

"INK RIBBON CASSETTE"

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The present invention relates to an ink ribbon cassette, and, although the invention is not so restricted it relates more particularly to a serial printer in which a printing head is reciprocable in relation to a platen, the printer being provided with an ink ribbon cassette of a stationary type in which an ink ribbon is positioned so as to move in front of the printing head throughout the range of reciprocating movement of the latter.

Ink ribbon apparatus for serial printers is generally grouped in two types. There is a stationary type in which the ink ribbon extends in front of the printing head throughout the range of reciprocating movement of the printing head but does not move together with the printing head (see for example, European Patent Application No. 19649/80). There is also a movable type in which the ink ribbon moves together with the printing head.

In either of these two types the ink ribbon usually extends parallel to the direction of movement of the printing head. Therefore, only a restricted portion of the entire width of the ink ribbon is available for printing. In some apparatus of the movable type, although the ink ribbon is disposed at an angle to the direction of movement of the printing head (see Japanese Patent Laid-Open Publication No. 56-127464), only a restricted portion of the entire width of the ink ribbon is available for printing, like the former

type, because the ribbon cassette is movable together with the printing head.

These known apparatus are disadvantageous in that, since only a limited area of the entire width of the ink ribbon is available for printing, the ink of this limited area can swiftly become exhausted, so that the ribbon tends to become easily damaged and hence must be replaced with a new one after a very short life.

One solution has been proposed in Japanese Utility Model Publication No. 60-18930, in which the ink ribbon is shifted periodically vertically during the reciprocating movement of the printing head so that virtually the entire width of the ink ribbon is available for printing. However, this prior apparatus requires many parts for the shifting mechanism, thus causing a complex construction and a laborious assembly, which results in an increased cost of production.

On the other hand, in the movable type in which an ink ribbon cassette is mounted on a carriage of a printing head so as to move together with the printing head, it is known to incline an ink ribbon with respect to the direction of movement of the printing head as is shown, for example, in Japanese Patent Laid-Open Publication Nos. 56-127464 and 58-42465. In this prior art, in order to arrange the ink ribbon in an inclined manner with respect to the direction of movement of

the printing head, the entire ribbon cassette is mounted on the carriage in an inclined manner.

The prior art is thus such that it is inevitable that the structure for mounting the ribbon cassette is of a special form. This makes the mounting and dismounting of the cassette complex, which makes it difficult to design and to manufacture.

It is therefore an object of the present invention to provide an ink ribbon cassette in which virtually the entire width of the ink ribbon thereof is available for printing, without need to use a ribbon shifting mechanism, thus increasing the life of the ribbon.

According to the present invention, there is therefore provided an ink ribbon cassette adapted to be mounted in a stationary position on a printer and to extend throughout the range of the reciprocating movement of a printing head of the printer, the said ink ribbon cassette containing an ink ribbon which is inclined longitudinally of the ink ribbon cassette so as in operation to extend at an angle to the reciprocating movement of the printing head.

Such a cassette has a width greater than usual so as to face the printing head through the range of reciprocating movement of the printing head.

The ink ribbon may be an impact type ribbon or may be adapted for use in transfer under heat printing.

The ink ribbon is preferably endless. Thus the ink ribbon cassette preferably comprises a storage chamber for storing the greater part of the endless ribbon, an exit passageway through which the ribbon is withdrawn from the storage chamber, and an inlet passageway through which the ribbon passes on its return path to the storage chamber, the exit and inlet passageways extending forwardly from the storage chamber to different extents.

Preferably at least one of said exit and inlet passageways has at least one inclined surface over which in operation the ribbon travels.

The invention also comprises a printer provided with an ink ribbon cassette as set forth above, the printer having a platen and a printing head reciprocable parallel thereto, and the ink ribbon of the ink ribbon cassette being in operation moved in front of the printing head and extending throughout the range of the reciprocating movement of the latter.

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

Figure 1 is a plan view of a part of a printer provided with an ink ribbon cassette according to the present invention;

Figure 2 is a front view as viewed from the direction of an arrow A, of the structure shown in Figure 1;

Figures 3 and 4 are views showing printing loci on the ink ribbon of the said ink ribbon cassette;

Figure 5 is a horizontal cross-sectional view showing the internal construction of the ribbon cassette of the present invention;

Figure 6 is a cross-sectional view taken along the line VI-VI of Figure 5, and

Figure 7 is a cross-sectional view taken along the line VII-VII of Figure 3.

A preferred embodiment of the present invention will now be explained with reference to the accompanying drawings.

In Figure 1 there is shown part of a printer having a printing head 2 of the impact type which is disposed in front of a platen 1. The printing head 2 is mounted on a carriage 5 which is slidably supported by guide shafts 3, 4 and is reciprocable parallel to the platen 1. A ribbon cassette 6 is disposed rearwardly of the printing head 2 and above the carriage 5. The ribbon cassette 6 is a stationary type of ribbon cassette which is attached to a stationary member such as the printer frame (not shown) which supports the guide shafts 3, 4 or the platen 1. The majority of an endless ink ribbon 7 is accommodated in a zigzag form in the ribbon cassette 6. The ink ribbon 7 is an impact type ribbon constituted by a

woven fabric containing ink. A portion of the ink ribbon 7 is exposed by virtue of being drawn out of the ribbon cassette 6 and through a passageway arm 6c thereof, the ink ribbon 7 then passing into a passageway arm 6d.

5 This exposed portion of the ink ribbon 7 passes rearwardly of a paper guide 2a, carried by the printing head 2, and then passes forwardly of the forward end surface of the printing head 2. The paper guide 2a has an aperture 2b (Figure 2) at a position opposite to the forward end surface
10 of the printing head 2. The distance between the two passageway arms 6c, 6d is set so as to be slightly greater than the distance of reciprocating movement of the printing head 2. The ink ribbon 7 is driven by a ribbon drive mechanism (not shown) for movement in the direction
15 of an arrow 9 in response to the reciprocating movement of the printing head 2. A record medium (not shown) such as paper is inserted between the platen 1 and the paper guide 2a.

As shown in Figure 2, the ink ribbon 7 is stretched
20 at a predetermined angle to the direction of movement of the printing head 2 (which is shown in Figure 2 as horizontal). In order to stretch the ink ribbon 7 in this inclined position, the passageway arm 6d extends forwardly from a position at the same height as that of the cassette 6,
25 while the passageway arm 6c extends forwardly of the

passageway arm 6d. The printing head 2 is movable horizontally with respect to the ink ribbon 7. The width of the ink ribbon 7 is such that a vertical row of printing elements 8 such as wires, which row is arranged on the forward end surface of the printing head 2, faces the ink ribbon 7 during the whole movement of the printing head 2.

Printing by means of the obliquely stretched ink ribbon 7 will now be described with reference to Figures 3 and 4.

Although in practice the ink ribbon 7 is moved at a predetermined speed in the direction of the arrow 9 during the reciprocating movement of the printing head 2, an imaginary situation will be considered, for the purposes of better understanding, in which the ink ribbon 7 is halted or suspended during the printing and is then moved intermittently after the printing. The printing loci on the ink ribbon 7 are shown in Figure 3, being designated by reference numerals 10, 11. Figure 3 is a view of the ink ribbon 7 as viewed from the side of the printing head 2. The printing locus 10 is a locus made during forward printing, and the printing locus 11 is a locus made during rearward printing. The two printing loci 10, 11 are thus formed on the ink ribbon 7 throughout virtually its entire width. The two printing loci 10, 11 have the

same length L_0 , the latter being equal to the width of the printing stroke of the printing head 2. Further, the printing loci 10, 11 extend in a horizontal direction, namely, in the direction of movement of the printing head 2.

The actual movement of the printing head 2 produces the printing loci as the ink ribbon 7 is continuously moved in the direction of the arrow 9 shown in Figures 1 and 2 and during the reciprocating movement of the printing head 2, these loci being shown in Figure 4, by reference numerals 12, 13. The two printing loci 12, 13 are slightly inclined to the horizontal direction and partially overlap each other. The length L_1 of the printing locus 12 is longer than the length L_0 by a length $\underline{d}$. The difference in length between the two printing loci 12, 13 is $2\underline{d}$. The length $\underline{d}$ is the length through which the ink ribbon 7 is moved during the forward printing or the rearward printing.

The interior structure of the cassette for supporting the ink ribbon 7 in tension in an inclined manner as shown in Figure 2 will now be described in detail with reference to Figures 5 to 7.

The passageway $6\underline{d}$ extends forwardly from a position at the same height as that of a storage chamber $6\underline{b}$, while the passageway $6\underline{c}$ extends forwardly from a position beyond

the passageway 6d. The storage chamber 6b has a slit 6f formed in a side wall 6e at the side of the passageway 6c, the ribbon 7 being introduced into the passageway 6c through the slit 6f. In order to change the direction of advancement of the ribbon 7, ribbon guide surfaces 6g, 6h, 6i, 6j, 6k are integrally formed with the passageway 6c. Out of these guide surfaces, the guide surfaces 6g, 6h, 6j are inclined where the ribbon 7 is twisted.

On the other hand, the storage chamber 6b has at its end adjacent the side of the passageway 6d a ribbon drive roller 14 and a pressure roller 15 for moving the drawn ribbon 7 into the storage chamber 6b via the passageway 6d. The drive roller 14 has on an inner surface of its hollow shaft a sprocket 14a which is arranged to be driven counter-clockwise as seen in Figure 5 by a ribbon driving shaft (not shown). Ribbon guide surfaces 6m, 6n, 6p are integrally formed in the passageway 6d, the guide surface 6n being inclined.

As the drive roller 14 is driven counter-clockwise as seen in Figure 5, the exposed ink ribbon 7 is introduced into the storage chamber 6b via the passageway 6d, while the ink ribbon 7 in the storage chamber 6b is drawn outside the latter and through the passageway 6c. At that time the ribbon 7 is advanced obliquely

upwardly in the passageway 6c. Since the guide surfaces 6g, 6h, 6j are inclined, the ribbon 7 can be advanced smoothly.

The present invention is not limited to the above embodiment, and various modifications are possible. For example, the ink ribbon does not have to be either a cassette type ribbon or an endless type ribbon which is wound around a pair of spools. Further, the direction of movement of the ink ribbon 7 may be opposite to the direction as shown in the drawings. Moreover, the ink ribbon 7 may be a transfer-under-heat printing type of ribbon instead of an impact type of ribbon. In this case, the printing head 2 can, of course, be replaced with a thermal head. It is necessary in this case that the printing loci do not overlap each other as shown in Figure 3.

In the arrangement shown in the drawings, virtually the entire width of the ink ribbon is available for printing without a ribbon shifting mechanism. Since the apparatus is not complex in construction and is easy to assemble, it is possible to increase the life of the ribbon at virtually no cost. In addition, with the ribbon cassette shown in the drawings, since the ribbon which is drawn out of the cassette is already at an angle to the cassette body, it is not necessary to set the cassette in an inclined position as has been suggested. Therefore,

the cassette body can be perpendicularly mounted on and dismounted from the printing head or from supporting the printing head by means of the mounting and dismounting device of an ordinary known structure. Further, since inclined

5 guide surfaces are formed respectively in the take-in and take-out passageways of the cassette body for guiding the ribbon, smooth travel of the ribbon can be achieved.

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C L A I M S

1. An ink ribbon cassette adapted to be mounted in a stationary position on a printer and to extend throughout the range of the reciprocating movement of a printing head of the printer, the said ink ribbon cassette containing an ink ribbon which is inclined longitudinally of the ink ribbon cassette so as in operation to extend at an angle to the reciprocating movement of the printing head.

2. An ink ribbon cassette as claimed in claim 1 in which the ink ribbon is an impact type ribbon.

3. An ink ribbon cassette as claimed in claim 1 in which the ink ribbon is adapted for use in transfer under heat printing.

4. An ink ribbon cassette as claimed in any preceding claim in which the ink ribbon is endless.

5. An ink ribbon cassette as claimed in claim 4 in which the ink ribbon cassette comprises a storage chamber for storing the greater part of the endless ribbon, an exit passageway through which the ribbon is withdrawn from the storage chamber and an inlet passageway through which the ribbon passes on its return path to the storage chamber, the exit and inlet passageways extending forwardly from the storage chamber to different extents.



6. An ink ribbon cassette as claimed in claim 5 in which at least one of said exit and inlet passageways has at least one inclined surface over which in operation the ribbon travels.

7. An ink ribbon cassette substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

8. A printer provided with an ink ribbon cassette as claimed in any preceding claim, the printer having a platen and a printing head reciprocable parallel thereto, and the ink ribbon of the ink ribbon cassette being in operation moved in front of the printing head and extending throughout the range of the reciprocating movement of the latter.

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