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(54) Impact dot head for a printer.

(57) An impact dot head for a printer comprising a plurality of printing wires (8) which are movable into and out of a printing position; and guide means (6,7,14) through which the printing wires (8) pass and by means of which the printing wires (8) are bent to different extents, each printing wire (8) being arranged to be moved in one direction by a respective movement effecting member (19) and being arranged to be moved in the opposite direction by a respective resilient member (16) which acts on the respective movement effecting member (19) so as to restore the latter to an initial position, whereby each movement effecting member (19) is subjected to a restoring force which depends both on the force exerted by the respective resilient member (16) and by the extent to which the respective printing wire (8) is bent, characterised in that the resilient members (16) are substantially similar to each other but are arranged to exert different forces so that each movement effecting member (19) is subjected to substantially the same restoring force.

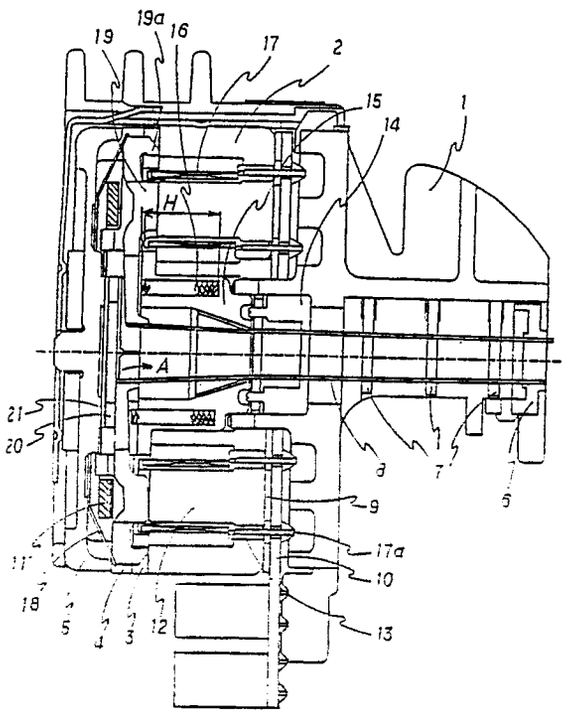

Fig. 2

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IMPACT DOT HEAD FOR A PRINTER

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

An impact dot head known to the Applicants is shown in Figures 4 and 5. As will be seen therein, the head comprises a plurality of printing wires 308 which are movable into and out of a printing position and a plurality of wire guides 307 through which the printing wires 308 pass and by means of which they are bent so as to pass through two rows of holes 310 in each of the wire guides 307. Each printing wire 308 is arranged to be moved in the printing direction by an armature 319 and to be moved in the opposite direction by a restoring spring 316 which acts on the respective armature 319 so as to restore the latter to an initial position. Each armature 319 is connected to one end of its respective printing wire 308. As will be seen in Figure 4, the armatures 319 are positioned on a circle at equally divided intervals, and there is linear positioning of the tips of the wires 308. Thus, as shown in Figure 5, each armature 319 is retained in a waiting or initial state by means of a spring force exerted by its restoring spring 316, and each printing wire 308, in this initial state, is supported by the wire guides 307 in a relaxed condition.

However, the extent ΔY to which each of the printing wires 308 is bent differs so that the bending moment M which is exerted by a printing wire 308 on its respective armature 319 differs for each armature. This bending moment M gives the armature a rotational force, so that the retaining force during the waiting state of the armature (hereinafter referred to as the restoring force) becomes the sum of a spring force derived from the restoring spring 316 and a force which tends to rotate the armature and which is derived from the bending moment M of the printing wire. Because the spring force of the restoring spring 316 has an equal value in the case of each armature, the restoring force differs for each armature. This has caused different printing forces to be exerted by the respective armatures which result in non-uniform printing quality.

It has been suggested that the setting angles of the various printing wires should vary so as to obtain a uniform restoring force on each armature. Alternatively, it has been suggested that the specifications of the various restoring springs should vary so as to obtain a uniform restoring force on each armature. However, such methods result in an increase in the number of different parts, which makes assembly difficult and therefore increases costs.

It is therefore the object of the present invention to provide an impact dot head by means of which uniform printing quality can be obtained without increasing the cost of assembly.

According, therefore, to the present invention, there is provided an impact dot head for a printer comprising a plurality of printing wires which are movable into and out of a printing position; and guide means through which the printing wires pass and by means of which the printing wires are bent to different extents, each printing wire being arranged to be moved in one direction by a respective movement effecting member and being arranged to be moved in the opposite direction by a respective resilient member which acts on the respective movement effecting member so as to restore the latter to an initial position, whereby each movement effecting member is subjected to a restoring force which depends both on the force exerted by the respective resilient member and by the extent to which the respective printing wire is bent, characterised in that the resilient members are substantially similar to each other but are arranged to exert different forces so that each movement effecting member is subjected to substantially the same restoring force.

Thus, in the case of the present invention, the restoring forces of the various resilient members can be varied to take account of the rotational forces exerted on the various movement effecting members due to the bending moments of the various printing wires. Thus the total restoring force exerted on all the movement effecting members can be made the same, so that it becomes possible to obtain uniform printing quality with a printer in which the said head is used.

Preferably, each of the resilient members is carried by a common support member. Thus each of the resilient members is preferably mounted in a respective hole in the common support member, the depth of each hole depending upon the extent to which the respective printing wire is bent by the said guide means.

Each resilient member is preferably constituted by a coil spring.

Each movement effecting means preferably comprises an armature which, when actuated by electro-magnetic means, moves the respective printing wire into the printing position.

Preferably, the movement effecting means are arranged in a circular or part-circular array, the ends of the printing wires remote from the movement effecting means being arranged in at least one linear row.

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

Figure 1 is a plan view of a printer which may be provided with an impact dot head according to the present invention;

Figure 2 is a cross sectional illustration of an embodiment of an impact dot head according to the present invention;

Figure 3 is a perspective view of a restoring spring holder forming part of the head of Figure 2;

Figure 4 is a schematic view showing a printing wire arrangement known to the Applicants; and

Figure 5 is a plan view showing a printing wire, an armature, and a restoring spring in the arrangement of Figure 4.

In Figure 1 there is shown an impact printer which may be provided with an impact dot head 50 according to the present invention. The impact dot head 50 is mounted on a carriage 56 for movement in the direction of the lines of print to be produced. Thus the desired figures, letters and the like may be printed on printing paper P which is arranged between a platen 57 and an ink ribbon 55.

Figure 2 is a cross-sectional illustration of an impact dot head showing an embodiment of the present invention. The head comprises a frame 2 which is provided with a plurality of cores 12 arranged in a circular array, a coil 17 being wound around each core 12 to form an electromagnet. Two through holes 13 for each of the cores 12 are provided in the bottom surface of the frame 2, respectively, and the terminal portions 17a of the coils 17 are permanently secured, by way of an insulation plate 9, to a base plate 10 by soldering.

On the upper surface of the peripheral edge of the frame 2, there are laminated a yoke plate 3, a side yoke 4, and an armature holder 5. Armatures 19, each of which faces a core 12, are arranged on a circle at equally divided intervals. An end portion of each armature 19 is fixed by brazing to an end portion of a respective printing wire 8, the printing wires 8 being arranged on a circle at equally divided intervals.

As shown in Figure 2, each printing wire 8, which passes through a tip guide 6 which is attached to a nose 1 and through a plurality of wire guides 7, and a back guide 14, is guided thereby in such a way that, as shown in Figure 4, a non-parallel arrangement of wires which form two vertically spaced apart linear arrays is provided at the end portions of the printing wires 8. Therefore, the amount of bending of the various printing wires 8 is different for each of the armatures 19.

In a central hole of the frame 2 there is arranged a restoring spring holder 15 a perspective view of which is shown in Figure 3. The restoring spring holder 15 is moulded from a thermoplastic resin, and a plurality of holes 15d are provided in the restoring spring holder 15. The depth H of each of the holes 15d is different and depends on its angular position. A restoring spring 16 constituted by a coil spring, is mounted in each hole 15d so as to push the respective armature 19 towards a damper 20. All the restoring springs 16 are made substantially the same.

A printing wire 8, in which the extent ΔY to which it is bent by the guides 6, 7, 14 is small, makes only a small contribution to the restoring force of the respective armature 19 because of the small bending moment of the wire. Thus, in the present embodiment, the depth H of the hole 15d of the restoring spring holder 15 is made small at a place where the amount of bending of the respective printing wire 8 is small so as to make the restoring force produced by the respective restoring spring 16 large.

On the other hand, the restoring force produced by a printing wire 8 is large at a place where the amount of bending ΔY of the wire 8 is large, so that the depth H of the respective hole 15d of the restoring spring holder 15 is made large so as to make the restoring force produced by the restoring spring 16 small.

The calculation indicated above is carried out for each printing wire 8 to define the depth H of the respective hole 15d of the restoring spring holder 15 so as to be appropriate for each wire, in order to ensure that the restoring forces of all the armatures 19 is substantially constant and the same. The range of depths H may be ± 0.4 mm.

A plurality of slot portions 15a which are provided in the restoring spring holder 15 permit determination of the lateral position of the respective armature 19, and the armatures 19 may be moved in the direction of the slot portions 15a. Three projecting portions 15b are provided on the restoring spring holder 15 and have a trapezoidal cross section, the projecting portions 15b serving as guides during insertion of the armature holder 5. Two cylindrical projecting portions 15c of the restoring spring holder 15 enable determination of the positions of supporting point springs 18 which engage the armatures 19 so as to hold them in the armature holder 5. A supporting point portion 19a of each armature 19 is caused to engage the upper surface of the peripheral edge of the frame 2 by means of the respective spring 18, the latter being attached to the armature holder 5. This enables each armature 19 to rotate about the supporting point portion 19a as a centre.

The operation of the head will be explained with reference to Figure 2. Each armature 19 is retained by its restoring spring 16 in a non-operative state in which it is pushed against the damper 20. When a power pulse is transmitted to the respective coil 17, a magnetic force of attraction is generated between the respective armature 19 and

the respective core 12. The armature 19 is accelerated due to this force, and begins to rotate in the direction of the arrow A about the supporting point 19a as a centre. As a result, the respective printing wire 8 is brought into collision with the printing paper P (Figure 1) or other medium to form a dot. After this collision, the armature 19 begins to undergo a restoring action owing to the repulsion force during the collision and to the spring force of the restoring spring 16, the armature coming into collision with the damper 20 so as to complete the first printing step.

During the printing step described above, the amount of bending of the printing wire 8 differs for each armature 19, so that the rotational force exerted on an armature 19 by its printing wire 8 differs for each armature. In this embodiment, the depth H of the hole portion 15d in which the restoring spring 16 is located in the restoring spring holder 15 is such that the restoring force acting on the armature 19 is the same irrespective of the rotational force exerted on the armature 19 on account of the bending of the respective printing wire 8. This makes the printing force of all the printing wires 8 uniform, which makes it possible to obtain a uniform printing quality. In addition, the uniform printing quality can be obtained merely by appropriate arrangement of the depths H of the hole portions 15d in which the restoring springs 16 are located in the restoring spring holder 15, so that there is no increase in the cost of the parts or in the cost of the assembly.

Thus in the embodiment described above, the depth of each hole 15d in which the restoring springs 16 are located in the restoring spring holder 15 changes according to the amount of bending of the respective printing wire 8, so that the restoring forces of the armatures 19 becomes uniform which makes it possible to obtain a uniform printing quality.

In addition, since only the depths of the holes 15d are changed, an impact dot head of low cost can be obtained.

Claims

1. An impact dot head for a printer comprising a plurality of printing wires (8) which are movable into and out of a printing position; and guide means (6,7,14) through which the printing wires (8) pass and by means of which the printing wires (8) are bent to different extents, each printing wire (8) being arranged to be moved in one direction by a respective movement effecting member (19) and being arranged to be moved in the opposite direction by a respective resilient member (16) which acts on the respective movement effecting member (19) so as to restore the latter to an initial position, whereby each movement effecting member (19) is subjected to a restoring force which depends both on the force exerted by the respective resilient member (16) and by the extent to which the respective printing wire (8) is bent, characterised in that the resilient members (16) are substantially similar to each other but are arranged to exert different forces so that each movement effecting member (19) is subjected to substantially the same restoring force.

2. An impact dot head as claimed in claim 1 characterised in that each of the resilient members is carried by a common support member (15).

3. An impact dot head as claimed in claim 2 characterised in that each of the resilient members (16) is mounted in a respective hole (15d) in the common support member (15), the depth of each hole (15d) depending upon the extent to which the respective printing wire (8) is bent by the said guide means (6,7).

4. An impact dot head as claimed in any preceding claim characterised in that each resilient member is constituted by a coil spring.

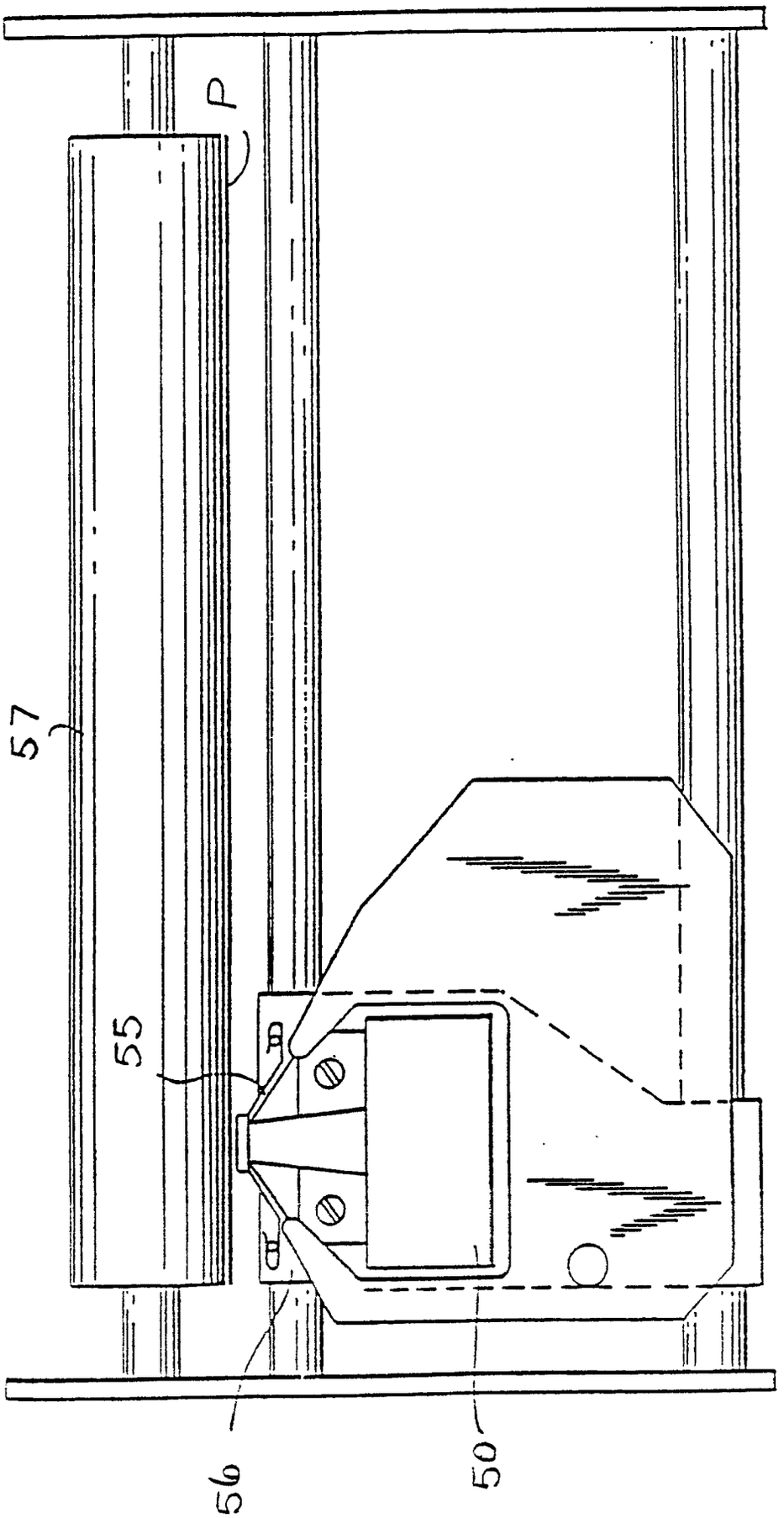
5. An impact dot head as claimed in any preceding claim characterised in that each movement effecting means comprises an armature (19) which, when actuated by electro-magnetic means (12,17), moves the respective printing wire (8) into the printing position.

6. An impact dot head as claimed in any preceding claim characterised in that the movement effecting means (19) are arranged in a circular or part-circular array, the ends of the printing wires (8) remote from the movement effecting means being arranged in at least one linear row.

7. An impact dot head for a printer comprising a plurality of printing wires (8) which are movable into and out of a printing p.siti.n, each printing wire (8) being arranged to be moved in one direction by a respective movement effecting member (19) and being arranged to be moved in the opposite direction by a respective resilient member (16) which acts on the respective movement effecting member (19) so as to restore the latter to an initial position characterised in that all the resilient members (16) are carried by a common support member (15).

8. A printer with an impact dot head wherein plural armatures to which printing wires are attached to fix, plural coil springs which give restoring forces to the armatures, and retaining members for retaining the coil springs are arranged, and plural cores on which coils are wound are arranged at facing portions of the armatures in the impact dot head characterized in that retaining positions of the coil springs in said retaining members for retaining said coil springs are defined for each said armature.

Fig. 1



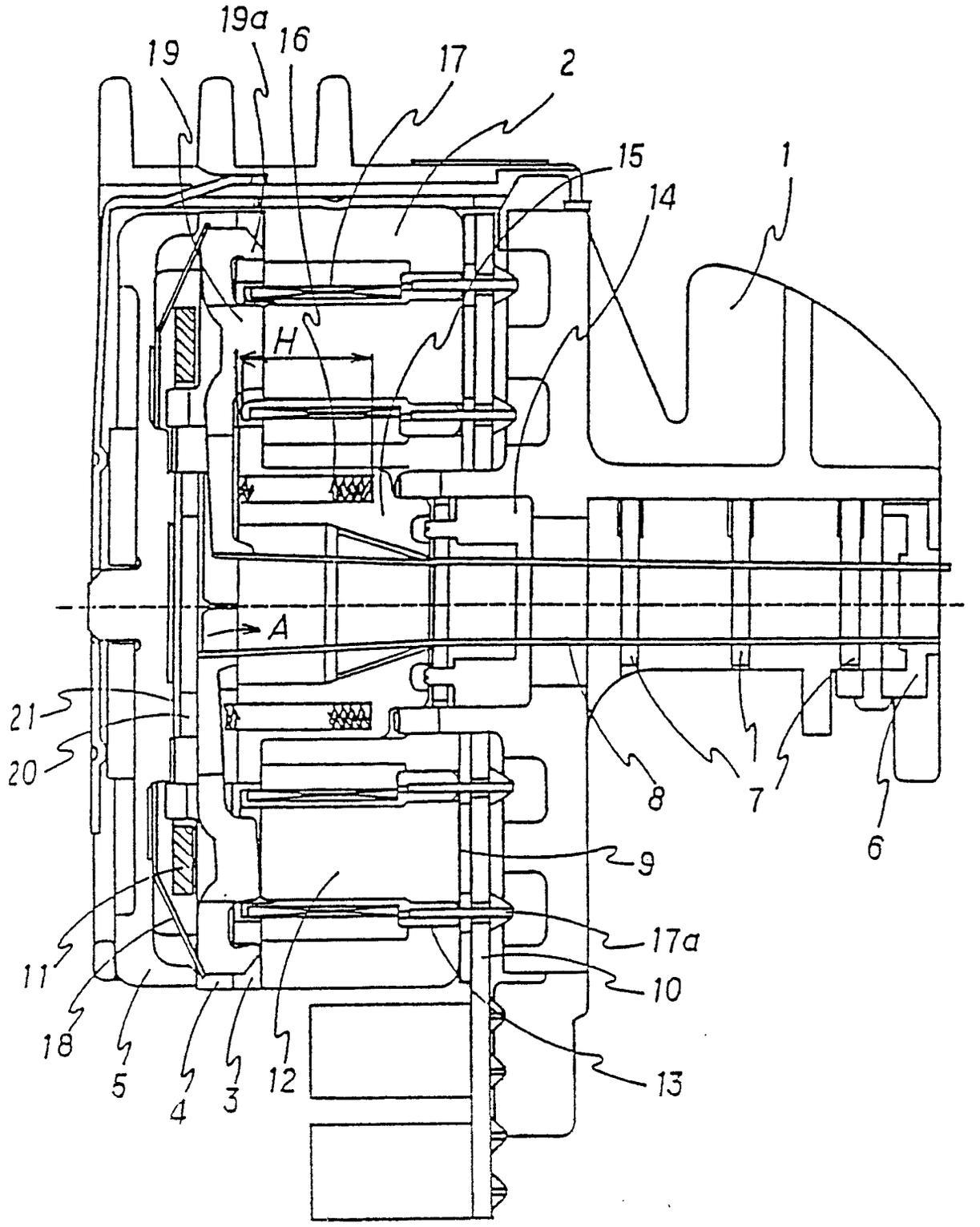


Fig. 2

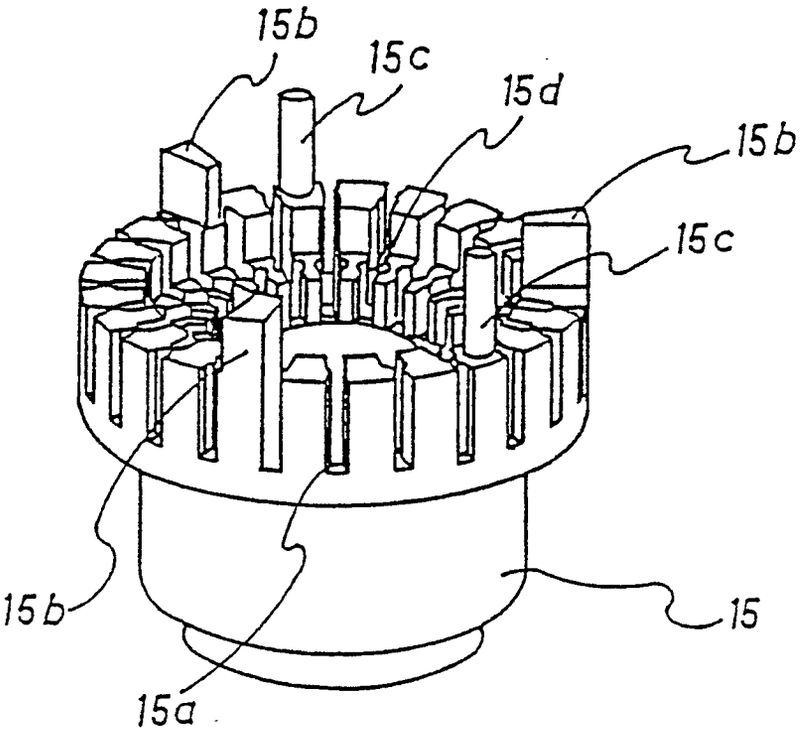


Fig. 3

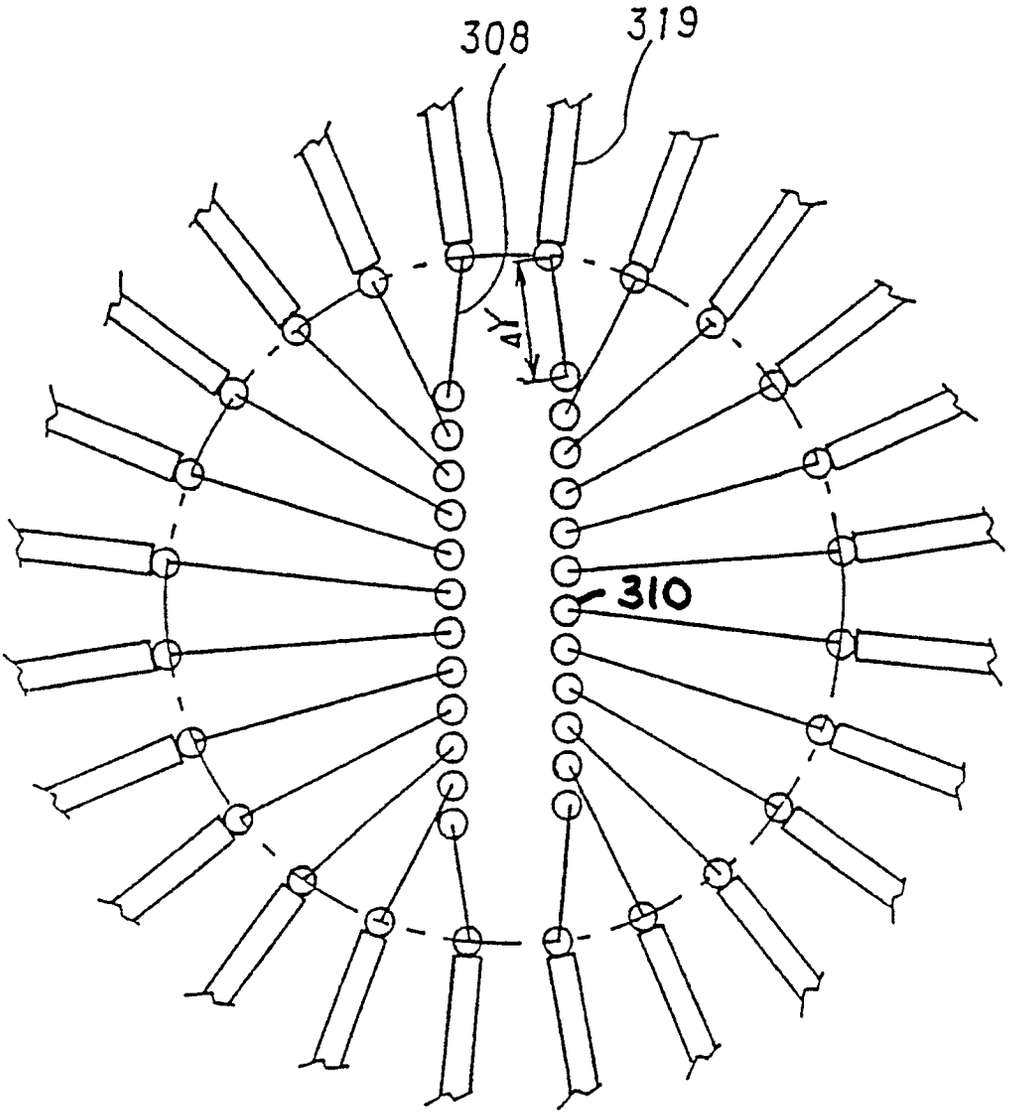


Fig. 4

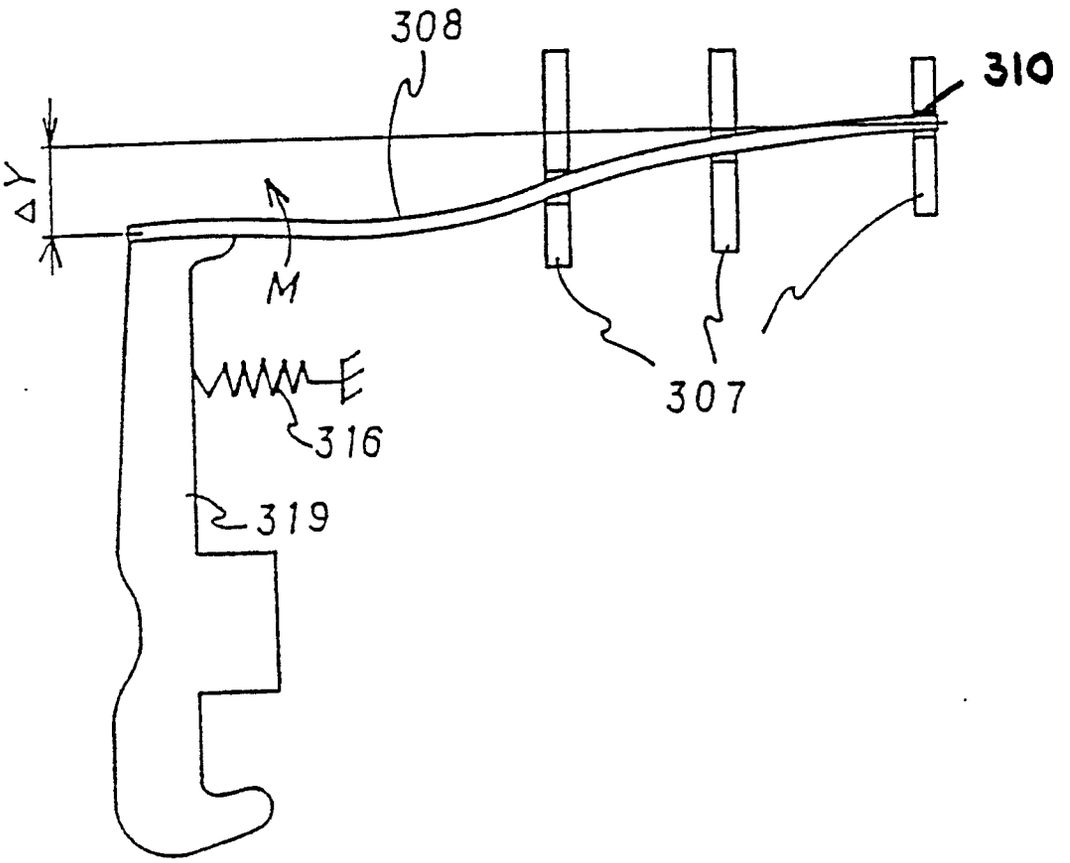


Fig. 5

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EUROPEAN SEARCH REPORT

Application Number

EP 90307540.6

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US - A - 4 723 854 (SAKAIDA) * Fig. 2; column 8, line 17 - column 9, line 26 * --	1-8	B 41 J 2/235
A	US - A - 4 697 939 (ARA) * Fig. 2 * ----	1-8	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 41 J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	01-10-1990	WITTMANN

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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