

Description

The present invention relates to a dot type printing head for use in a serial printer.

5 A serial printer is known in which a plurality of dot forming elements are arranged to print characters and figures as assembled dots. The dot type printing head used for such a serial printer has been constructed with a great number of dot forming elements to achieve high quality character printing and high speed printing.

10 In order to provide a large number of dot forming elements in a single printing head, there are two ways of arranging the dot forming elements. For example, in a printing head employing 48 dot forming elements, a first way of arranging the elements is shown in Figure 6a. When the printing head is mounted on a carriage, a four row dot forming element arrangement is formed comprising four vertical 12 dot rows whose dots are spaced vertically at two dot intervals, each row being shifted vertically by half a dot with respect to the neighbouring row.

15 In the second way of arranging the elements shown in Figure 7a, the arrangement provided four vertically arranged 12 dot rows whose dots are spaced vertically at two dot intervals. The dots in the neighbouring first and second rows, and those in the neighbouring third and fourth rows are aligned vertically, but the third and fourth rows are shifted vertically by one dot with respect to the first and second rows.

20 In the Figure 6(a) arrangement, since the dot forming positions of each of the rows are shifted vertically by 1/2 dots, when the printer is used in its normal, i.e. its high quality, printing mode, the vertically arranged dots overlap each other by 1/2 dots. Consequently, as shown in Figure 6b, a fine dot pattern can be produced to achieve high quality printing.

25 However, printers are generally operable in a draft printing mode to achieve high speed printing but inferior printing quality in addition to the normal or high quality printing mode referred to above. When the printing head of Figure 6(a) is used in its draft printing mode, when a horizontal line is printed using two rows including either the first and second rows or the third and fourth rows, neighbouring dots are shifted vertically and alternately by 1/2 dots so that character quality is reduced, as shown in Figure 6c.

30 In the Figure 7(a) arrangement, moreover, since there are pairs of rows in the same position, not only can high speed printing be performed in the draft printing mode but also a horizontal line can be printed in high print quality as a linear assembly of dots as shown in Figure 7(c). However, since the dots of the second and third rows of dots are shifted by one dot intervals, mutual interposition of the dots cannot be effected vertically as shown in Figure 7b so that print quality is unsatisfactory in the normal printing mode.

As described above, the print quality of either normal printing mode or the draft printing mode is unsatisfactory in both the arrangements described above.

35 Documents JP-A-40345/89 and GB-A-2,198,391 disclose examples of prior arrangements as described above. Document DE-A-3208104 discloses an arrangement having the features set out in the pre-characterising clause of claim 1 of this application.

40 According to the present invention, there is provided a dot type printing head for use in a serial printer comprising dot-forming means for forming 2N rows of dots where N is a positive integer of 2 or more, each row of dots being spaced from an adjacent row by a substantially fixed interval in the carriage moving direction of the printer and being shifted with respect to the adjacent row in the paper feeding direction of the printer, the dots in each row being arranged at substantially N dot pitches in the paper feeding direction; and driving means for driving the dot-forming means, the driving means effecting printing of various rows of dots at different timings, characterised in that each row of dots which is printed at an even numbered timing being given a predetermined shift of not more than 1/3 dot in the paper feeding direction with respect to a selected previous row of dots in the carriage moving direction which is printed at an odd numbered timing; successive rows of dots which are printed at the odd numbered timings and successive rows of dots which are printed at the even numbered timings being relatively shifted in the paper feeding direction by one dot.

45 Preferably, the predetermined shift is in the range 1/9 dot to 1/3 dot.

50 In one embodiment, there are four said rows the dots in each of which are spaced from each other by 2 dot intervals, the said predetermined shift between the first and second rows and between the third and fourth rows being a 1/4 dot shift, and the said predetermined shift between the second and third rows being a 3/4 dot shift.

55 In another embodiment, there are four said rows the dots in each of which are spaced from each other by 2 dot intervals, the said predetermined shift between the first and third rows and between the second and fourth rows being a 1/4 dot shift, and the said predetermined shift between first and second rows being a one dot shift.

In yet another embodiment, there are six said rows the dots in each of which are spaced from each other by 3 dot intervals, the said predetermined shift between the first and third rows and between the third and fifth rows being a 1 dot shift.

The head may comprise a plurality of wires driven by electromagnets.

5 Alternatively, it may comprise a plurality of heating elements formed on a substrate.

It may also comprise ink nozzles which are arranged to jet ink droplets as a result of the action of a heater or the deformation of a piezo-electric element.

The invention also comprises a serial printer provided with a head as set forth above.

10 Thus when a dot type printing head according to the present invention is used in a normal printing mode, spaces between the dots in rows thereof printed at the odd numbered timings, for example, between the dots in first and third rows, are filled with the dots in second and fourth rows which are printed at even numbered timings, so that high quality printing can be achieved. Also, in a draft printing mode, when a horizontal line is printed, the printing speed can be improved by using either the first and the second rows or the third and the fourth rows. Since the respective dots are printed vertically with a shift not exceeding
15 $1/3$ dots, the horizontal dots can be arranged as straight as possible, whereby the printing quality can be improved in the draft printing mode.

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

Figure 1 is a cross-sectional view showing a dot type printing head according to the present invention;

20 Figure 2 is a diagram showing the positions of dots which can be produced by dot forming elements of the printing head shown in Figure 1;

Figure 3a is a diagram showing the arrangement of dots produced by the printing head shown in Figure 1;

Figure 3b is a diagram showing the positions of enlarged dots for a letter "A" printed by the printing head of Figure 1 when used in a normal printing mode;

25 Figure 3c is a diagram showing the positions of enlarged dots for a letter "A" printed by the printing head of Figure 1 when used in a draft printing mode;

Figure 4 is a diagram showing another arrangement of dot forming elements which may be used in a printing head according to the present invention;

30 Figure 5 is a diagram showing yet another arrangement of dot forming elements which may be used in a printing head according to the present invention;

Figure 6a shows an arrangement of dot forming elements in a prior art 48 dot type printing head for a serial printer;

Figure 6b is a diagram showing the positions of enlarged dots for a letter "A" printed by the printing head of Figure 6(a) when used in a normal printing mode;

35 Figure 6c is a diagram showing the positions of enlarged dots for a letter "A" printed by the printing head of Figure 6(a) when used in a draft printing mode;

Figure 7a shows an arrangement of dot forming elements in a prior art 48-dot type printing head used for a serial printer;

40 Figure 7b is a diagram showing positions of enlarged dots of a letter "A" printed by the printing head of Figure 7(a) when used in a normal printing mode;

Figure 7c is a diagram showing the positions of enlarged dots of a letter of "A" printed by the printing head of Figure 7(a) when used in a draft printing mode; and

Figure 8 is a plan view showing a serial printer provided with a dot type printing head as shown in Figure 1.

45 In Figure 8 there is shown a serial printer 200 using a dot type printing head 100 according to the present invention. The dot type printing head 100 is mounted on a carriage 204, the latter being supported movably in the printing column direction by shafts 206 and 207 mounted in plates 201, 202. The dot type printing head 100 is arranged to print desired figures and characters on a printing paper or other record medium 208 arranged between a platen 203 and an ink ribbon 209.

50 Figure 1 shows the printing head 100. The printing head 100 comprises two printing units 1, 2. Each of the printing units 1, 2 has two stages, the printing units 1, 2 being fixed to a nose member 3.

In each of the printing units 1 and 2, twenty four dot forming elements are provided which are constituted by wires 12, 13. Each of the wires 12 of the printing unit 1 is operated by a respective coil 10 wound on a respective bobbin 8 having a respective core 6, while each of the wires 13 of the printing unit 2 is operated by a respective coil 11 wound on respective bobbin 9 having a respective core 7. The wires 12
55 and their associated coils 10, bobbins 8 and cores 6 are equi-angularly arranged in a cup-shaped case 4, while the wires 13 and their associated coils 11, bobbins 9 and cores 7 are equi-angularly arranged in a cup-shaped case 4, the cases 4, 5 forming magnetic cores. Pivotaly mounted levers 14, 15 are provided

which are urged towards a non-printing position by coil springs 16, 17 respectively and which are moved into a printing position by energization of the coils 10, 11 respectively. Each lever 14, 15 is connected to the end of the respective wire 12, 13 remote from the nose 3.

The nose member 3 guides the wires 12 and 13 which act as dot forming elements and which are driven by each of the printing units 1 and 2 so that the ends of the wires 12 and 13 are disposed in a desired arrangement. An end guide plate 20, which is formed of a wear resistant material such as ceramic and metal, is arranged at the end of the nose member 3. One or a plurality of intermediate guide plates 21, 21...22, 22 are arranged between the end guide plate 20 and the printing head units 1 and 2. The intermediate guide plates 21, 21, 22, 22 have guide openings formed to guide smoothly the wires 12 and 13 from the ends of the levers 14 and 15 to guide openings in the end guide plate 20.

Figure 2 shows the positions of the dots which are formed when the printing head 100 operates all the wires 12, 13 without moving with a carriage. The end guide plate 20 has a plurality of vertically (in the paper feeding direction Y of Figure 2) arranged guide openings (twelve guide openings in the embodiment) and first, second, third, and fourth rows of guide openings. The wires inserted in the guide openings form a first dot row P1 to P12, a second dot row P13 to P24, a third dot row P25 to P36, and a fourth dot row P37 to P48. In these rows, the intervals between the dots of each of the rows is determined by the wires 12 and 13, the dots being arranged at a pitch of about two dots in the paper feeding direction Y of the printer. When the printing head 100 is mounted on the carriage 204, the dot interval is positioned so as to be spaced horizontally and equally at prescribed dot intervals 23, for example, at a fixed distance of four dot intervals in the carriage moving direction X. The second dot row P13 to P24 is arranged so as to be shifted in the Y direction by a distance in the range of $1/9$ dot to not more than $1/3$ dot ($1/4$ dot in this embodiment) with respect to the first dot row P1 to P12. The third dot row P25 to P36 is arranged so as to be shifted in the Y direction by one dot with respect to the first dot row P1 to P12, or by $3/4$ dot with respect to the second dot row P13 to P24. The fourth dot row P37 to P48 is arranged so as to be shifted in the Y direction by a distance in the range of $1/9$ dot to not more than $1/3$ dot with respect to the third dot row P25 to P36. In this embodiment, the extent to which the fourth dot row is shifted with respect to the third dot row is $1/4$ dot, that is, by $5/4$ dot with respect to the first dot row P1 to P12.

In this embodiment, the letter "A" may be printed using the dot pattern data in a normal printing mode, as shown in Figure 3(b). The $(1+2n)$ th dot data from the horizontal base line are printed by the wires corresponding to the first dot row P1 to P12. The $(2+2n)$ th dot data are printed by the wires corresponding to the second dot row P13 to P24. The $(3+2n)$ th dot data are printed by the wires corresponding to the third dot row P25 to P36. The $(4+2n)$ th dot data are printed by the wires corresponding to the fourth dot row P37 to P48. The printing head 100 travels horizontally with the motion of the carriage 204, thus moving horizontally the wires corresponding to each of the dot rows P1 to P12, P13 to P24, P25 to P36, and P37 to P48 to form dots corresponding to the dot data.

As described before, the first dot row P1 to P12 and the second dot row P13 to P24 are shifted by $1/4$ dot with respect to each other, and the third dot row P25 to P36 and the fourth dot row P37 to P48 are shifted by $1/4$ dot with respect to each other. Hence, the dot formed with the wires corresponding to the first dot row P1 to P12 and the third dot row P25 to P36 overlaps by $1/4$ and $3/4$ the dot formed with the wires corresponding to the second dot row P13 to P24 and the fourth dot row P37 to P48, respectively. Spaces produced between the dots formed with the wires corresponding to the first dot row P1 to P12 and the third dot row P25 to P36 are filled with the dots formed with the wires corresponding to the second dot row P13 to P24 and the fourth dot row P37 to P48, whereby a pattern can be formed with smooth lines (Figure 3b).

Vertically neighbouring dots are formed by the first dot row P1 to P12 and the third dot row P25 to P36, and they do not overlap the middle portion between dots shifted by $1/2$ dot as in the prior art or the middle portion between the vertical dots. However, the blur and spread of ink due to dot printing can overlap the middle portion sufficiently so that a printing quality can be achieved which is almost as good as that in $1/2$ dot shifting.

A printing operation in a draft printing mode may be carried out according to dot pattern data for a normal printing mode, but without any interposition of dot data. The printing head 100 can print at twice the speed possible in the normal printing mode. Hence, draft printing mode is inferior in character quality by comparison with that achieved in the normal printing mode, but the printing speed can be doubled.

A horizontal line in the draft printing mode can be printed using either the wires corresponding to the first dot row P1 to P12 and the second dot row P13 to P24, or the wires corresponding to the third dot row P25 to P36 and the fourth dot row P37 to P48. In this embodiment, the horizontally neighbouring dots are shifted only by $1/4$ dot and in a zigzag form, but a viewer can recognize it as a straight line because of ink blur and spread (Figure 3c).

That is, the draft mode printing achieved by the said embodiment is not quite as good as that of the horizontal line (Figure 7(c)) printed by a printing head with the known second arrangement of dots, but can provide extremely high printing quality compared with the known first arrangement printing (Figure 6c) in which the dots are mutually shifted vertically by 1/2 dot.

5 In the embodiment described above, the printing head 100 can provide the printing quality obtained by a printing head having the first known arrangement of Figure 6(a) and the printing quality obtained by a printing head having the second known arrangement of Figure 7(a). For example, in table data printing, a table can be printed in high quality and at high speed by switching between a normal printing mode for data characters and a draft printing mode for horizontally ruled lines.

10 In a further embodiment (not shown) of the present invention, 0.2 mm diameter wires are used as the print forming elements. A dot forming element row is constructed by arranging 12 wires each of 0.2 mm diameter and by spacing them vertically at 0.28 intervals, and then four such dot forming element rows are formed.

The vertical shift between the first and second dot-forming element rows is designed to be 0.035 mm. 15 The third dot forming element row is shifted vertically by 0.14 mm with respect to the first dot forming element chain. The fourth dot forming element row is shifted by 0.035 mm with respect to the third dot forming element row.

The printing head forms dots on a printing paper using an ink ribbon, the diameter of the dots so produced ranging from 0.23 to 0.27 mm due to ink blur. This allows the first dot and the third dot forming 20 element rows to be formed without interruption.

The dots formed by the second dot forming element row overlap with the dots obtained by the first dot forming element row by 0.21 mm. The dots formed by the second dot forming element row overlap with the dots obtained by the third dot forming element row by 0.07 mm. Also, the dots obtained by the fourth dot forming element row overlap with the dots obtained by the first dot forming element row by 0.07mm. The 25 dots obtained by the fourth dot forming element row overlaps with those of the third dot forming element row by 0.21 mm.

As a result, the dots formed by the first and third dot forming element rows can interpose with the dots formed by the second and fourth dot forming element rows, whereby high quality printing can be performed. In a draft printing mode which prints a horizontal line using either the first and second dot 30 forming element rows or the third and fourth dot forming element rows, a shift between the horizontal dots is only 14% ($=0.035/0.25$). The small shift can print practically a horizontal line, so that a draft character and ruled lines can be printed in high quality.

In this embodiment the dot forming element rows in even numbered rows (i.e. in the second and fourth rows) and the dot forming element rows in the odd numbered rows (i.e. in the first and third rows) are 35 shifted by 1/4 dot. However, it has been ascertained that characters and patterns in high quality can be printed in practice by properly selecting a shift ranging from 1/9 dot or more up to 1/3 dot in accordance with the dot shape or size formed by the dot forming elements.

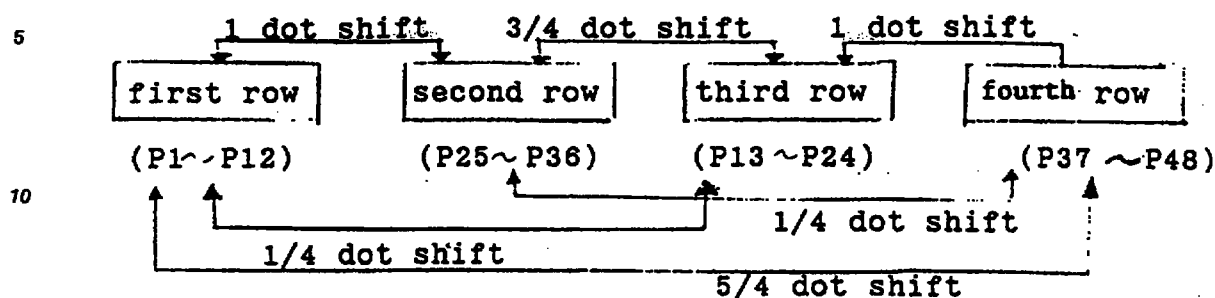
A wire dot type printing head has been referred to in the illustrated embodiment of the present invention. However, the present invention can be effectively applied to a thermal transfer type printing head, 40 a thermally sensitive type printing head, a bubble ink jet type printing head, and an ink jet type printing head. The thermal transfer type printing head and the thermally sensitive type printing head are provided with heating elements in rows arranged on a heated substrate surface. The bubble ink jet type printing head has nozzle openings in rows and heating elements near to the openings to jet an ink droplet by utilizing the expansion force of partially vaporized ink. The ink jet type printing head has piezo-electric elements 45 associated with ink reservoirs connected to nozzle openings.

In the illustrated embodiment, the printing head has 48 dot forming elements, but it is obvious that the present invention can be used with other numbers of dot forming elements.

Furthermore, dot forming element rows arranged in a regular driving order have been described with reference to Figure 2. However, the dot forming element rows can be arranged in other driving orders, as 50 shown in Figure 4. For example, the same effects can be obtained by arranging that the elements of the first dot forming element row P1 to P12 are driven at a first or odd numbered timing; the elements of the second dot forming element row P25 to P36 are driven at a third or odd numbered timing; the elements of the third dot forming element row P13 to P24 are driven at a second or even numbered timing, and the elements of the fourth dot forming element row P37 to P48 are driven at a fourth or even numbered timing.

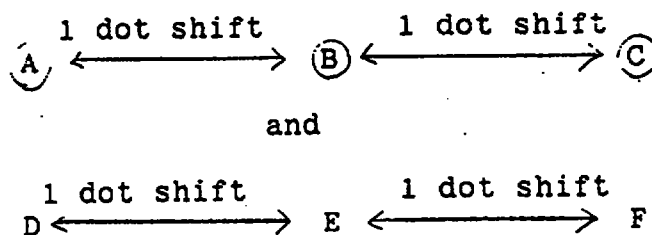
55 That is, the same functional effect can be obtained by shifting the second dot forming element row P25 to P36 by one dot with respect to the first dot forming element row P1 to P12; by shifting the third dot forming element row P13 to P24 in the range 1/9 dot to not more than 1/3 dot with respect to the first dot forming element row P1 to P12; and by shifting the fourth dot forming element row P37 to P48 by 1/9 dot to

not more than $1/3$ dot with respect to the second dot forming element row P25 to P36. Thus the arrangement may be as shown in the following diagram:-

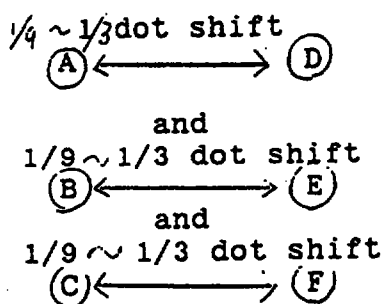


Furthermore, the above-described embodiments employ four dot forming element rows, but the same functional effect can be clearly obtained even by arranging a plurality of rows such as six or eight rows.

For example, even when the dot forming elements are arranged in six rows in a head mounted on a carriage, as shown in Figure 5, the same functional effects can be obtained. In this case, each of the six dot forming element rows (A to F) is formed by arranging a plurality of dot forming elements at three dot intervals in the paper feeding direction Y. Each dot forming element row (A, B, C) which is driven at odd numbered timings and each dot forming element row (D, E, F) which is driven at even numbered timings is shifted respectively with respect to its corresponding adjacent row by one dot intervals, so that:-



The dot forming element rows (A, B, C) which are driven at odd numbered timings and the dot forming element rows (D, E, F) which are driven at even numbered timings are shifted respectively between $1/9$ and $1/3$ dot and in the paper feeding direction Y in the following manner:-



Dot forming element rows having equal numbers of elements have been described above. However, the number of dot forming elements of each row may differ. For example, the same functional effects can obviously be obtained even by arranging that the external shape of the dot forming element rows is a diamond shape or a circular shape.

Claims

1. A dot type printing head for use in a serial printer comprising dot-forming means (12, 13) for forming
 5 2N rows of dots (P1-P12; P13-P24; P25-P36; P37-P48; A-F) where N is a positive integer of 2 or more, each row of dots being spaced from an adjacent row by a substantially fixed interval (23) in the carriage moving direction (X) of the printer and being shifted with respect to the adjacent row in the paper feeding direction (Y) of the printer, the dots in each row being arranged at substantially N dot pitches in the paper feeding direction (Y); and driving means (6, 10, 14, 16; 7, 11, 15, 17) for driving the dot-forming means (12, 13), the driving means (6, 10, 14, 16; 7, 11, 15, 17) effecting printing of various
 10 rows of dots (P1-P12; P13-P24; P25-P36; P37-P48; A-F) at different timings, characterised in that each row of dots (P13-P24, P37-P48; D, E, F) which is printed at an even numbered timing being given a predetermined shift of not more than 1/3 dot in the paper feeding direction (Y) with respect to a selected previous row of dots (P1-P12, P25-P36; A, B, C) in the carriage moving direction (X) which is printed at an odd numbered timing; successive rows of dots (P1-P12, P25-P36; A, B, C) which are
 15 printed at the odd numbered timings, and successive rows of dots (P13-P24, P37-P48; D, E, F) which are printed at the even numbered timings being relatively shifted in the paper feeding direction (Y) by one dot.
2. A dot type printing head as claimed in claim 1 characterised in that the predetermined shift is in the
 20 range 1/9 dot to 1/3 dot.
3. A dot type printing head as claimed in claim 1 or 2 characterised in that there are four said rows the dots in each of which are spaced from each other by 2 dot intervals, the said predetermined shift between the first and second rows and between the third and fourth rows being a 1/4 dot shift, and the
 25 said predetermined shift between the second and third rows being a 3/4 dot shift.
4. A dot type printing head as claimed in claim 1 or 2 characterised in that there are four said rows the dots in each of which are spaced from each other by 2 dot intervals, the said predetermined shift between the first and third rows and between the second and fourth rows being a 1/4 dot shift, and the
 30 said predetermined shift between first and second rows being a one dot shift.
5. A dot type printing head as claimed in claim 1 or 2 characterised in that there are six said rows the dots in each of which are spaced from each other by 3 dot intervals, the said predetermined shift between the first and third rows and between the third and fifth rows being a 1 dot shift.
- 35 6. A dot type printing head as claimed in any preceding claim characterised in that the head comprises a plurality of wires (12,13) driven by electromagnets (6,10; 7,11).
7. A dot type printing head as claimed in any of claims 1-5 characterised in that the head comprises a
 40 plurality of heating elements formed on a substrate.
8. A dot type printing head as claimed in any of claims 1-5 characterised in that the head comprises ink nozzles which are arranged to jet ink droplets as a result of the action of a heater or the deformation of a piezo-electric element.
- 45 9. A serial printer characterised in that the printer is provided with a dot type printing head as claimed in any preceding claim.
10. A serial printer having a dot type printing head wherein 2N (where N is a positive integer of 2 or more)
 50 dot forming element chains are arranged at a fixed interval and in a carriage moving direction, each of said chains are formed by arranging a plurality of dot forming elements at N dot pitches in a paper feeding direction and in row when it is mounted on a carriage; dot forming element chains driven by odd numbered timings are arranged so as to be shifted by one dot, and dot forming element chains driven by even numbered timings are arranged so as to be shifted by one dot; said dot forming
 55 element chains driven by even numbered timings and said dot forming element chains driven by odd numbered timings being arranged so as to be shifted by less than 1/3 dot and in a paper feeding direction.



Claims

1. A dot type printing head for use in a serial printer comprising dot-forming means (12, 13) for forming 2N rows of dots (P1-P12; P13-P24; P25-P36; P37-P48; A-F) where N is a positive integer of 2 or more, each row of dots being spaced from an adjacent row by a substantially fixed interval (23) in the carriage moving direction (X) of the printer and being shifted with respect to the adjacent row in the paper feeding direction (Y) of the printer, the dots in each row being arranged at substantially N dot pitches in the paper feeding direction (Y); and driving means (6, 10, 14, 16; 7, 11, 15, 17) for driving the dot-forming means (12, 13), the driving means (6, 10, 14, 16; 7, 11, 15, 17) effecting printing of various rows of dots (P1-P12; P13-P24; P25-P36; P37-P48; A-F) at different timings, characterised in that each row of dots (P13-P24, P37-P48; D, E, F) which is printed at an even numbered timing being given a predetermined shift of not more than 1/3 dot in the paper feeding direction (Y) with respect to a selected previous row of dots (P1-P12, P25-P36; A, B, C) in the carriage moving direction (X) which is printed at an odd numbered timing; successive rows of dots (P1-P12, P25-P36; A, B, C) which are printed at the odd numbered timings, and successive rows of dots (P13-P24, P37-P48; D, E, F) which are printed at the even numbered timings being relatively shifted in the paper feeding direction (Y) by one dot.
2. A dot type printing head as claimed in claim 1 characterised in that the predetermined shift is in the range 1/9 dot to 1/3 dot.
3. A dot type printing head as claimed in claim 1 or 2 characterised in that there are four said rows the dots in each of which are spaced from each other by 2 dot intervals, the said predetermined shift between the first and second rows and between the third and fourth rows being a 1/4 dot shift, and the said predetermined shift between the second and third rows being a 3/4 dot shift.
4. A dot type printing head as claimed in claim 1 or 2 characterised in that there are four said rows the dots in each of which are spaced from each other by 2 dot intervals, the said predetermined shift between the first and third rows and between the second and fourth rows being a 1/4 dot shift, and the said predetermined shift between first and second rows being a one dot shift.
5. A dot type printing head as claimed in claim 1 or 2 characterised in that there are six said rows the dots in each of which are spaced from each other by 3 dot intervals, the said predetermined shift between the first and third rows and between the third and fifth rows being a 1 dot shift.
6. A dot type printing head as claimed in any preceding claim characterised in that the head comprises a plurality of wires (12,13) driven by electromagnets (6,10; 7,11).
7. A dot type printing head as claimed in any of claims 1-5 characterised in that the head comprises a plurality of heating elements formed on a substrate.
8. A dot type printing head as claimed in any of claims 1-5 characterised in that the head comprises ink nozzles which are arranged to jet ink droplets as a result of the action of a heater or the deformation of a piezo-electric element.
9. A serial printer characterised in that the printer is provided with a dot type printing head as claimed in any preceding claim.
10. A serial printer having a dot type printing head wherein 2N (where N is a positive integer of 2 or more) dot forming element chains are arranged at a fixed interval and in a carriage moving direction, each of said chains are formed by arranging a plurality of dot forming elements at N dot pitches in a paper feeding direction and in row when it is mounted on a carriage; dot forming element chains driven by odd numbered timings are arranged so as to be shifted by one dot, and dot forming element chains driven by even numbered timings are arranged so as to be shifted by one dot; said dot forming element chains driven by even numbered timings and said dot forming element chains driven by odd numbered timings being arranged so as to be shifted by less than 1/3 dot and in a paper feeding direction.



Patentansprüche

1. Punkt-Typ-Druckkopf zur Verwendung in einem Seriendrucker, umfassend punktbildende Mittel (12, 13) zum Bilden von 2N Reihen von Punkten (P1-P12; P13-P24; P25-P36; P37-P48; A-F), wobei N eine positive ganze Zahl größer oder gleich 2 ist, wobei jede Punktreihe von einer benachbarten Reihe mit einem im wesentlichen festen Intervall (23) in der Trägerbewegungsrichtung (X) des Druckers im Abstand angeordnet ist und bezüglich der benachbarten Reihe in der Papierzuführrichtung (Y) des Druckers verschoben ist, wobei die Punkte in jeder Reihe mit im wesentlichen N-Punkt-Abständen in der Papierzuführrichtung (Y) angeordnet sind, und Antriebsmittel (6, 10, 14, 16; 7, 11, 15, 17) zum Antreiben der punktbildenden Mittel (12, 13), wobei die Antriebsmittel (6, 10, 14, 16; 7, 11, 15, 17) das Drucken verschiedener Punktenreihen (P1-P12; P13-P24; P25-P36; P37-P48; A-F) zu verschiedenen Zeiten bewirken, dadurch gekennzeichnet, daß jede Reihe von Punkten (P13-P24, P37-P48; D, E, F), welche zu einer geradzahlig bezeichneten Zeit gedruckt wird, eine vorgegebene Verschiebung von nicht mehr als 1/3 Punkt in der Papierzuführrichtung (Y) bezüglich einer ausgewählten vorherigen Reihe von Punkten (P1-P12; P25-P36; A, B, C) in der Trägerbewegungsrichtung (X) aufweist, welche zu einer ungeradzahlig bezeichneten Zeit gedruckt wird, wobei aufeinanderfolgende Reihen von Punkten (P1-P12, P25-P36; A, B, C), welche zu den ungeradzahlig bezeichneten Zeiten gedruckt werden, und aufeinanderfolgende Reihen von Punkten (P13-P24, P37-P48; D, E, F), welche zu den geradzahlig bezeichneten Zeiten gedruckt werden, in der Papierzuführrichtung (Y) relativ zueinander um einen Punkt verschoben sind.
2. Punkt-Typ-Druckkopf nach Anspruch 1, dadurch gekennzeichnet, daß die vorbestimmte Verschiebung im Bereich von 1/9 Punkt bis 1/3 Punkt liegt.
3. Punkt-Typ-Druckkopf nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß vier Punktreihen vorhanden sind, wobei die Punkte jeder davon jeweils einen Abstand von zwei Punktintervallen zueinander aufweisen, wobei die vorbestimmte Verschiebung zwischen der ersten und der zweiten Reihe und zwischen der dritten und der vierten Reihe eine Verschiebung um 1/4 Punkt ist und die vorbestimmte Verschiebung zwischen der zweiten und der dritten Reihe eine Verschiebung um 3/4 Punkt ist.
4. Punkt-Typ-Druckkopf nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß vier Reihen vorhanden sind, wobei die Punkte in jeder davon zueinander einen Abstand von zwei Punktintervallen aufweisen, wobei die vorbestimmte Verschiebung zwischen der ersten und der dritten Reihe und zwischen der zweiten und der vierten Reihe eine Verschiebung um 1/4 Punkt ist und die vorbestimmte Verschiebung zwischen der ersten und der zweiten Reihe eine Verschiebung um 1 Punkt ist.
5. Punkt-Typ-Druckkopf nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß sechs Reihen vorhanden sind, wobei die Punkte in jeder davon zueinander einen Abstand von drei Punktintervallen aufweisen, wobei die vorbestimmte Verschiebung zwischen der ersten und der dritten Reihe und zwischen der dritten und der fünften Reihe eine Verschiebung um 1 Punkt ist.
6. Punkt-Typ-Druckkopf nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Kopf eine Mehrzahl von durch Elektromagneten (6, 10; 7, 11) angetriebenen Nadeln (12, 13) umfaßt.
7. Punkt-Typ-Druckkopf nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß der Kopf eine Mehrzahl von auf einem Substrat gebildeten Heizelementen umfaßt.



8. Punkt-Typ-Druckkopf nach einem der Ansprüche 1 bis 5,
dadurch gekennzeichnet,
daß der Kopf Tintendüsen umfaßt, welche zum Ausstoßen von Strahlintentröpfchen als Ergebnis des Betriebs eines Heizers oder der Verformung eines piezoelektrischen Elements eingerichtet sind.
9. Seriendrucker,
dadurch gekennzeichnet,
daß der Drucker mit einem Punkt-Typ-Druckkopf nach einem der vorhergehenden Ansprüche ausgestattet ist.
10. Seriendrucker mit einem Punkt-Typ-Druckkopf, worin $2N$ (wobei N eine positive ganze Zahl größer oder gleich 2 ist) Ketten punktbildender Elemente mit einem festen Intervall und in einer Trägerbewegungsrichtung angeordnet sind, wobei jede der Ketten durch Anordnen einer Mehrzahl von punktbildenden Elementen bei N -Punkt-Abständen in einer Papierzuführrichtung und in einer Reihe gebildet ist, wenn er an einem Träger angebracht ist, wobei Ketten punktbildender Elemente, welche zu ungeradzahlig bezeichneten Zeiten angetrieben werden, derart angeordnet sind, daß sie um einen Punkt verschoben sind, und Ketten punktbildender Elemente, welche zu geradzahlig bezeichneten Zeiten angetrieben werden, derart angeordnet sind, daß sie um einen Punkt verschoben sind, wobei die Ketten punktbildender Elemente, welche zu geradzahlig bezeichneten Zeiten angetrieben werden, und die Ketten punktbildender Elemente, welche zu ungeradzahlig bezeichneten Zeiten angetrieben werden, derart angeordnet sind, daß sie in einer Papierzuführrichtung um weniger als $1/3$ Punkt verschoben sind.

Revendications

1. Tête d'imprimante du type par points pour utilisation dans une imprimante série, comprenant des moyens de formage de points (12, 13) pour former $2N$ rangées de points (P1-P12; P13-P24 ; P25-P36 ; P37-P48; A-F) où N est un entier positif de 2 ou plus, chaque rangée de points étant distante d'une rangée adjacente d'un intervalle sensiblement fixe (23) suivant la direction de déplacement du chariot (X) de l'imprimante et étant décalée par rapport à la rangée adjacente suivant la direction d'avance du papier (Y) de l'imprimante, les points de chaque rangée étant disposés à des pas de points sensiblement de N suivant la direction d'avance du papier (Y) ; et des moyens de commande (6, 10, 14, 16 ; 7, 11, 15, 17) pour commander les moyens de formage de points (12, 13), lesdits moyens de commande effectuant l'impression de diverses rangées de points (P1-P12 ; P13-P24 ; P25-P36 ; P37-P48 ; A-F) à des positionnements temporels différents, caractérisée en ce qu'à chaque rangée de points (P13-P24, P37-P48 ; D, E, F) qui est imprimée à un positionnement temporel pair est affecté un décalage prédéterminé d'au maximum $1/3$ de point suivant la direction d'avance du papier (Y) par rapport à une rangée précédente de points sélectionnée (P1-P12, P25-P36 ; A, B, C) suivant la direction de déplacement du chariot (X) qui est imprimée à un positionnement temporel impair ; des rangées de points successives (P1-P12, P25-P36 ; A, B, C) qui sont imprimées à des positionnements temporels impairs, et des rangées de points successives (P13-P24, P37-P48 ; D, E, F) qui sont imprimées aux positionnements temporels pairs étant relativement décalées d'un point suivant la direction d'avance du papier (Y).
2. Tête d'imprimante du type par points suivant la revendication 1, caractérisée en ce que le décalage prédéterminé est compris entre $1/9$ de point et $1/3$ de point.
3. Tête d'imprimante du type par points suivant la revendication 1 ou 2, caractérisée en ce que quatre desdites rangées sont constituées chacune de points distants les uns des autres d'un intervalle de 2 points, ledit décalage prédéterminé entre les première et deuxième rangées et entre les troisième et quatrième rangées étant un décalage de $1/4$ de point, et ledit décalage prédéterminé entre les deuxième et troisième rangées étant un décalage de $3/4$ de point.
4. Tête d'imprimante du type par points suivant la revendication 1 ou 2, caractérisée en ce que quatre desdites rangées sont constituées chacune de points distants les uns des autres d'un intervalle de 2 points, ledit décalage prédéterminé entre les première et troisième rangées et entre les deuxième et quatrième rangées étant un décalage de $1/4$ de point, et ledit décalage prédéterminé entre les première et deuxième rangées étant un décalage d'un point.



5. Tête d'imprimante du type par points suivant la revendication 1 ou 2, caractérisée en ce que six desdites rangées sont constituées chacune de points distants les uns des autres d'un intervalle de 3 points, ledit décalage prédéterminé entre les première et troisième rangées et entre les troisième et cinquième rangées étant un décalage de 1 point.
- 5 6. Tête d'imprimante du type par points suivant l'une des revendications précédentes, caractérisée en ce que la tête comprend une pluralité de fils (12,13) actionnés par des électroaimants (6,10 ; 7,11).
- 10 7. Tête d'imprimante du type par points suivant l'une des revendications 1 à 5, caractérisée en ce que la tête comprend une pluralité d'éléments de chauffage formés sur un substrat.
- 15 8. Tête d'imprimante du type par points suivant l'une des revendications 1 à 5, caractérisée en ce que la tête comprend des buses d'encre qui sont placées pour éjecter des gouttelettes d'encre sous l'action d'un appareil chauffant ou de la déformation d'un élément piézo-électrique.
- 20 9. Imprimante série, caractérisée en ce que l'imprimante est munie d'une tête d'impression du type par points selon l'une des revendications précédentes.
- 25 10. Imprimante série ayant une tête d'imprimante du type par points dans laquelle 2N (où N est un entier positif de 2 ou plus) chaînes d'éléments de formage de points sont disposées à un intervalle fixe et suivant la direction de déplacement d'un chariot, chacune desdites chaînes est formée par la disposition d'une pluralité d'éléments de formage de points à N pas de points suivant une direction d'avance du papier et en rangée lorsqu'elle est montée sur un chariot ; les chaînes d'éléments de formage de points commandées par des positionnements temporels impairs sont disposées de façon à être décalées d'un point, et les chaînes d'éléments de formage de points commandées par des positionnements temporels pairs sont disposées de façon à être décalées d'un point ; lesdites chaînes d'éléments de formage de points commandées par des positionnements temporels pairs et lesdites chaînes d'éléments de formage de points commandées par des positionnements temporels impairs étant disposées de façon à être décalées de moins de 1/3 de point et suivant la direction d'avance du papier.
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