

PRINTING HEAD FOR PRINTER

The present invention relates to a printing head for a printer.

A printing head is known which comprises a solenoid yoke having a plurality of drive units. A plurality of solenoids are fitted around respective core sections, and respective armatures are supported against an abutment surface of a radially outward peripheral wall of the solenoid yoke. Central portions of the armatures are arranged to face respective core sections. When any one of the drive units is energized, the armature corresponding to that drive unit is actuated to execute printing. As disclosed in Japanese Patent Laid-Open No. 135759/1986, when the armatures are pivoted, the printing head has a radially inward peripheral wall which is abutted against the swinging ends of the armatures, to limit or regulate their pivotal stroke. Alternatively, as disclosed in Japanese Utility Model Laid-Open No. 56462/1988, the printing head has no such inner peripheral wall.

The former example has the following problem. That is, the width of the gap defined by a step between the abutment surface of the outer peripheral wall and the abutment surface of the inner peripheral wall of the solenoid yoke and the surface of the core section, and that defined by a step between the radially inward and outward abutment surfaces of the armature and the central portion of the armature, must be controlled or managed adequately. However, it is difficult to manufacture armatures and yokes with these steps to a high accuracy. This causes high cost.

Further, the latter example, without the radially inward peripheral wall, has the problem that a spacer needs to be arranged over the surface of each of the core sections. The spacers are assembled individually onto all of the respective core sections. Thus, the

number of parts and the number of assembling steps increase, so that the cost increases.

Accordingly, the invention provides a printing head for a printer, comprising an array of armatures driven by respective solenoids formed in respective yokes of a common yoke arrangement; in which each yoke has first and second boundary structures and an intermediate core for the solenoid, providing respectively first and second abutment surfaces and an intermediate free core surface all mutually spaced and coplanar; and in which each corresponding armature has a first end portion pivotally engaged against the first abutment surface of its respective yoke, a central portion facing and overlying the intermediate free core surface, and a second end portion overlying and facing the second abutment surface; the arrangement being such that the first and second end portions are coplanar and, in the extreme operative position of the armature with it drawn against the yoke, there is still a gap between the intermediate free core surface of the yoke and the central portion of the armature.

Manufacture of such a printing head can be facilitated and its cost reduced. The gap defined between each armature and the intermediate core of the corresponding yoke is easily made to a satisfactory dimension, and this influences strongly the performance of the printing head. By making the surfaces of the yoke which face the armature co-planar, they can be finished highly accurately by grinding or polishing or the like and at low cost.

The pivotal engagement of the first end portion of each armature with the yoke has the effect of inhibiting translational movement of the armature, even when the armature abuts against the yoke, and the printing head can be made superior in abrasion resistance and antifriction properties.

In one example, the first and second abutment surfaces and the intermediate free surface of each

armature are coplanar, and a spacer is disposed over the second boundary structure of the yoke in the gap between it and the second abutment surface of the armature, so that the latter abuts the spacer at the said extreme operative position of the armature. This simplifies the finishing process of the armatures, and the thickness of the spacer defines the gap between the armature and the intermediate free surface of the yoke with a high accuracy.

Two embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which: -

Fig. 1 is a longitudinal cross-sectional view of a printing head for a printer; and

Fig. 2 is a fragmentary traverse cross-sectional view showing the printing head for the printer.

Referring first to Fig. 1, there is shown a printing head 1 for a printer, which comprises a solenoid yoke 2, a nose section 3, a plurality of armatures 4 and a plurality of print wires 5.

The solenoid yoke 2 is generally in the form of a torus, and has an outer cylindrical peripheral wall 6, an inner cylindrical wall 7, a plurality of columnar intermediate core sections 8 arranged between the outer and inner peripheral walls 6 and 7 and spaced peripherally by suitable spacings, and a plurality of solenoids 9 fitted over the core sections 8. A wire receiving cavity 10 is defined through the centre of the printing head 1, parallel to the axis of the solenoid yoke 2. For each individual yoke 2, the surfaces of the outer peripheral wall 6, the inner peripheral wall 7 and the core section 8 are coextensive along the yoke axis and coplanar.

The wire receiving cavity 10 extends through the nose section 3 along its central axis. A plurality of axially-spaced wire guides 11 are arranged within the wire receiving cavity 10 in a stacked manner, each

extending transverse to the axis. The guides 11 are formed therein with a plurality of respective wire-receiving bores 12.

The solenoid yoke 2 and the nose section 3 are arranged such that the successive sections of the wire receiving cavity 10 are located on the same axis. The wire 5 is arranged within the wire receiving cavity 10 so as to be slidable through the wire-receiving bores 12.

Further, the armatures 4, each radially orientated, are disposed at respective peripherally-spaced locations corresponding respectively to the core sections 8, facing the coplanar surfaces of the solenoid yoke 2 and facing towards the nose section 3 in the axial direction. Each armature 4 has a first end portion, at its radially outer end, abutted pivotally against a first abutment surface 19 of the yoke 2 by a respective leaf spring 14. The abutment surface 19 is on the outer peripheral wall 6. The radially inner end of the armature 4 is bonded to the end of a respective wire 5.

A second end portion 16 of the armature 4 projects axially from the main radially-extending body of the armature, to face a second abutment surface 20, on the inner peripheral wall 7 of the yoke 2.

An intermediate member 13 is fitted axially into the inner peripheral wall 7 of the solenoid yoke 2 through a guard plate 18 which is in the form of a ring. A plurality of return springs 17 for resiliently biasing respectively the armatures 4 in a direction away from the nose section 3, and thus away from the printing position, are received respectively at locations of the intermediate member 13 corresponding respectively to the armatures 4. Furthermore, the guard plate 18 is interposed between the second abutment surface of the inner peripheral wall 7 and the second end portion of the respective armature 4. By the thickness of the guard plate 18, a gap or space is secured between the

intermediate core sections 8 and the surfaces 21 of the central portions 15 which face them.

The operation of the printing head 1 will now be described. When the solenoids 9 mounted on the solenoid yoke 2 are deenergized, the armatures 4 are returned, away from the nose section 3, by the resilient biasing forces of the respective return springs 17. The wires 5 connected respectively to the armatures 4 are retracted into the nose section 3.

When any one of the solenoids 9 is energized, the central portion 15 of the corresponding armature 4 is attracted against the biasing force of the return spring 17. The wire 5 is thus moved axially forward within the wire receiving cavity 10 to project from the nose section 3. Thus, a printing operation is executed.

In this printing operation, if the wires 5 do not press onto a sheet of paper, the second end portions 20 of the respective armatures 4 abut against the guard plate 18 which is mounted over the second abutment surface of the inner peripheral wall 7. At this point, the gap between the intermediate free surfaces of the core sections 8 of the solenoid yoke 2 and the surfaces 21 of the central portions 15 is a certain fraction of the thickness of the guard plate 18. This fraction is the ratio between the distances radially from the pivot point 19 of respectively the core section 8 and the second abutment surface 20.

When the magnetic attracting force of the solenoid 9 disappears, the armature 4 is moved apart from the solenoid yoke 2 by the resilient force of the return spring 17, and enters its respective return stroke. The wire 5 is again retracted into the nose section 3.

In an alternative embodiment of the invention, the surface 21 of the central portion 15 of each armature 4 is so formed as to be recessed relative to the plane of the first abutment surface 19 and the second abutment surface 20, and the guard plate 18 may be omitted. This

gives the gap between the central portion 15 and the core section 8 even when the armature is drawn fully towards the yoke, without the need for a guard plate 18.

Claims

1. A printing head for a printer, comprising an array of armatures driven by respective solenoids formed in respective yokes of a common yoke arrangement; in which each yoke has first and second boundary structures and an intermediate core for the solenoid, providing respectively first and second abutment surfaces and an intermediate free core surface all mutually spaced and coplanar; and in which each corresponding armature has a first end portion pivotally engaged against the first abutment surface of its respective yoke, a central portion facing and overlying the intermediate free core surface, and a second end portion overlying and facing the second abutment surface; the arrangement being such that the first and second end portions are coplanar and, in the extreme operative position of the armature with it drawn against the yoke, there is still a gap between the intermediate free core surface of the yoke and the central portion of the armature.
2. A printing head according to Claim 1, in which the first and second abutment surfaces and the intermediate free surface of each armature are coplanar, and a spacer is disposed over the second boundary structure of the yoke in the gap between it and the second abutment surface of the armature, so that the latter abuts the spacer at the said extreme operative position of the armature.
3. A printing head according to Claim 1, in which the intermediate free surface of each armature is recessed from the plane of its first and second abutment surfaces.
4. A printing head substantially as described herein with reference to the accompanying drawings.



5. A dot matrix printer having a printing head in accordance with any preceding claim.