

"PRINTING HEAD"

2221194

The present invention relates to a printing head such, for example, as an impact-type printing head.

5 A known printing head of the so-called clapper type is provided with a plurality of printing levers for effecting movement of a plurality of printing elements, there being a plurality of electro-magnetic driving devices for driving the respective printing levers. Each of the printing levers is also provided with a return spring, e.g. a coil spring or a plate spring, for
10 returning each of the printing elements. Each of the printing elements is moved in a printing direction by the corresponding electro-magnetic driving device when the latter is energized and, when the driving device is de-energized, the printing element is moved by its
15 return spring so as to be retracted to a stand-by position.

In the printing head described above, each of the printing levers is moved by applying a current to a coil of the respective electro-magnetic driving device until
20 an armature portion of the printing lever is attracted to and contacts a core element of the respective electro-magnetic driving device. After printing has been effected by a printing element, it is retracted by its return spring. However, since each of the
25 armature portions is in contact with the corresponding core element, a large force is required to separate them and thus enable the respective printing lever to be moved backwardly against the magnetic force. It is also very difficult to exert a constant force of attraction
30 on all the printing levers because of factors such as production errors and so on, and thus it is very

difficult to equalize the respective times required for moving all the printing levers backwardly, with the result that there are discrepancies between the operations of the various printing levers.

5 According to the present invention, there is therefore provided a printing head comprising a plurality of pivotally mounted printing levers each of which has an armature portion and each of which is secured to a printing element, each printing lever
10 having a pivot portion at one end thereof, and a respective printing element being secured to the opposite end thereof; a head plate having first openings therein in which are mounted the pivot portions of the printing levers, the head plate also having second
15 openings therein in which are mounted the armature portions of the printing levers; an electro-magnetic driving device for each printing lever, each electro-magnetic driving device, when energised, attracting the armature portion of the respective printing lever so
20 that the latter and its printing element is moved in a printing direction; lever return means for urging each printing lever in the reverse direction; and the head plate being provided with stopper means which project from the head plate and which is so positioned
25 that, when a driving device is energised, the stopper means is contacted by a contact part of the respective printing lever before there can be any contact between the respective armature portion and the driving device.

30 Thus the present invention enables the armature portion of each of the printing levers to be prevented from making close contact with a core element of the respective driving device so as to ensure that each of the printing levers is rapidly returned with a small return force and so as to enable differences between the

movements of the respective printing levers to be reduced, whereby to obtain an uniform return motion.

The return means preferably comprises a plurality of return springs each of which acts on a respective printing lever.

In a printing operation, the contact part of each of the printing levers comes into contact with the stopper means before the armature portion of each of the printing levers can strike against a corresponding core element of the driving device. If, on the other hand, each armature portion made close contact with the corresponding core element, the core element would strongly attract the respective armature portion which thus could not be easily separated therefrom and moved during the return step. Each of the printing levers, however, is caused to contact the stopper means before it can contact the respective core element so that it can be easily moved away therefrom during the return step.

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

Figure 1 is a sectional view of a principal portion of a first embodiment of a printing head according to the present invention;

Figure 2 is a reduced front view of a first yoke plate which forms part of the said first embodiment and in which a stopper portion is formed;

Figure 3 is a reduced front view of a stopper plate which is secured to the said first yoke plate; and

Figure 4 is a reduced front view of a second yoke plate which forms part of the said first embodiment.

In the embodiment of the present invention shown in Figures 1-4, an impact-type printing head is shown as having a printing wire 1, serving as a printing

element, which is slidably mounted in a wire guide 3 which is held by a guide support frame 2 made of plastics material. In practice, a plurality of printing wires 1 are of course provided and are supported by a plurality of wire guides 3. The rear end portion of each of the printing wires 1 is fixed to a front end portion 4b of a respective printing lever 4. Each of the printing levers 4 is mounted so as to be pivotable around a rear end portion or pivot portion 4a thereof, with the front end portion 4b functioning to drive the respective printing wire 1. A coil spring 5 serving as a return spring is fitted in a recess 2a provided in the guide support frame 2 and resiliently contacts a portion 4c of the respective printing lever 4 so as to apply a return force to the latter in the backward direction.

An electro-magnetic driving device 6 for driving each of the printing levers 4 comprises a U-shaped core body 7 made of a magnetically permeable material and a drive coil 8 wound around a core element 7a. Yoke or

head plates 9, 10 and 11 are mounted successively on the rear end surface of the external side wall 7b of the core body 7 and are coupled together by means of a screw or screws (not shown) which pass through a yoke-retaining frame 12. A retaining spring 13 is fixed in the centre of the front of the yoke-retaining frame 12. The retaining spring 13 has at its central portion a ring-shaped portion 13a which engages the yoke retaining frame 12. A plurality of spring members 13b extend radially from the portion 13a and engage the respective printing levers 4. The rear end portion 4a which serves as a supporting point for each of the printing levers 4 is pressed against the yoke plate 9 by the front end portion of each of the spring members 13b.

The yoke plate 10 mounted on the rear side of the yoke plate 9 has a shape as shown in Figure 2. In the yoke plate 10, grooves or other openings 10a in which the supporting points in the rear end portions of the printing levers 4 are respectively inserted are formed along the external periphery thereof. Elongated grooves or other openings 10b, in which movable yoke portions or armature portions 4d of the printing levers 4 are mounted, are formed in the yoke plate 10 radially inwardly of the grooves 10a. The yoke plate 10 has a central hole 10c and has a stopper portion 10d which is integrally formed between the elongated grooves 10b and the central hole 10c. The stopper portion 10d has on its rear surface a stopper plate 15 (Figure 3) which projects from the yoke plate 10 and which is made of a material such as a polyimide having a high durability, and as shown in Figure 1 the stopper portion 10d and the stopper plate 15 are integrated to constitute a stopper means.

The stopper means 10d, 15 functions to stop the

rotation of each of the printing levers 4 by contacting a contact part 4e thereof when each of the printing levers 4 is driven during a printing operation. The stopper means 10d, 15 is so set up that the contact part 4e of each of the printing levers 4 contacts the stopper plate 15 before the respective armature portion 4d the latter can strike against the respective core element 7a. Consequently, the armature portions 4d do not make the close contact with the core elements 7a which would otherwise occur.

The yoke plate 11 mounted on the rear side of the yoke plate 10 has, as shown in Figure 4, elongated grooves 11a each having substantially the same form as would be obtained by connecting each groove 10a and each elongated groove 10b. The grooves 11a are so formed as to communicate with a central hole 11b in the yoke plate 11. As shown in Figure 1, a stopper 16 is provided for defining a rest position of the printing levers 4.

In the above-described structure, when no current is supplied to the driving coils 8, each of the printing levers 4 is separated from its respective core member 7a of the core body 7, as shown by the solid lines in Figure 1, while each of the printing elements 1 is at a stand-by position at which it is urged rearwardly by the force of the respective coil spring 5 and contacts the stopper 16.

When a printing signal is received by a driving coil 8, the respective core body 7 is magnetized so that the armature portion 4d of the respective printing lever 4 is attracted by the core element 7a. Consequently, the printing lever 4 is pivoted around the supporting point in the rear end portion 4a thereof. The contact part 4e of the printing lever 4 then collides with the stopper plate 15 bonded to the stopper portion 10d just

before the armature portion 4d would otherwise collide with the core element 7a, i.e. in a state wherein the armature portion 4d is disposed opposite to the respective core element 7a with a small gap therebetween, so that the printing lever 4 cannot be further rotated. The rotation of each printing lever 4 causes its front end portion 4b to advance so that printing energy is supplied to the printing element 1 from the respective electro-magnetic driving device 6, whereby each printing element 1 moves forwardly for printing.

After printing has been completed, each of the printing levers 4 is moved backwardly by being subjected to the return force of the return spring 5 because no force of attraction is exerted on the printing lever 4 from the respective core body 7. However, since there is a small gap between each armature portion 4d and its respective core element 7a, the return of each printing lever 4 is started immediately and it is rapidly returned to the initial position because of a weak force of attraction between the respective armature portion 4d and the respective core element 7a as compared with that which exists when there is close contact therebetween.

As described above, as the armature portion of each printing lever 4, is not brought into close contact with the corresponding core element 7a when the printing lever is driven to effect printing, the printing lever can be returned by a small return force, and thus little time is required to start the return movement of each printing lever which is thus rapidly returned. Although it is very difficult to equalize the force of attraction exerted on all the printing levers, the constructions described above ensure that there is no close contact between each armature portion 4d,

and its core element 7a and this enables variations in the force of attraction and variations in the return movement of the respective printing levers to be of less importance. It is also possible to reduce the necessary return force acting on the printing levers and thus to drive the printing levers with a smaller amount of energy than in known printing heads.



CLAIMS

1. A printing head comprising a plurality of pivotally mounted printing levers each of which has an armature portion and each of which is secured to a printing element, each printing lever having a pivot
5 portion at one end thereof, and the respective printing element being secured to the opposite end thereof; a head plate having first openings therein in which are mounted the pivot portions of the printing levers, the head plate also having second openings therein in which are
10 mounted the armature portions of the printing levers; an electro-magnetic driving device for each printing lever, each electro-magnetic driving device, when energised, attracting the armature portion of the respective printing lever so that the latter and its printing
15 element is moved in a printing direction; lever return means for urging each printing lever in the reverse direction; and the head plate being provided with stopper means which project from the head plate and which is so positioned that, when a driving device is
20 energised, the stopper means is contacted by a contact part of the respective printing lever before there can be any contact between the respective armature portion and the driving device.

2. A printing head as claimed in claim 1 in
25 which the return means comprises a plurality of return



springs each of which acts on a respective printing lever.

3. A printing head substantially as hereinbefore described with reference to and as shown in the accompanying drawings.