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(54) A DRIVING MECHANISM, FOR EXAMPLE, A PRINTER

(71) We, KABUSHIKI KAISHA SUWA SEIKOSHA and SHINSHU SEIKI KABUSHIKI KAISHA, both Japanese body corporates, of 3—4, 4-chome, Ginza, Chuo-ku, Tokyo, Japan and 3—5, 3-chome, Owa, Suwa-shi, Nagano-ken, Japan, respectively, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a driving mechanism, for example, for printers.

According to the present invention there is provided a driving mechanism comprising: a rotor; a motion transmitting means; trigger means for causing the motion transmitting means to move from an initial position into contact with the rotor, rotation of the latter causing the motion transmitting means to move linearly in a first direction; separating means, including a first spring means, for disengaging the motion transmitting means from the rotor when the motion transmitting means has moved a predetermined distance in the first direction; and second spring means for subsequently moving the motion transmitting means in a second direction to the initial position.

Preferably the trigger means is an electromagnet which, when energised, attracts a part of the motion transmitting means thereto to cause the latter to engage the rotor.

In the preferred embodiment the motion transmitting means has a rack engageable with a gear wheel mounted for rotation with the rotor.

According to a further aspect of the present invention there is provided a printer having a driving mechanism as recited above.

The printer may include print paper advancing means connected with the

motion transmitting means, the print paper advancing means being operated by the driving mechanism.

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

Figure 1 illustrates a conventional driving mechanism for a printer;

Figure 2 illustrates a driving mechanism according to the present invention for a printer;

Figure 3 shows part of the mechanism of Figure 2 for the purpose of explaining the operation thereof; and

Figure 4 shows a modification of the driving mechanism of Figure 2.

Referring first to Figure 1 there is shown a conventional driving mechanism for a printer of relatively small size. The printer is arranged to feed print paper 3 after a line printing operation has been performed by a hammer 1 striking a print drum 4, an inked ribbon 2 and the print paper 3 being disposed between the hammer 1 and the print drum 4.

A plate 19, rigidly mounted on the electromagnet lever 20, is attracted to an electromagnet 7 when the latter is energised. The electromagnet lever 20 is mounted for pivotal movement about a shaft 21 fixed to a paper feed lever 8. When the electromagnet is energised, the electromagnet lever 20 is caused to rotate in a counterclockwise direction against the action of a spring 22. Consequently an end 20a of the electromagnet lever 20 is disengaged from a notch 23b in a rack lever 23 which itself is mounted for pivotal movement about a shaft 24 fixed to the paper feed lever 8. A rack 23a is provided on one end of the rack lever 23, the rack being engageable with a gear 5 fixed on a shaft 6 on which the print drum 4 is mounted for rotation therewith.

The paper feed lever 8 is movable in a direction parallel to its length and is guided

for such movement by a support pin 16 and a shaft 17 of a paper feed roller 14. A paper feed finger 10 is mounted for pivotal movement about a shaft 11 on the paper feed lever 8 and is biased towards a ratchet wheel 13 by a spring 12 so as to engage a tooth 13a of the ratchet wheel 13.

When, after energisation of the electromagnet 7, the end 20a of the electromagnet lever 20 is disengaged from the notch 23b and the rack lever 23, the latter pivots in the counterclockwise direction until the rack 23a engages with the gear 5. The paper feed lever 8 then moves in the direction of an arrow A by virtue of rotation of the gear 5 with the print drum 4, causing the paper feed finger 10 to move from engagement with the tooth 13a of the ratchet wheel into engagement with a tooth 13b thereof. When subsequently a face 23c of the rack lever 23 strikes an abutment 18 and the rack 23a is disengaged from the gear 5, the notch 23b in the rack lever 23 is engaged with the end 20a of the electromagnet lever 20, and the paper feed lever 8 is moved by a spring 9 in the direction of an arrow B. At this time, the paper feed finger 10 indexes the ratchet wheel 13 in the clockwise direction by one tooth space. Since the paper feed roller 14 and the ratchet wheel 13 are both mounted on a shaft 17 and, furthermore, since the print paper 3 is led between the paper feed roller 14 and a pressure roller 15 urged towards the latter, this indexing of the ratchet wheel 13 causes the paper feed roller 14 and the print paper to be advanced correspondingly in the direction of an arrow C.

This conventional driving mechanism has the following disadvantages:—

(1) The driving mechanism is complicated, employing an electromagnet and a number of levers in order to cause the rack 23 to engage with the gear 5.

(2) It is difficult to achieve accurate timing for the advancement of the print paper relative to the printing operation because the electromagnet lever 20 causes a variation in the time it takes, after the electromagnet has been energised, for the rack 23a to engage with the gear 5.

(3) The rack 23a is sometimes re-engaged with the gear 5 after the print paper has been advanced because the engagement between the end 20a of the electromagnet lever 20 and the notch 23b of the rack lever 23 tends to be uncertain.

(4) The driving mechanism is not suitable for miniaturisation on account of the provision of both the rack lever 23 and an electromagnet lever 20.

(5) The starting operation of the driving mechanism tends to be unreliable because the rack lever 23 is disengaged from the electromagnet lever 20 by shock.

A driving mechanism according to the present invention for a printer is illustrated in Figure 2. Like parts in Figures 1 and 2 have been designated by the same reference numerals and will not be described in detail further. The plate 19 is rigidly mounted on a rack lever 26, which is mounted for pivotal movement on a shaft 27 fixed to the paper feed lever 8. When the electromagnet 7 is energised, the rack lever 26 pivots in the counterclockwise direction against the action of a spring 28. Consequently, a rack 26a on the rack lever 26 is brought into engagement with the gear 5 which, at this time, is rotating with the print drum. Thus the paper feed lever 8 is moved linearly in the direction of the arrow A i.e. in a direction substantially parallel to its length. The paper feed lever 8 is guided for this linear movement by the support pin 16 and the shaft 17.

Figure 3 shows the direction of the reaction F when the rack lever 26 engages with the gear 5. As the rack 26a engages with the gear 5 this reaction F biases the rack lever 26 for rotation in a counterclockwise direction and consequently the rack lever 26 and the gear 5 cannot unintentionally become disengaged. As the paper feed lever 8 is moved in the direction of the arrow A by virtue of the rotation of the gear 5 and just before a face 26b of the rack lever 26 strikes against the abutment 18, the direction of the reaction F acts to bias the rack lever 26 for rotation in a clockwise direction about the shaft 27 (now in position 27a). Thus the rack 26 is easily disengageable from the gear 5. When the face 26b of the rack lever 26 strikes against the abutment 18, the rack 26a of the rack lever 26 is disengaged from the gear 5 and the rack lever 26 is pivoted by the spring 28 in a clockwise direction until it strikes against an abutment 8a provided on the paper feed lever 8. The advancing of the print paper follows as described in connection with Figure 1.

The driving mechanism illustrated in Figures 2 and 3 has the following advantages:—

(1) The driving mechanism is simple in construction, has a fewer number of parts and is more reliable than the conventional driving mechanism described in connection with Figure 1.

(2) Accurate timing for the advancement of the print paper relative to the printing operation may be achieved.

(3) The driving mechanism may be miniaturised.

(4) The driving mechanism is stable because the rack 26a is biased away from the gear 5 when it is not required to advance the print paper.

(5) The driving mechanism enables

feeding of the print paper and feeding of the inked ribbon to be effected simultaneously or separately and additionally or alternatively enables a change in the colour of printing to be effected when using a two-colour inked ribbon.

The rack lever 26 and the paper feed lever 8 are, in the driving mechanism of Figure 2, separate components. Thus manufacture of the rack lever and the paper feed lever is relatively easy and a comparatively small force is sufficient to cause the rack lever 26 to engage with the gear 5 because the inertia of the rack lever may be made relatively small. However, if so desired, the rack lever and the paper feed lever may be constructed as a unit.

The driving mechanism described above is for a printer and in particular for a printer of relatively small size. However, the driving mechanism may have other applications.

Figure 4 shows a modification of the driving mechanism of Figures 2 and 3 in which the rack lever 26 is stabilised by providing a damper 29 in place of the abutment 8a to cushion to spring return movement and hence to prevent the rack lever 26 from oscillating, i.e. bouncing against the return stop abutment. The damper 29 can be disclosed in any suitable position as long as it prevents the rack lever 26 from oscillating.

WHAT WE CLAIM IS:—

1. A driving mechanism comprising: a rotor; a motion transmitting means; trigger means for causing the motion transmitting means to move from an initial position into contact with the rotor, rotation of the latter causing the motion transmitting means to

move linearly in a first direction; separating means, including a first spring means, for disengaging the motion transmitting means from the rotor when the motion transmitting means has moved a predetermined distance in the first direction; and second spring means for subsequently moving the motion transmitting means in a second direction to the initial position.

2. A mechanism as claimed in claim 1 in which the trigger means is an electromagnet which, when energised, attracts a part of the motion transmitting means thereto to cause the latter to engage the rotor.

3. A mechanism as claimed in claim 1 or 2 in which the motion transmitting means has a rack engageable with a gear wheel mounted for rotation with the rotor.

4. A driving mechanism substantially as herein described with reference to and as shown in Figures 2 and 3 or in Figures 2 and 3 as modified by Figure 4 of the accompanying drawings.

5. A printer having a driving mechanism as claimed in any preceding claim.

6. A printer as claimed in claim 5 including print paper advancing means connected with the motion transmitting means, the print paper advancing means being operated by the driving mechanism.

7. A printer as claimed in claim 5 and substantially as herein described with reference to and as shown in Figures 2 and 3 or Figures 2 and 3 as modified by Figure 4 of the accompanying drawings.

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