at one end and normally elastically bent so as to close the magnetic circuit, a free end of the leaf extending in a printing needle actuation arm (16), each of the movable armatures comprising:

- a resilient and magnetic leaf (8) having a circular opening with axis perpendicular to the leaf plane and arranged near the free end of the leaf.
- a post of magnetic material having a stop collar (18) and a cylindrical-appendix (19) in opposition to said post as to said stop collar, said collar being inserted in said circular opening, said cylindrical appendix being provided with a diametral groove (20),
- an actuation arm in form of a plate (16) arranged perpendicularly to the plane of said leaf and having a first end (22) inserted into said diametral groove, a flat edge of this first end laying on one face of said leaf, a keeping tooth (24) protruding from said flat edge, a cogging groove (23) defined by said flat edge and a side tooth, the free end of said leaf being inserted in said cogging groove, said leaf, said post and said actuation arm being fixed together through brazing or welding of respective contact areas.

Patentansprüche

1. Nadeldruckkopf mit mehreren Magnetkreisen, die jeweils einen Permanentmagnet (4), eine Entmagnetisierungsspule (5) sowie einen beweglichen Anker in Form eines elastischen, magnetischen blattförmigen Auslegers (8) umfassen, der am einen Ende befestigt und normalerweise zum Schließen des Magnetkreises gebogen ist und wobei ein freies Ende des Auslegers in einen Drucknadel-Betätigungsarm (16) eingreift und jeder Anker umfaßt:

- ein magnetisches Federblech (8) mit einem kreisförmigen Durchgangsloch nahe dem freien Ende des Blechs, wobei die Achse des Lochs senkrecht auf der Ebene des Federblechs steht;
- einen Zapfen aus Magnetmaterial mit einem Anschlagkragen (18) und einem zylindrischen Ansatz (19) auf der dem Zapfen gegenüberliegenden Seite des Anschlagkragens, wobei der Kragen im Durchgangsloch sitzt und der zylindrische Ansatz eine diametrale Nut (20) aufweist;
- einen Betätigungsarm in Form einer rechtwinklig zur Ebene des Federblechs angeordneten Platte (16), deren erstes Ende (22) in die Diametralnut eingesetzt ist, wobei eine flache Kante dieses ersten Endes auf einer Fläche des Federblechs aufliegt, ein Haltezahn (24) aus der flachen Kante herausragt, durch die flache Kante und eine Seite des Zahns eine Verzahnungsnut (23) gebildet ist und das freie Ende des Federblechs in diese Verzahnungsnut eingesetzt ist und wobei das Federblech, der Zapfen und der Betätigungsarm durch Verspannen oder Verschweißen entspre-

chender Berührungsflächen miteinander verbunden sind.

Revendications

1. Tête d'impression à aiguilles comportant une pluralité de circuits magnétiques, chacun d'entre eux étant pourvu d'un aimant permanent (4), d'une bobine de démagnétisation (5) et d'une armature mobile (8) en forme de lame élastique et magnétique encastrée à une extrémité et normalement courbée de façon élastique de manière à fermer le circuit magnétique, une extrémité libre de la lame s'étendant pour former un bras de manœuvre (16) de l'aiguille d'impression, chacune des armatures mobiles comprenant:

- une lame élastique et magnétique (8) présentant une ouverture circulaire avec un axe perpendiculaire au plan de la lame et positionnée près de l'extrémité libre de la lame;
- un montant fait d'un matériau magnétique et pourvu d'un collier d'arrêt (18) et un appendice cylindrique (19) opposé audit montant par rapport au collier d'arrêt, ledit collier étant inséré dans ladite ouverture circulaire, ledit appendice cylindrique étant pourvu d'une gorge diamétrale (20);
- un bras de manœuvre en forme de plaque (16) disposé perpendiculairement au plan de ladite lame et présentant une première extrémité (22) insérée à l'intérieur de ladite gorge diamétrale, un bord plat de cette première extrémité reposant sur une face de ladite lame, une dent de maintien (24) formant saillie à partir dudit bord plat, un évidement de logement de la dent (23) défini par ledit bord plat et une dent latérale, l'extrémité libre de ladite lame étant insérée dans ledit évidement, ladite lame, ledit montant et ledit bras de manœuvre étant fixés ensemble par soudure ou brasage à l'endroit de leurs surfaces de contact respectives.

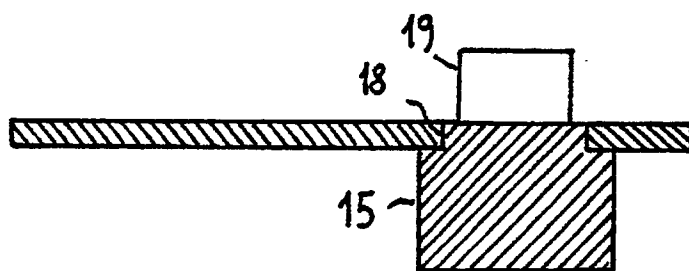
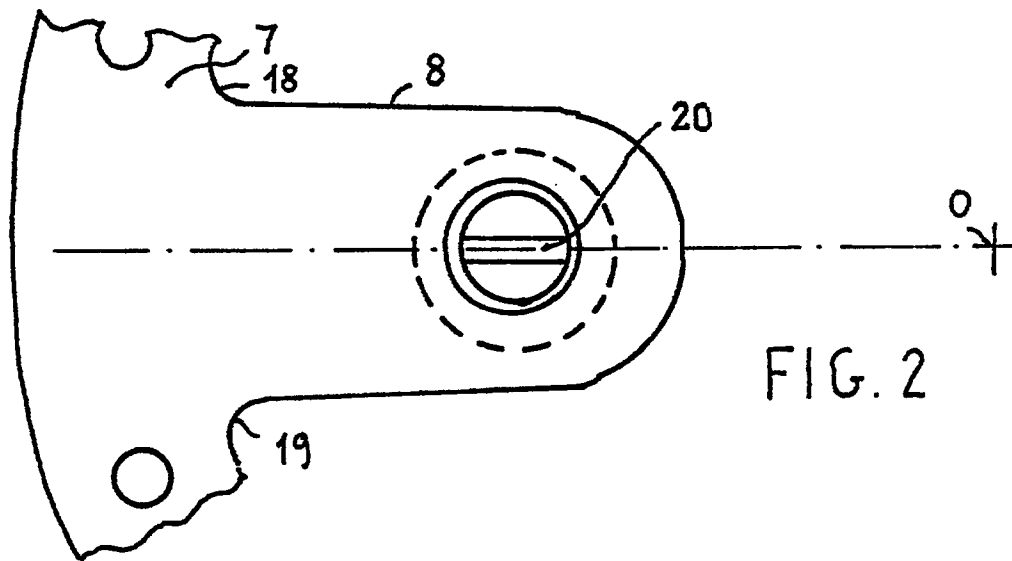
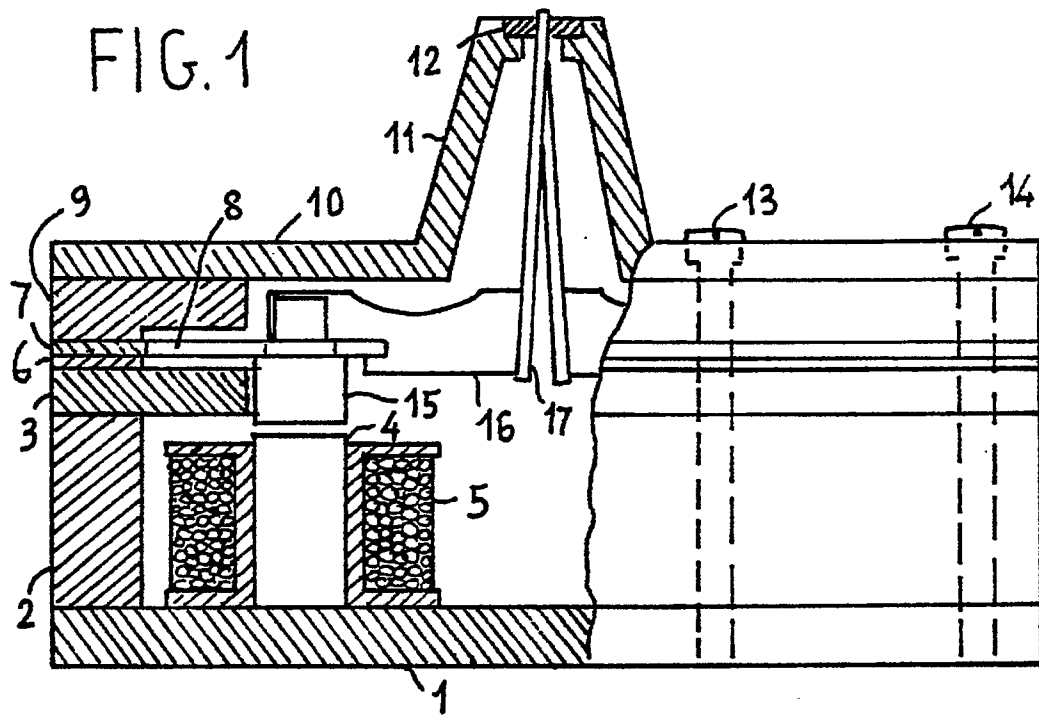


FIG. 4

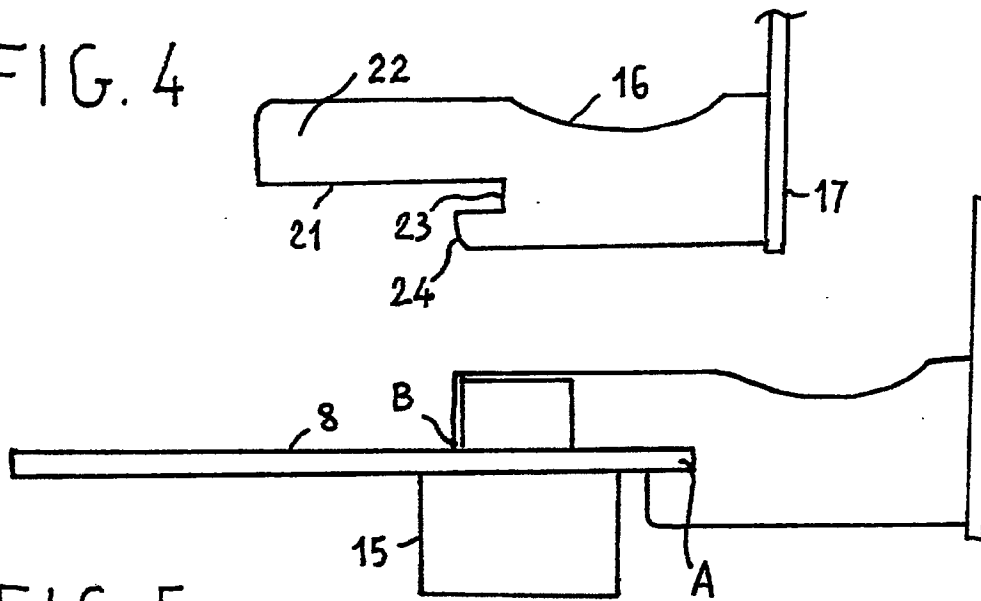


FIG. 5

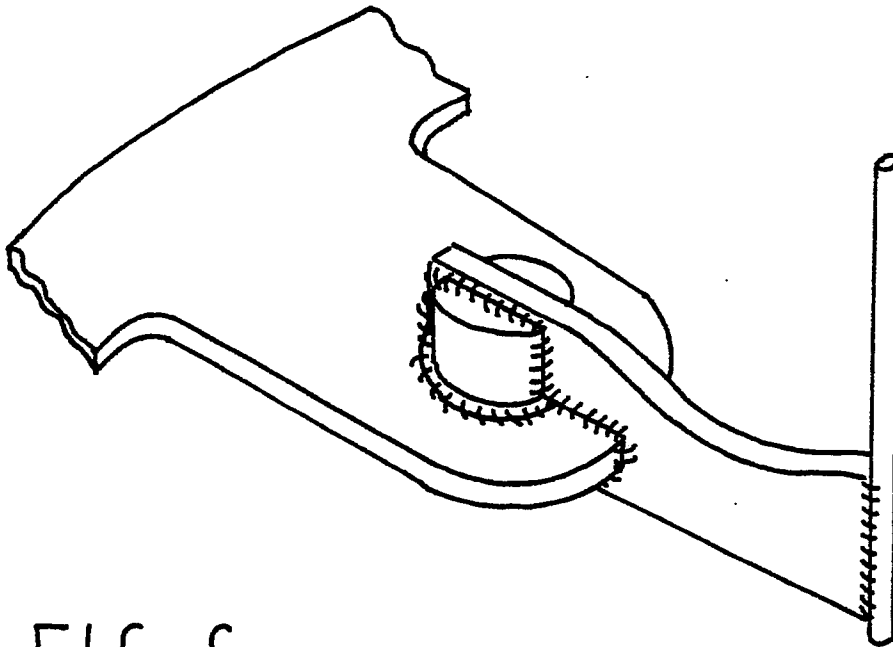


FIG. 6