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(54) **Pin printer head for a high definition dot matrix printer.**

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US-A- 4 652 158
US-A- 4 652 158

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Description

This invention relates to a pin printing head for a high definition dot matrix printer. Such a pin printing head is shown in document US-A-4 652 158.

In printers of the abovementioned type the pins printing individual points are generally individually activated by the keepers of a corresponding series of electromagnets placed circumferentially in the head supporting structure. In heads with a ballistic action each printing pin is provided with a head having a greater diameter than the pin which is pressed directly by the inside end of the keeper. Because the various keepers are arranged radially in order to reduce the inclination of the pins to the striking head at the printing end the width of the internal extremity of the keeper is generally reduced and is connected to a tapering portion of the keeper. This width may not however be less than the diameter of the pin head.

This type of structure is satisfactory for low definition printers, that is with a small number of pins, for example between seven and twelve. In the case of high definition printers, with eighteen or more pins, this structure requires the inclination of the pins to be increased because of the size of the pin heads. On the one hand this requires a greater striking force from the electromagnet and greater strength in the pin return springs, while on the other hand it has the disadvantage of reducing the maximum striking frequency on an individual pin, and therefore the printing rate, while it increases the risk of a pin becoming jammed in its guide.

Heads with a large number of pins in which the keepers are divided into two groups of different lengths so that the internal ends of the pins are placed on two different circumferences have been proposed. These heads have the disadvantage that arms of different lengths are required for the two types of keeper. These therefore generate different striking intensities on their respective pins, with the result that such heads are not suitable for the LQ or NLQ (letter quality or near letter quality) printing required for correspondence.

The object of this invention is to provide a high definition pin printer which does not have the abovementioned disadvantages of known heads and ensures optimum printing quality.

This object is accomplished by the head according to the invention which has maximum simplicity and reliability of operation while reducing the inclination of the pins to a minimum and achieving maximum packing of the electromagnets. In particular the head according to the invention includes a series of pins which are slidably guided towards the printing position by a common support which incorporates a substantially cylindrical portion, the said pins be activated effectively by a corresponding series of electromagnet keepers positioned radially substantially in a plane perpendicular to the axis of the said portion, the said electromagnets being placed circumferentially about a substantially cylindrical structure which is attached coaxially to the said portion and is characterised in that each of the said pins is fixed on a corresponding blade placed in a radial plane with respect to the said axis and attached to a terminal appendage of the corresponding keeper. According to another characteristic of the invention each blade includes an internal appendage with an edge of predetermined length welded to an axial length of the corresponding pin, the said blades being divided into at least two groups, the appendages of a first group of the said blades having a different shape from those of the other group so that the said edge is in a position which is offset along the said axis by a distance of no less than the said length, the blades of the said first group being mounted on the said structure and intercalated with those of the said other group.

These and other characteristics of the invention will be more clearly apparent from the following description of a preferred embodiment provided purely by way of a non-restrictive example with reference to the appended drawings, in which:

Figure 1 is a median section through a pin printing head according to the invention,

Figure 2 is a partial cross-section along the line II-II in Figure 1,

Figure 3 is a plan view of a pin activating keeper in the head on an enlarged scale,

Figures 4 and 5 are two sections along the line IV-IV in Figure 3, illustrating two adjacent activating keepers in their working position.

With reference to Figure 1, 10 generically indicates a common support for a series of printing pins 11. In particular support 10 is constructed of light alloy and has a portion 12 in which a guide is mounted, not illustrated in the drawing. This guide is designed to guide the printing ends of 24 pins 11, placed in two vertical rows which are slightly offset in the conventional way. Portion 12 of support 10 is reinforced above by a vertical rib 13.

Support 10 also has a flange 14 of circular shape which is extended in a substantially cylindrical portion consisting of a sleeve 15 whose axis 16 forms the axis of the head. Sleeve 15 is provided on its extreme edge with four pins 17 (Figure 2), by means of which it is attached to four corresponding appendages 18 of a structure 19 which is also of light alloy.

Structure 19 (Figure 1) has a basic disc 20 of circular shape which internally has a sleeve 21 with a slightly tapering outside surface provided with a series of prismatic grooves 22 (Figure 2) placed

radially with respect to disc 20. On its outer edge disc 20 has a rib 23 for engaging within the end of sleeve 15. Internally rib 23 has a radial projection 24 corresponding to each channel 22.

Both channels 22 and projections 24 are twenty four in number, that is equal to the number of pins 11. Each channel 22 with its corresponding projection 24 forms the seat in which a corresponding electromagnet is fixed, indicated generically by 25, with the object of activating corresponding pin 11.

Each electromagnet 25 includes a magnetic circuit consisting of a block 26 of ferromagnetic material. Block 26 is formed of a prismatic core 27 (Figure 1) around which is placed an electrical coil 28 and another prismatic portion 29 connected to core 27 by means of a crosspiece 30. The end of core 27 and portion 28 form the polar expansions of the magnetic circuit and are coplanar.

In the gap between two adjacent projections 24 (Figure 2) disc 20 has a pair of holes 31 for the passage of the electrical conductors of corresponding coil 28. The various conductors are connected to a plate 32 (Figure 1) of insulating material fixed to disc 20.

Structure 19 also has a central sleeve 33 placed corresponding to a depression 34 in disc 20. Sleeve 33 has a cylindrical cavity 35 while depression 34 has a central hole 35' of lesser diameter than cavity 35 whose function will be better understood below.

Within flange 14 is fixed by means of a pair of bolts 36 a shaped disc 37 of rigid plastics material which has a central hole 38 for the passage of pins 11. Disc 37 is provided internally with a number of axial pegs 39 corresponding to the polar expansion of portions 29, on each of which is engaged a hole 40 (Figures 2 and 3) of a corresponding plate 41 which is thus hinged on peg 39. Plate 41 is of ferromagnetic material and forms the keeper of a corresponding electromagnet 25. Plates 41 are therefore arranged radially substantially in a plane perpendicular to the axis 16 of the head. Each plate 41 includes a principal portion 42 of substantially rectangular shape so as to cover the polar expansions of core 27 and portion 29 of corresponding electromagnet 25. Each plate 41 also has a terminal appendage 43 which is tapered and turned towards axis 16 of the head. Appendage 43 is connected to a blade generically indicated by 44 which is placed in a radial plane with respect to axis 16 perpendicular to the plane of corresponding plate 41. The thickness of blade 44 is equal to the diameter of pin 11 and 1/3 of the thickness of plate 41. Each blade 44 (Figures 3 - 5) has a principal portion 45 which is identical for all the blades, which towards its outer end terminates in a rectangular appendage 46 adjacent to a notch 47 which opens downwards. In turn appendage 43 of each plate 41 is provided with a slot 48 of length equal to that of appendage of 46 which ends in an appendage or crosspiece 49 of thickness equal to the width of notch 47.

Each blade 44 is connected to corresponding plate 41 by inserting appendage 46 of blade 44 into slot 48 of plate 41 in a substantially rigid manner and crosspiece 49 of the latter in notch 47. As a result of the limited travel of which blade 44 and plate 41 are capable between disc 37 and electromagnets 25, each blade 44 remains constantly attached to corresponding plate 41.

Disc 37 is provided with an annular rib 50 (Figure 2) which has a series of radial notches 51 guiding blades 44. The unit plate 41 - blade 44 therefore remains attached by a peg 39 and a corresponding notch 51 in disc 37.

An axial length 52 of corresponding pin 11 is welded to the inner end of each blade 44 (Figures 4 and 5). Section 52 is at a certain distance from the end of pin 11 opposite the printing end. In particular the inner end of blade 44 has an appendage which may have one or other of two different forms indicated by 53 and 54 respectively in the drawings. Each appendage 53 and 54 has an edge 56 of predetermined length to which section 52 is welded. Appendage 53 is slightly extended towards disc 37, while appendage 54 is extended in the opposite direction. Edge 56 of appendage 53 is offset on axis 16 with respect to edge 56 of appendage 54, by a distance greater than the length of edge 56 itself.

Blades 44 can therefore be subdivided into two groups, each of twelve blades 44, of which those in one group have appendage 53 while those in the other group have appendage 54. Blades 44 of the two groups mounted on plates 41 are then assembled on disc 37 which is intercalated between them, with the inevitable increase in the diameter of the welded section 52 of two adjacent pins 11, not reducing the circumferential play between them (Figure 2). Pins 11 may therefore be located at the minimum possible mutual distance and therefore at a minimum distance from axis 16 of the head, with the result that pins 11 have the minimum possible inclination.

Portion 45 of each blade 44 has a shoulder 57 capable of being engaged by a piston 58 placed in a corresponding cylindrical seat 59 in disc 37. A compression spring 61 acting in seat 59 against the flange of piston 58 normally keeps blade 44 supported with one shoulder 62 (Figures 4 and 5) against a stop ring 63 of elastomeric material. Blade 44 in turn holds plate 41 in a resting position in which it rests against a pair of rings 64 and 65 of elastomeric material mounted in two corresponding annular seats in disc 37, as shown for the lower

blade 44 illustrated in Figure 1, and as indicated by dashed and dotted lines in Figures 4 and 5.

When coil 28 (Figure 1) of corresponding electromagnet 25 is excited, plate 41 moves into the printing position resting against the polar expansions of core 27 and portion 29, as indicated for the upper blade 44 illustrated in Figure 1 and as shown by solid lines in Figures 4 and 5.

Corresponding to the polar expansion of portion 29, plate 41 has a step 66 which forms an edge 67 which acts as a fulcrum for rotating plate 41 between its two positions. Edge 67 lies within elastic ring 64 and in a position which is substantially opposite to the contact position with ring 65. In reality edge 67 is slightly outside 65. Plate 41 however remains in constant contact with ring 65, while edge 67 remains in constant contact with the polar expansion of portion 29. In the printing position plate 41 therefore slightly compresses ring 65, the elastic force of which favours restoration and helps to return it to rest when corresponding coil 28 ceases to be excited.

Stop ring 63 for blades 44 is placed in a cavity 35 in sleeve 33 and rests against an adjusting sleeve 68. The latter can slide axially in cavity 35, but cannot rotate about it because a key 69 engages an axial groove 71 in sleeve 33. Sleeve 68 has an internal thread 72 which engages the threaded cylinder 73 having a head 74 provided with a notch 75 which may be engaged by a screwdriver. The diameter of thread 72 is substantially equal to the diameter of the hole in ring 63 and is such that appendages 54 of blades 44 do not interfere with sleeve 68. Cylinder 73 is provided with a plug 76 which can rotate in hole 35' of depression 34. Cylinder 73 is locked axially in hole 35' by an elastic fork 77 which blocks a circlip on plug 76. This therefore ensures that the play between cylinder 73 and depression 34 is taken up, and ring 63 is positioned with extreme accuracy for this purpose.

From what has been seen above it will be obvious that the connection between blades 44 and pins 11 and plates 41 makes it possible to reduce the distance between them. This distance may be further reduced by axially offsetting the point of attachment between section 52 of the pins and blades 44, and providing the latter with appendages 53 and 54 of different shape. Thus for the same number of pins, blades 44 may be of a length such as to bring the internal ends of pins 11 as close as possible to axis 16, thus reducing the inclination of the latter. The transverse component of pin movement is thus reduced, as is the corresponding friction and the risk of jamming. Finally all pins 11 are activated by keepers 41, 44 which act with the same lever arm, thus ensuring uniformity of striking intensity at various points.

It is obvious that various modifications and improvements may be made to the head described without going beyond the scope of the invention as defined by the appended claims. For example, blades 44 may be of three different types or may be connected to corresponding plates 41 by welding. Also structure 19 may have a different form or maybe integrated in a single piece with the various magnetic circuits of electromagnets 25. Finally the core 27 of each electromagnet 25 may be placed within portion 29 and plates 41 may have a principal portion of a shape other than a rectangular shape.

Claims

1. A pin printer head for a high definition dot matrix printer consisting of a series of pins slidably guided towards the printing position by a common support including a substantially cylindrical portion, the said pins being activated selectively by a corresponding series of electromagnet keepers arranged radially substantially in a plain perpendicular to the axis of the said portion, the said electromagnets being arranged circumferentially on a substantially cylindrical structure fixed coaxially to the said portion, each of the pins presenting an own axial section fixed to an internal edge of predetermined length of a relative blade, said blades being located in a radial plain with respect to the said axis, and being attached to a terminal appendage of a corresponding said keeper, characterized in that the blades (44) are separated in at least two groups, the blades (44) of one group having a different shape from that of the blades (44) of the other of said groups, and such to present the said edge (56) in a position along the said axis (16) staggered by a distance at least equal to the length of the edge (56), the blades (44) of one of said groups being assembled on said structure (18) alternated with the blades (44) of the other group.

2. A head according to claim 1, characterised in that each of the blades (44) comprises an internal appendage (53, 54) having the said edge (56) of predetermined length, said edge (56) being welded to an axial section of the relative pin (11), and the appendeges of the blades (44) of one of the said groups having a different shape from that the appendeges of the blades (44) of the other group of the said groups to locate the relative edge (56) in a position along the said axis (16) staggered.

3. A head according to claims 1 or 2, characterised in that the said axial section is located on each pin (11) at a specific distance from the end of the pin opposite of the printing end.

4. A head according to one of the foregoing claims, characterised in that each blade (44) is provided with a shoulder (62) to engage a common stop ring (63), each blade being pressed to engage this stop ring by an individual return spring (61) acting on the corresponding blade.

5. A head according to claim 4, characterised in that the said stop ring (63) consists of an elastomeric material and is supported by a member (68) placed in an axially adjustable position on the said structure (19).

6. A head according to claim 5, characterised in that the said member (68) consists of a tubular block which can slide axially in a cylindrical cavity (35) in the said structure (19) and is connected thereto by means of a threaded member (73).

7. A head according to one of the foregoing claims from 4 to 6, characterised in that each blade (44) has an external appendage (46) engaging in a slot (48) of the said terminal appendage (43) of the corresponding keeper (41) and a notch (47) engaging a further appendage (49) of the said corresponding keeper.

8. A head according to claim 7, characterised in that each of the said keepers (41) is provided with a hole (40) whereby it is hinged on an axial appendage (39) of a plate (37) borne by the said support (10).

9. A head according to claim 8, characterised in that each of the said keepers (41) is provided with an edge (67) whereby they rest on a polar expansion (29) of the magnetic circuit (26) of the corresponding electromagnet (25), an elastic ring (65) being placed on the said support in a position substantially opposite the said edge, the said keepers being capable of rotating between a resting position and a printing position while remaining in contact with the said elastic ring and each maintaining the said edge in contact with the said polar expansion.

10. A head according to claim 9, characterised in that the said keepers (41) are also normally held by corresponding return springs (61) supported against a second elastic ring (64) located outside the said edge (67).

11. A head according to claims 9 or 10, characterised in that each of the said magnetic circuits is formed of a block (26) of magnetic material comprising two coplanar polar expansions (27 and 29) for each electromagnet, one (27) of which expansion bears the corresponding electrical coil, each keeper (41) resting by means of the said edge (67) on the other (29) of the said polar expansions.

Patentansprüche

1. Nadeldruckkopf für einen hochauflösbaren Punktmatrixdrucker, mit einem eine Reihe von gleitverschieblich in Druckposition zu führenden Nadeln enthaltenden, einen im wesentlichen zylindrischen Abschnitt aufweisenden Tragkörper, wobei die Nadeln durch eine entsprechende Reihe von Elektromagnet-Ankern auswahlbar zu betätigen sind, die im wesentlichen in einer zur Achse des erwähnten Abschnitts senkrecht verlaufenden Ebene radial angeordnet sind und diese Elektromagneten kreisförmig auf einem im wesentlichen zylindrischen Bauteil angeordnet sind, das auf dem erwähnten Abschnitt koaxial befestigt ist, wobei jede der Nadeln einen eigenen axialen Abschnitt besitzt, über den sie mit vorgegebener Länge an der Innenkante einer Halteklinge befestigt ist, und diese Halteklingen in einer bezüglich der erwähnten Achse radialen Ebene angeordnet sowie an den Aufhängeenden der entsprechenden Elektromagnetanker angebracht sind, **dadurch gekennzeichnet**, daß die Halteklingen (44) in mindestens zwei Gruppen unterteilt sind, von denen die Halteklingen (44) der einen Gruppe eine unterschiedliche Form gegenüber den Halteklingen (44) der anderen Gruppe besitzen, und zwar so, daß die erwähnten Innenkanten (56) in Richtung der erwähnten Achse (16) um einen Abstand zueinander versetzt angeordnet sind, der zumindest der Länge der Innenkante (56) entspricht, wobei die Halteklingen (44) der einen Gruppe zu den Halteklingen (44) der anderen Gruppe auf dem erwähnten zylindrischen Bauteil (19) abwechselnd angeordnet sind.

2. Nadeldruckkopf nach Anspruch 1, **dadurch gekennzeichnet**, daß jede der Halteklingen (44) ein inneres Aufhängeende (53,54) besitzt, das die erwähnte Innenkante (56) von vorbestimmter Länge aufweist, die mit dem axialen Abschnitt der entsprechenden Nadel (11) verschweißt ist, wobei die Aufhängeenden der Halteklingen (44) der einen Gruppe eine unter-

schiedliche Form gegenüber den Halteenden der Halteklingen (44) der anderen Gruppe aufweisen, um zur entsprechenden Versetzung der Innenkanten (56) längs der erwähnten Achse (16) zu gelangen.

3. Nadeldruckkopf nach Anspruch 1 oder 2, **dadurch gekennzeichnet**, daß der erwähnte axiale Abschnitt auf jeder Nadel (11) in einem spezifischen Abstand von dem dem Druckende gegenüberliegenden Ende der Nadel liegt.

4. Nadeldruckkopf nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß jede Halteklinge (44) mit einer Schulter (62) versehen ist, mit der sie an einem gemeinsamen Anschlagring (63) anliegt, und wobei jede Halteklinge durch eine individuelle, sie beaufschlagende Rückholfeder (61) gegen diesen Anschlagring (63) zu drücken ist.

5. Nadeldruckkopf gemäß Anspruch 4, **dadurch gekennzeichnet**, daß der erwähnte Anschlagring (63) aus einem elastischen Polymer besteht und an einem Ringkörper (68) abgestützt ist, welcher in axial einstellbarer Position auf dem erwähnten Bauteil (19) angeordnet ist.

6. Nadeldruckkopf nach Anspruch 5, **dadurch gekennzeichnet**, daß der erwähnte Ringkörper (68) aus einem rohrförmigen Block besteht, der axial gleitbar in einen zylindrischen Hohlraum (35) im erwähnten Bauteil (19) angordnet und darin mit einem Gewindeglied (73) in Verbindung steht.

7. Nadeldruckkopf nach einem der vorerwähnten Ansprüche 4 bis 6, **dadurch gekennzeichnet**, daß jede Halteklinge (44) ein äußeres Aufhängeende (46), das in einem Schlitz (48) des erwähnten Aufhängeendes (43) des entsprechenden Magnetankers (41) liegt, und weiterhin eine Kerbe (47) aufweist, die mit einer weiteren Aufhängestelle (49) des erwähnten entsprechenden Magnetankers in Eingriff steht.

8. Nadeldruckkopf nach Anspruch 7, **dadurch gekennzeichnet**, daß jeder der erwähnten Magnetanker (41) ein Loch (40) aufweist, mit dem er auf einem axialen Aufhängezapfen (39) einer vom Tragkörper (10) getragenen Platte (37) gelenkig sitzt.

9. Nadeldruckkopf nach Anspruch 8, **dadurch gekennzeichnet**, daß jeder Magnetanker (41) mit einer Stufenkante (67) versehen ist, über die die Magnetanker (41) auf einem Polschuh (29) des Magnetkreises (26) des entsprechenden Elektromagneten (25) aufliegen, wobei auf dem erwähnten Tragkörper ein elastischer Ring (65) in einer zur Stufenkante (67) im wesentlichen gegenüberliegenden Position vorhanden ist, und wobei weiterhin die erwähnten Magnetanker (41) zwischen einer Ruheposition und einer Druckposition schwenkbar sind, sowie dabei mit dem erwähnten elastischen Ring (65) in Verbindung bleiben und auch jede Stufenkante (67) mit dem erwähnten Polende (29) in Verbindung bleibt.

10. Nadeldruckkopf nach Anspruch 9, **dadurch gekennzeichnet**, daß die Magnetanker (41) normalerweise durch Rückholfedern (61) gegen einen zweiten elastischen Ring (64) gedrückt werden, der außerhalb der erwähnten Stufenkante (67) liegt.

11. Nadeldruckkopf nach den Ansprüchen 9 oder 10, **dadurch gekennzeichnet**, daß jeder der erwähnten Magnetkreise von einem Block aus magnetischem Material gebildet wird, der zwei Polenden (27 und 29) für jeden Elektromagnet besitzt, von denen das eine Polende (27) die entsprechende Spulenwicklung trägt, während auf dem anderen Polende (29) jeder Magnetanker (41) mit seiner Stufenkante (67) aufliegt.

Revendications

1. Tête d'impression à aiguilles pour une imprimante matricielle à points, à haute définition, constituée d'une série d'aiguilles guidées à coulissement, en direction d'une position d'impression, par un support commun comportant une partie sensiblement cylindrique, ces aiguilles étant actionnées sélectivement par une série correspondante d'armatures d'électro-aimants disposées radialement, pratiquement dans un plan perpendiculaire à l'axe de ladite partie cylindrique, les électro-aimants étant disposés, dans le sens circonférentiel, sur une structure sensiblement cylindrique fixée coaxialement à ladite partie cylindrique, chacune des aiguilles présentant une propre section axiale fixée à un bord interne, d'une longueur prédéterminée, d'une lame associée, ces lames étant disposées chacune dans un plan radial par rapport à l'axe et étant attachées à un appendice terminal d'une armature correspondante, caractérisée en ce que les lames (44) sont séparées en au moins deux groupes, les lames (44) d'un groupe ayant une forme différente de celle des lames (44) de l'autre groupe, de manière à présenter le bord (56) dans une position, le long de l'axe (16), qui est décalée d'une distance au moins égale à la

longueur du bord (56), les lames (44) de l'un des groupes étant assemblées sur la structure (18) en alternant avec les lames (44) de l'autre groupe.

2. Tête suivant la revendication 1 caractérisée en ce que chacune des lames (44) comprend un appendice interne (53,54) présentant le bord (56) ayant la longueur prédéterminée, ce bord (56) étant soudé à une section axiale de l'aiguille associée (11), et les appendices des lames (44) de l'un des groupes ont une forme différente de celle des appendices des lames (44) de l'autre groupe de manière à placer le bord associé (56) dans une position décalée le long de l'axe (16).

3. Tête suivant l'une quelconque des revendications 1 ou 2 caractérisée en ce que la section axiale est située, sur chaque aiguille 11, à une distance spécifique de l'extrémité de l'aiguille qui est opposée à son extrémité d'impression.

4. Tête suivant l'une quelconque des revendications précédentes caractérisée en ce que chaque lame (44) est pourvue d'une saillie (62) destinée à venir en contact avec un anneau (63) formant une butée commune, chaque lame étant pressée, de manière à venir en contact avec cet anneau formant butée, par un ressort de rappel individuel (61) agissant sur la lame correspondante.

5. Tête suivant la revendication 4 caractérisée en ce que l'anneau formant butée (63) est réalisé en un matériau élastomère et il est supporté par un élément (68) placé dans une position réglable axialement sur la structure (19).

6. Tête suivant la revendication 5 caractérisée en ce que l'élément (68) est constitué par un bloc tubulaire qui peut coulisser axialement dans une cavité cylindrique (35) dans la structure (19) et qui lui est relié au moyen d'un élément fileté (73).

7. Tête suivant l'une quelconque des revendications 4 à 6 caractérisée en ce que chaque lame (44) présente un appendice externe (46) s'engageant dans une fente (48) de l'appendice terminal (43) de l'armature correspondante (41), et une encoche (47) recevant un appendice additionnel (49) de l'armature correspondante.

8. Tête suivant la revendication 7 caractérisée en ce que chacune des armatures (41) est pourvue d'un trou (40) par l'intermédiaire duquel elle est articulée sur un téton axial (39) d'une plaque (37) portée par le support (10).

9. Tête suivant la revendication 8 caractérisée en ce que chacune des armatures (41) est pourvue d'une arête (67) par l'intermédiaire de laquelle elle prend appui sur une pièce polaire (29) du circuit magnétique (26) de l'électroaimant correspondant (25), un anneau élastique (65) étant placé sur le support dans une position sensiblement opposée à cette arête, les armatures étant capables de tourner entre une position de repos et une position d'impression tout en demeurant en contact avec l'anneau élastique et en maintenant chacune son arête en contact avec ladite pièce polaire.

10. Tête suivant la revendication 9 caractérisée en ce que les armatures (41) sont aussi maintenues normalement appliquées, par des ressorts de rappel correspondants (61), contre un second anneau élastique (64) situé à l'extérieur par rapport à l'arête (67).

11. Tête suivant l'une quelconque des revendications 9 ou 10 caractérisée en ce que chacun des circuits magnétiques est formé d'un bloc (26) en matériau magnétique, comprenant deux pièces polaires coplanaires (27,29) pour chaque électroaimant, l'une de ces pièces polaires (27) portant la bobine électrique correspondante, chaque armature (41) étant en appui, au moyen de l'arête (67), sur l'autre pièce polaire (29).

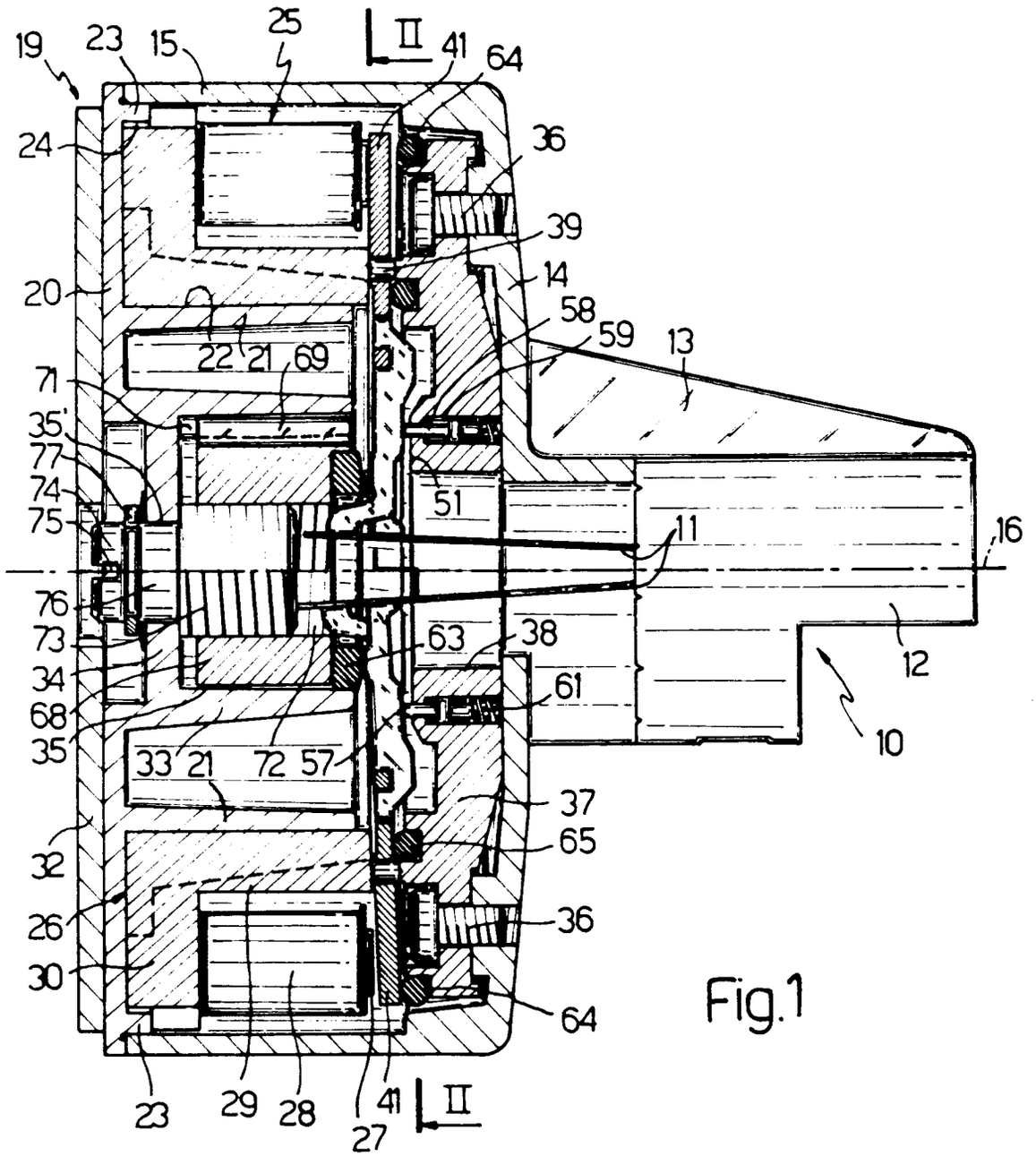
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Fig.1

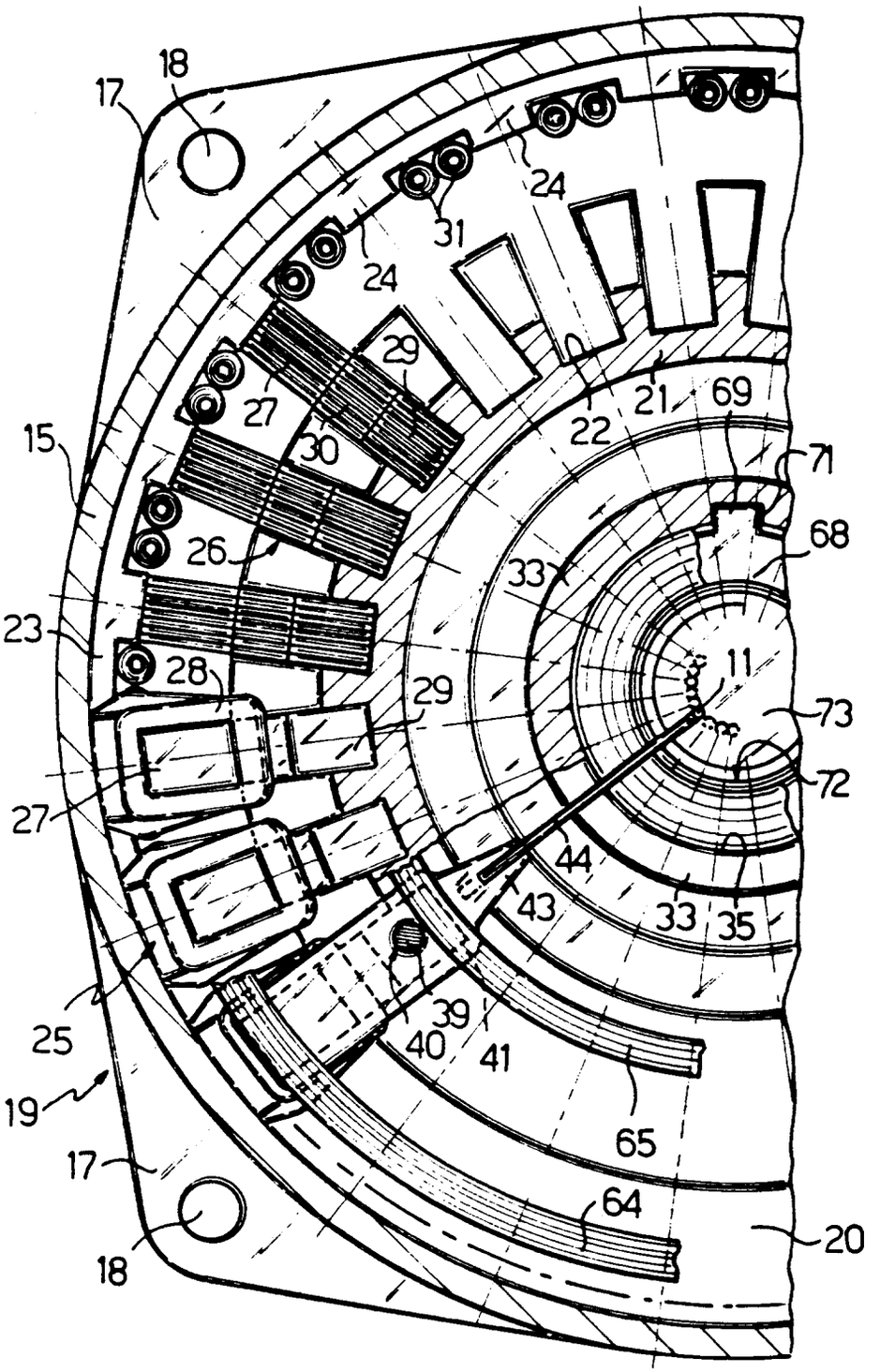
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Fig. 2

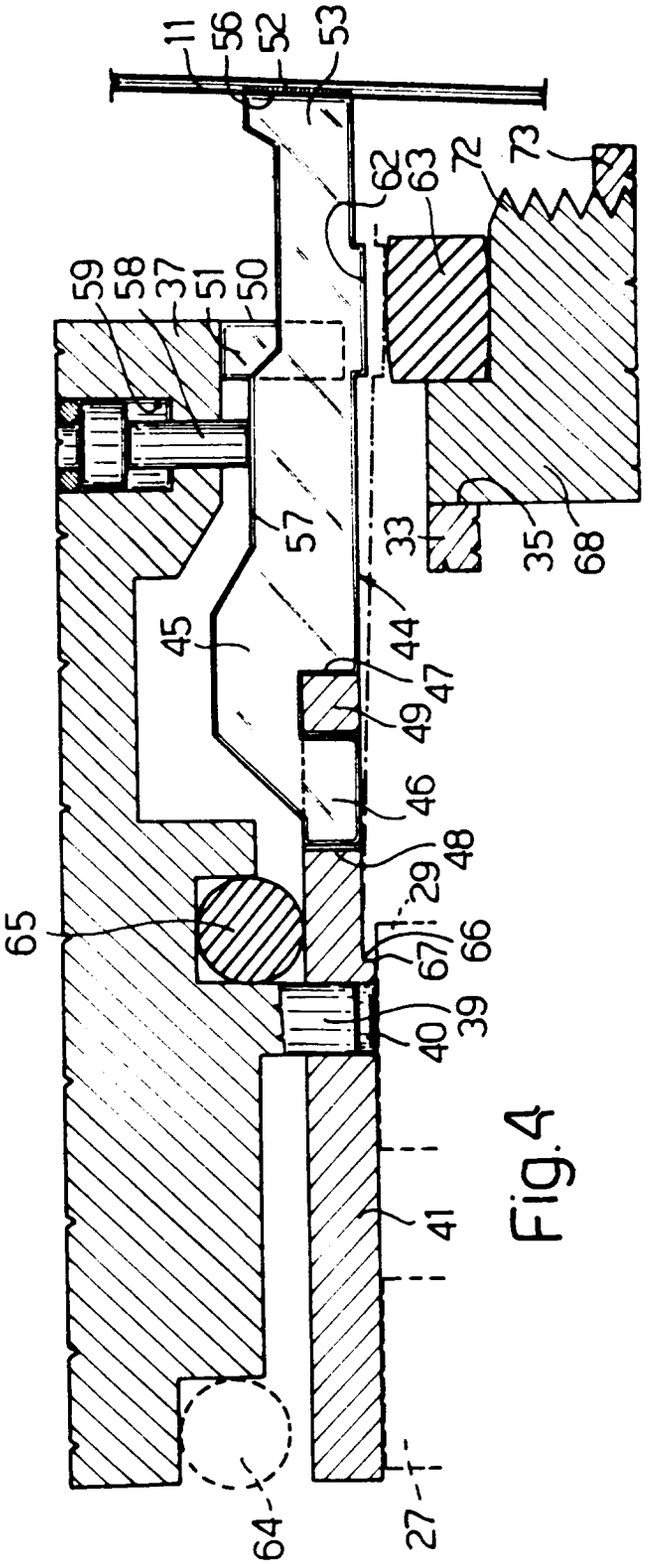
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Fig.4

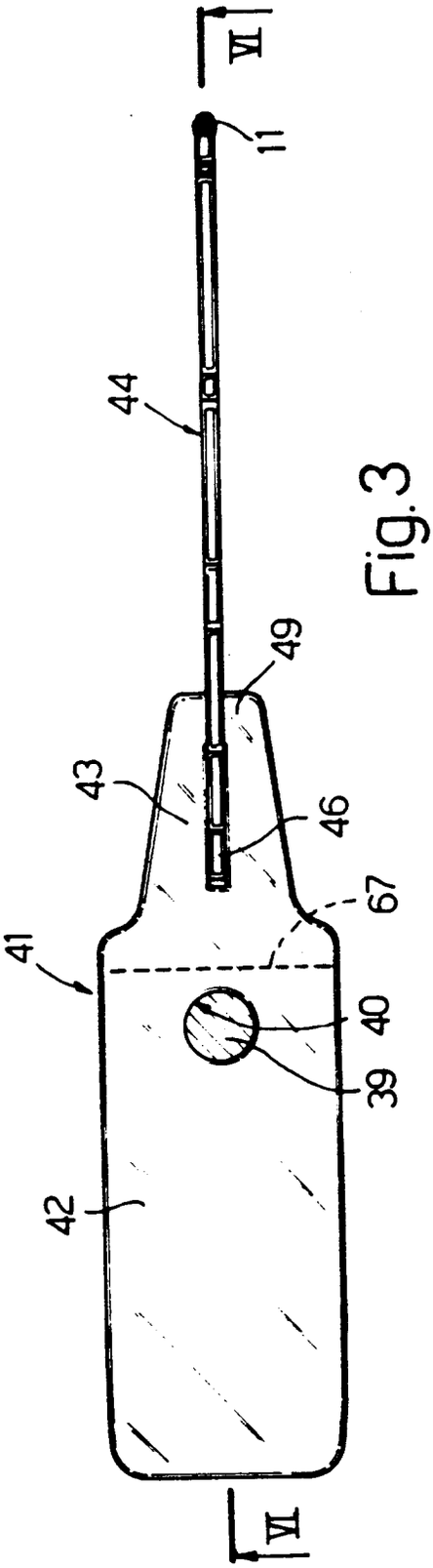
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Fig.3

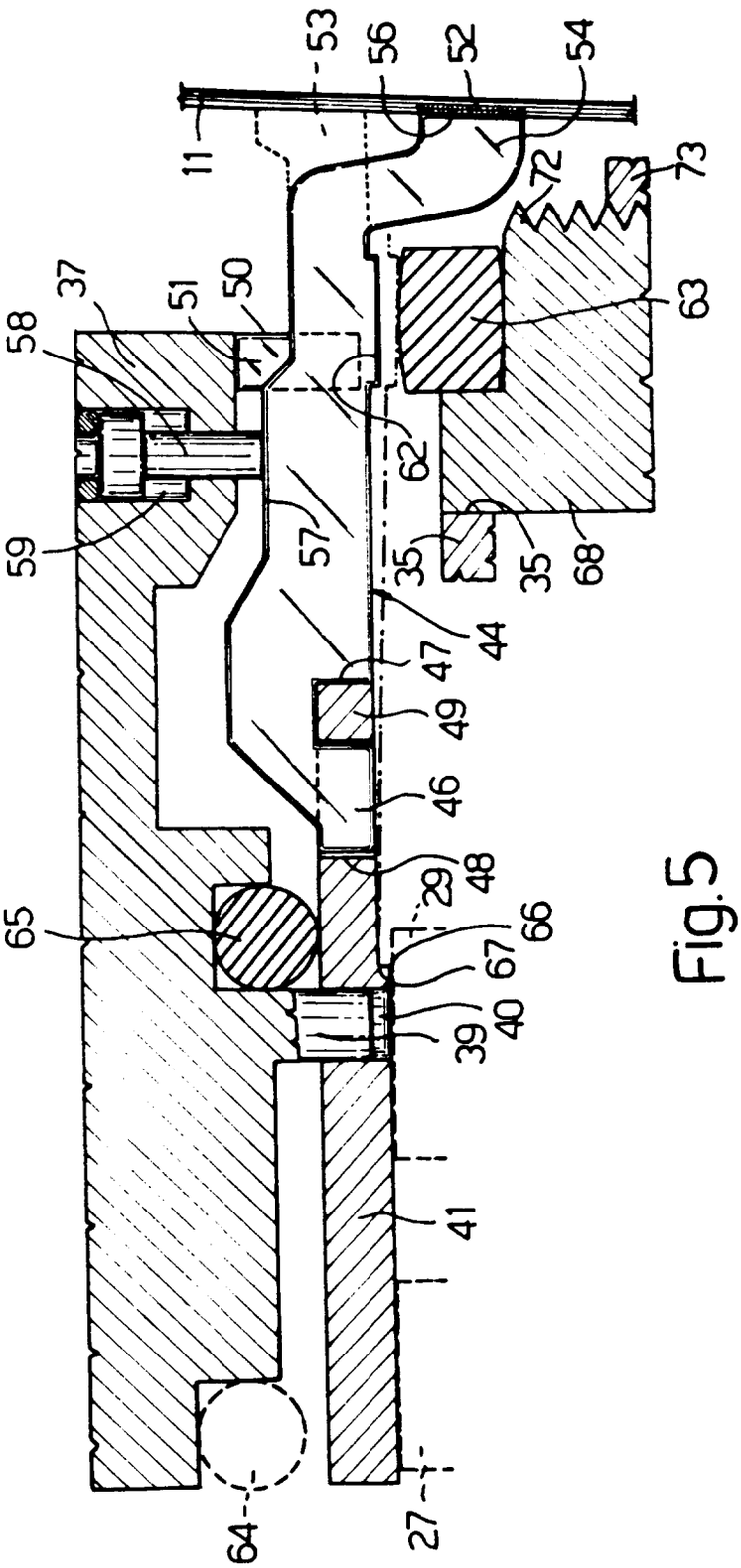
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Fig.5