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(54) Ink-jet colour printer

(57) Colour ink-jet printer with two removable printing heads (12, 13) at the same time available on the head-holder carriage (10), of which one (12) containing only a black ink for printing the document text parts, and the other (13) containing both a set of three inks of the primary colours, cyan, magenta and yellow, and, in addition, a "graphic" black ink, physically and chemically compatible with the colour inks, for printing the document parts containing colour figures; in such a manner all the document's black pixels may be printed as "true" black and not as "composite" black, optimizing printing quality cost and speed.

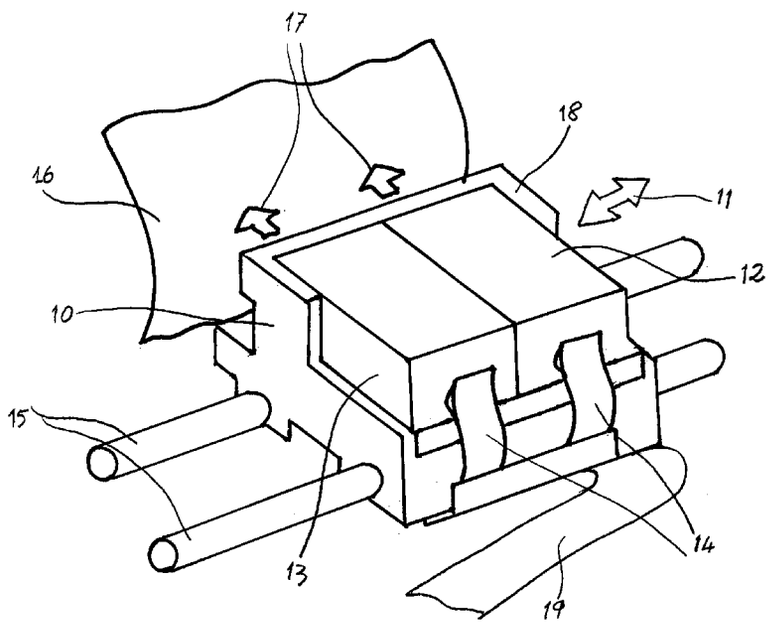

FIG. 1

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Description

TECHNICAL FIELD

The present invention relates to an equipment for recording black and colour images on a printing support, usually but not exclusively a sheet of paper, by way of the ink-jet technology.

TECHNICAL BACKGROUND

Equipments of the type above disclosed are known in the art, as for example, printers, copiers, facsimiles, etc., and in particular printers used for producing, by way of printing means generally in the form of a printing heads, the printing of a document, generated by using a complex electronic equipment and particularly a computer, on a printing support, as for example a sheet of paper, a continuous form or a thin transparent plastic material sheet; the document can be generated by way of the computer only using available functions inside it, or it can be made up by integrating a document or part of a document already existing, using a special device called "scanner" and per se known.

In the technology's most recent evolutions, the document comprises parts (usually, for example, a text) which must be black printed, and parts (usually figures, pictures or graphs for example) which must be colour printed, often mixed among them in a casual manner; in these cases the problem is to print with the best possible quality the black and the colour parts in short time and low cost: the ink-jet printers, initially capable of black printing only, gradually developed towards the colour printing, proving to be the most versatile and suitable printer to satisfy such requirements.

A typical ink-jet printer is schematically formed by:

- a feeding and advancement system of the sheet of paper on which it is required to print the image, selectively operated by a motor, so that the feeding takes place in a determined direction with discrete pitches (line feeding),
- a movable carriage sliding on guides in a direction perpendicular with respect to the sheet feeding direction, selectively operated by a motor in order to perform a back and forth motion throughout the same sheet width,
- a printing means, generally a printing head for example, removibily fixed to the carriage, capable of issuing drops of ink contained in a reservoir by way of a multiplicity of nozzles against the sheet surface, generating a visible image,
- an electronic controller that, on the grounds of the information received by the computer to which it is connected and of the prearrangements setted by the user, selectively drives the aforesaid motors and the ink drops issuing.

Leaving out the so-called "high end" printers with high performances, but also very expensive, which use four distinct printing heads (four-colour process) at the same time and often need a special printing support (''coated'' paper), in the medium and low end market segments, sometimes identified by the acronym SOHO (from the initial letters of the words "Small Office Home Office") several alternative solutions have been suggested and made commercially available, but they do not solve the aforesaid problem in a complete satisfactory manner.

A first known method to solve this problem consists, for example, in using, by mounting them in turn on the same carriage according to the features of the document to be printed, a black printing head or a colour printing head comprising three distinct groups of nozzles, each group connected to a reservoir containing a different colour ink and precisely a cyan ink, a yellow ink and a magenta ink, which represent the "primary" colours combining which it is possible to obtain all the other colours, the black included which is given by the sum of the three "primary" colours; the black obtained using this type of colour printing head is usually indicated as "composite black" or "process black", signifying in this way that it is not obtained by a single colour (the so-called "true black") but mixing three different colours. An example of the formulation and of the chemical-physical features of these colour inks are disclosed in the Italian Patent Application N. TO 94A000528.

This method permits to use the black printing head when it is necessary to print documents containing only texts, and the colour printing head in all the other cases; but the "composite black", because of several unfavourable factors among which the different paper absorption of the three "primary" inks cyan, yellow and magenta, the imperfect superimposition of the three inks drops and the imperfect pureness of the three colours corresponding to the "primary" colours used in their formulation, tends always to present a colour shading, for example blue or red; in addition, it can cause paper deformation, because the paper tends to swell in correspondence to the "composite black" for the excessive ink quantity deposited in the same place, and the possibility to obtain an optical density as good as with the "true black" ink. Therefore this first known method, even if economically favourable, does not permit to obtaining a good printing quality.

A commercial example of this first method is represented by the printer model DeskJet 500C manufactured by Hewlett-Packard®.

A second method to solve the aforementioned problem, known in the art, consists in mounting on the carriage a colour printing head, in alternative to a black printing head, on the grounds of the features of the document to be printed; the colour head comprising four distinct nozzles groups, three groups of which are connected each to a reservoir containing a different colour ink and particularly a cyan ink, a yellow ink and a magenta ink, and the fourth group is connected to a res-

ervoir containing a black ink, which will be called "graphic ink" to distinguish it from the black ink used in the printing head for the sole black printing.

In order to better understanding the reason of this distinction, it is necessary to recall some features of the ink-jet printing technology, well known by people skilled in the art.

In the ink-jet printing technology the images are formed by way of dots or pixels, tipically disposed on an orthogonal grid with constant pitch P, for example 1/300th or 1/360th of an inch, in both directions; the single pixels, corresponding to the image generated on the printing support by the ink drop issued by a single nozzle, are not visible to the naked eye, so that there is the perception of a continuous area, unless in mistake cases consisting in systematic, even if little, grid pitches changes, which, on the contrary, originate optical phenomenons of rarefaction or fattening easily noticeable by the naked eye, with deterioration of the image quality.

The black printing heads contain an ink which is expelled in the form of drops with a typical volume equal to about 160 pl, and which is formulated in such a way as to have a slow penetration in the printing support (the sheet of paper on which the printing takes place) and rather tends to spread on the surface, so that any single printed pixel widens till to enter into contact with the adjacent pixels, in such a way granting a good covering of the printing support and consequently a high optical density.

On the contrary, the colour printing heads contain inks which are expelled in the form of drops with a typical volume halved with respect to the previous one, equal to about 80-90 pl, and which are formulated in such a way to quickly penetrate in the printing support, without spreading on the surface, but leaving the most possible colour on the same surface. The reason is that, in order to obtain a correct colour rendering, it is necessary that every pixel, in getting dry, maintains its original colour, while, if it enters in contact with a different ink when it is in a liquid state, there it could be a reciprocal bleeding which could change the colours in an uncontrolled manner, producing changes in the colours and smudges of the separation lines between a colour and the adjacent one.

Therefore the "black graphic" ink contained in the colour printing head is really different from the ink contained in the printing head for black only printing, but it is chemically and physically similar, and therefore compatible with the colour inks in the immediate vicinity of which it is deposited during a colour printing containing black pixels too, either to darken the same colours or to draw lines or characters. The lower optical density obtained is a consequence of the lower size of the printed pixel, which appears separated by white areas of the sheet with respect to the adjacent pixels.

With this second known method, even the black printed on the colour documents is not more "composite" but "true", in such a way improving the printing quality with respect to the previous method; however it has the disadvantage that, for the aforesaid reasons, the possible characters of the black text printed by means of the colour printing head have an optical density lower than the characters printed by the black printing head; moreover, when printing colour documents which contain a considerable black text part, the black "graphic" ink, contained in the colour printing head, exhausts sooner than the colour inks and the printing head becomes useless even if it still contains some colour inks; obviously this only happens when it is impossible to separately refill or replace the reservoirs of the "graphic" black and of the colour inks.

A commercial example of this second solution form is the printer model BJC 4000 manufactured by Canon®.

Further disadvantages, common to both these twoknown methods, consist on one hand in a penalization of the printer operation, being the user requested to replace the printing head according to the document to be printed, with corresponding possibilities to damage the contacts between the head and the assembly seat on the carriage and of dirtying in case of accidental contact with the printing head nozzles; on the other hand it implies the necessity of having a suitable container where to put the printing head not used at the moment, in order to avoid that the nozzles clog in conseguence of the drying of the ink left at the air.

A third method to solve the aforementioned problem, known in the art, consists in using a black printing head and a colour printing head with the three "primary" colours, similar to the one disclosed in the first method, coupled on the same carriage, overcoming in such a way the printing head replacement problem according to the document to be printed; but this solution, following what stated before about the incompatibility of the black ink contained in the black printing head with respect to the colour inks contained in the printing head, requires particular expedients to operate in a satisfactory manner if the pixels to be black printed are adjacent, or at a distance lower than a predefined minimum limit, to those pixels to be colour printed. Moreover it is easily comprehensible that, since the black pixels are printed with drops coming from the black printing head and the colour pixels are printed with drops coming from the colour head, an imperfect geometrical alignment between the two printing heads causes the defect due to the pitch variations of the aforesaid grid.

Systems have been suggested in the art in order to avoid this disadvantage, for example either requiring to the operator to execute a complex alignment procedure, at any printing head replacement, or printing as ''composite black'', by means of the colour printing head, the black pixels at a distance lower than a predetermined value (for example 6 pitches P of 1/300th of an inch) with respect to colour pixels, which in such a way appear both geometrically aligned, all coming from the same colour head, and compatible in the physical dimensions and chemical features; and, on the contrary, printing as "true black", by means of the black printing

head, the other black pixels sufficiently distant from the colour pixels in order to create neither unfavourable optical effects, even if the black printing head is not perfectly aligned, nor contamination problems due to the colours diffusion. But all that causes great complications to the electronic controller, which must find in the images to be printed the black pixels to be printed by the one or the other printing head, and a penalization in the printing speed and in the optical density obtainable in the contiguous black pixels or mixed to the colour areas.

In the European Patent Application No. EP 590852 a disclosure can be found of one of these analysing, decoding and processing systems of the document to be printed, while a commercial example of this third method is shown in the model DeskJet 550C manufactured by Hewlett-Packard®.

Always in order to reduce the problems caused by the physical-chemical incompatibility of the black ink with repect to the colour inks, and in particular for increasing the ink penetration into the printing support to the detriment of the surface diffusion, in order to reduce the distance with respect to the colour pixels where to print the black pixels with the black ink, it has been even suggested in the art the possibility to previously send a colour ink drop (for example cyan) into the black pixels where subsequently a black ink drop is put down (see for example the European Patent Application No. EP 590854), but that can cause drying problems and consequent paper deformation, together with printing speed reduction and cost increase.

All the various method known in the art, according to what has been discussed before, present a series of disadvantages, in such a way leaving not yet solved in a satisfactory manner the problem of printing, with ink-jet printers, quickly, at low cost and with high quality documents which contain parts to be black printed and parts to be colour printed, mixed together.

SUMMARY OF THE INVENTION

An object of the present invention is to print, by way of ink-jet printers, documents containing parts to be black printed and parts to be colour printed mixed together, in such a way that each part is printed with the best possible quality and with the greatest obtainable speed.

A further object of the present invention is to print, by way of ink-jet printers, documents containing parts to be black printed and parts to be colour printed mixed together, in such a way that the printing quality is not strictly conditioned by the accuracy of the adjustments of reciprocal geometrical alignment of two printing heads, one for black printing and the other for colour printing, mounted on the same printer carriage.

An other object of the present invention is to print, by way of ink-jet printers, documents containing parts to be black printed and parts to be colour printed mixed together, in such a way that no sophisticated technologies are necessary to identify the black pixels to be printed as "true black" or as "composite black".

A further object of the present invention is to print, by way of ink-jet printers, documents containing parts to be black printed and parts to be colour printed mixed together, in such a way that even the black pixels of the parts to be colour printed are printed as "true black" and not as "composite black".

An other object of the present invention is to print, by way of ink-jet printers, documents containing parts to be black printed and parts to be colour printed mixed together, without need to replace the printing head on the printer carriage according to the document to be printed.

A further object of the present invention is to print, by way of ink-jet printers, documents containing parts to be black printed and parts to be colour printed mixed together, in such a way as to optimize the consumption of the inks, both black and colour, contained in the printing heads reservoirs.

The aforesaid objects are obtained by way of a colour ink-jet printer and of a printing method characterised as stated in the main claims.

These and other objects, features and advantages of the present invention will be clearly understood by means of the following disclosure of a preferred embodiment, given by way of non-limiting and not restrictive example, with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 - represents a schematic view of the carriage of the colour ink-jet printer on which two printing heads are mounted.

Fig. 2 - represents a possible arrangement of the nozzles for ink issuing in a black printing head.

Fig. 3 - represents a possible arrangement of the nozzles for ink issuing in a colour printing head.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As already stated in the "Technical background", the structure and the general functioning of an ink-jet printer are already widely known in the art, therefore a detailed description will not be given here, limiting the description, in more detailed manner, to only some features relevant for the comprehension of the present invention

The heads-holder carriage 10 (see Fig. 1) is formed by a support 18 sliding on one or more guides 15 for the action of a system driven by a motor, not shown in the figure, in both directions represented by the arrows 11. On the support 18 there are housed two ink-jet printing heads, a black printing head 12 and a colour printing head 13; the two printing heads 12, 13 can be mounted and separately removed from the carriage and are kept contrained in the correct position by way of two elastic elements 14, which for example can be two little leaf

springs co-operating in a suitable seat, not shown in the figure, made in the body of the same printing heads.

The two printing heads 12, 13 are positioned in such a way as to present towards a printing support 16, in the figure represented by a sheet of paper, the face with the nozzles from which drops of ink are issued, according to the direction of the arrows 17, which reach the sheet 16, in such a way generating an image on it. The lower face of the printing heads 12, 13, not visible in the figure, is in contact with the connection terminal of a flat cable 19, on which are obtained the conductors for supplying driving signals, coming from an electronic controller not shown in the figure, to the printing heads 12, 13 for the selective issuing of the ink drops.

From now it will be disclosed, by way of non-limiting and not restrictive example, a possible embodiment of a black printing head 12 and of a colour printing head 13, that can be used on the colour printer according to the present invention; it is intended that printing heads with a different nozzles number, and/or with a different geometrical arrangement, and/or with a different nozzles diameter, can be used without departing from the teachings of the invention.

The black printing head 12 comprises a black ink reservoir and an ejector plate having 50 nozzles 120 (see Fig. 2), disposed on two lines 121a and 121b spaced by 10 pitches P of 1/300th of an inch, and staggered in such a manner that their projection on the sheet 16 is represented by a 50 pixels row at a constant pitch of 1/300th of an inch. Since even the feeding of the sheet 16 in the direction of the arrows 17 takes place by multiples of 1/300th of an inch, the combination of the back and forth motion of the carriage 10 along the guides 15 and of the motion of the sheet of paper 16 in the direction of the arrows 17, allows to address all the possible pixels of an orthogonal grid at a pitch of 1/300th of an inch.

Nominally the diameter of each single nozzle is typically comprised between 40 and 60, preferably between 43 and 55, better equal to about 50 μm; the volume of the single drop issued is typically comprised between 100 and 220, preferably between 130 and 190, better equal to about 160 pl; and the pixel printed on the sheet of paper 16 has a typical diameter comprised between 130 and 70, preferably between 115 and 85, better equal to about 100 μm. The ink contained in the reservoir has tipically a surface tension comprised between 40 and 60, preferably between 40 and 50, better between 43 and 48 dyne.cm, and the fixing of the same ink on the paper takes prevalently place by surface diffusion and by the solvent evaporation.

The colour printing head 13 comprises four distinct reservoirs, respectively containing a "graphic" black ink, a cyan ink, a magenta ink and a yellow ink, and an ejector plate (see Fig. 3) having four groups of nozzles 130, the geometrical arrangement of the nozzles being similar to the one of the nozzles 120 of the black printing head 12:

- a first group 131 comprising 16 nozzles connected to the "graphic" black ink reservoir;
- a second group 132, spaced 17 pitches P of 1/300th of an inch, comprising 16 nozzles connected to the cyan ink reservoir;
- a third group 133, spaced 16 pitches P of 1/300th of an inch, comprising 17 nozzles connected to the magenta ink reservoir;
- and finally a fourth group 134, spaced 15 pitches P of 1/300th of an inch, comprising 18 nozzles connected to the yellow ink reservoir.

Nominally the diameter of each single nozzle is typically comprises between 30 and 50, preferably between 35 and 45, better equal to about 40 μm; the volume of the drop issued is comprised between 40 and 140, preferably between 70 and 110, better equal to about 90 pl; and the pixel printed on the sheet of paper 16 has a typical diameter comprised between 35 and 85, preferably between 50 and 70, better equal to about 60 μm. The three inks corresponding to the "primary colours" and the "graphic" black ink typically have a surface tension comprised between 25 and 45, preferably between 25 and 38, better between 28 and 34 dyne.cm and the fixing of the same ink on the paper takes prevalently place by the solvent penetratiom.

With this specific configuration and features of the two printing heads 12 and 13 mounted on the carriage 10 it is clear that, being two different types of black ink available at the same time for printing, each one optimized according to the use or for black printing parts of a document, or for printing parts of a document with four-colours (i.e. with the three "primary" colours plus the black one) process, it is possible to define a printing method which permits to print by way of the black printing head 12 the parts of a document which need only the black ink, and by way of the colour printing head 13 the parts which need or the colour inks only or the combination of colour and black inks, so that the quality, speed and cheapness of the printing is optimised.

This method, simple and easily applicable, consists in using the specific software known as "printer driver", that usually are supplied, in the form of magnetic diskettes, directly by the supplier of the same printer or by the supplier of the operating system of the computer to which the printer is connected, in order to decompose the document to be printed in homogeneous areas typologically characterised as "text" areas (texts, solid lines or halftone black and white images, etc.) containing pixels to be only black printed, or as "figures" areas (colour pictures, graphs, pie charts, etc.) containing pixels to be black and colours printed, assigning the printing of the "text" areas to the black printing head 12 and the "figures" areas to the colour printing head 13.

The physical separation between the "text" areas and the "figures" areas may be, for example, of 1-1,5 mm (corresponding to 12-18 pitches P 1/300th of an inch); in other words, the decomposition is rough, as compared with the grid definition having a pitch of

1/300th of an inch on which the single pixel can be driven, and may easily be done without using complicated algorithms, but only with the aid of tools well known by the field experts, as "pointers" and "mouse", within the functionalities made available by the "printer drive" software.

By way of this simple division it is anyway possible to get valuable qualitative results, even if the alignment of the two printing heads is not perfect. It is appropriate to observe that this areas assignment operation, instead of to be manually carryied out by the printer's user, may be automatically performed by the same "printer driver" software, on the grounds of internal algorithms.

People expert in the art will appreciate that the ink-jet colour printer and the operating method previously disclosed permit to obtain the following advantages:

- all the black pixels of the document, both in the "text" areas and in the "figure" areas, are always printed as "true black" and not as "composite black" and therefore with a high optical density and without colour smudges;
- since the black pixels of the parts of the document which need only black ink (the texts typically) are printed by way of the black printing head 12 which is cheaper than the colour printing head 13, being the former more easy to build and containing a cheaper ink, the printing of the document has a cost lower than the cost of using the colour printing head only, and moreover it may be performed in a shorter time, because the black printing head has a number of nozzles higher than the number of nozzles which issue the "graphic" black ink of the colour printing head;
- the consuption of the four inks contained in the colour printing head 13 reservoirs is substantially homogeneous; in fact, while the document in its totality is often very unbalanced in favour of a greater consuption of black ink, the parts to be colour printed usually require a consuption substantially balanced of cyan, yellow, magenta and black inks, in such a way allowing the optimum utilization of all the ink contained in the four reservoirs;
- since the document areas printed by way of the black printing head 12 and the areas printed by way of the colour printing head 13 are physically separated, it is not necessary that the two printing heads are perfectly aligned, the eye being capable of perceiving few tenths of a millimetre misalignments only through a direct comparison.
- it is not necessary to use sophisticated methodologies, with a corresponding increase of the printer electronic controller costs, and of the time needed to process the image to be printed, in order to separate the pixels of the image to be black printed in pixels to be printed with true black ink by means of the black printing head 12, and those to be printed with "graphic black" ink by way of the colour printing head 13;
- it is not necessary to replace the printing head according to the document to be printed, being only required a pre-setting operation at the "printer driver" software level, in order to correctly assign the printing functions to the one or to the other of the two printing heads 12 and 13 mounted on the printer carriage.

Anyway, it is always possible to use also the previously described more sophisticated method, in which the "printer driver" performs a further decomposition of the "figures" areas, in order to extract from the latter some sub-areas in which the pixels to be black printed are spaced more than a predefined minimum limit value, for example 5/300th of an inch, with respect to the pixels to be colour printed, and assigning also the printing of these sub-areas to the black printing head 12, in such a way as to increase the use, even if only a bit, of the cheapest and fastest printing head. In this case, the improvement obtainable by using the printer according to the present invention consists in that all the black pixels of the document are printed as "true" black, and not partly as "true" black and partly as "composite" black, as it would happens in the known art, with the consequent aforesaid advantadges in printing quality, speed and cost.

People expert in the art can easily identify variations or changes to the colour printer and to the printing method above disclosed, without departing from teachings of the invention.

For example, it is possible to use a colour printing head, always comprising four distinct reservoirs respectively containing a "graphic" black ink, a cyan ink, a magenta ink and a yellow ink, but having an ejector plate provided with four groups of nozzles characterised as following: a first group comprising 12 nozzles connected to the "graphic" black ink reservoir; a second group, spaced 12 pitches P of 1/300th of an inch, comprising 12 nozzles connected to the cyan ink reservoir; a third group, spaced 11 pitches P of 1/300th of an inch, comprising 13 nozzles connected to the magenta ink reservoir; and finally a fourth group, spaced 10 pitches P of 1/300th of an inch, comprising 14 nozzles connected to the yellow ink reservoir.

For example it is possible to use, instead of two different printing heads, only one printing head, comprising five groups of nozzles connected to five reservoirs respectively containing a black ink, a "graphic black" ink, a cyan ink, a magenta ink and a yellow ink, being the number of each nozzles group and the relevant distance and geometrical arrangement changeable within limits stated only by the relevant technologies and costs. Moreover, this printing head may be either of removable type, mounted on a carriage which crosses the width of the sheet of paper on which the printing is made, or of the fixed type, capable of issuing ink drops throughout the sheet width (line printing head).

For example, it is also possible to use, both for black and colour printing, printing heads in which the ink reservoirs, instead of being integrated in the same printing head (in this case the printing head is called "monobloc") are removable and replaceable, so that, when empty, it is not necessary to replace all the printing head but only the reservoir ("refilling" printing heads).

Moreover it is possible to use inks with chemical-physical features different from the ones described, as well as the nozzles disposition, number and diameter may be modified, with the corresponding variations of the volume of the drops issued, and of the size of the pixel printed on the paper.

Moreover it is possible to modify the orthogonal grid pitch, for example taking it to 1/360th or to 1/600th or to 1/720th of an inch, consequently modifying the pitch of the line feeding of the printing support and the pitch in which the nozzles are disposed.

Or it is possible to use printing heads comprising only the passive devices for the drops issue, receiving from outside all the relevant driving signals, or can be used printing heads with a higher or lower "intelligence" degree, or which have internal active components (for example diodes, transistors, MOS, etc.) capable of performing at least the decoding and/or the amplification of the driving signals.

Finally, for example, the ink-jet printing process used can be the one called "thermic", in which the ink drop is issued by way of a vapour bubble generated within the same ink by a thermic effect, or it can be the one called "piezoelectric", in which the ink drop is issued by a pressure wave generated by a piezoelectric effect.

Briefly, keeping the features of the present invention, the construction details and the embodiment can be widely changed with respect to what described and explained, without departing from the teachings of the invention.

Claims

1. Colour ink-jet printer for printing images on a printing support (16), comprising printing means (12, 13) to print with a plurality of inks, characterised in that said plurality of inks comprises a first black ink, a set of three colour inks, and a second black ink.

2. Printer according to claim 1, characterised in that said second black ink is chemically and physically compatible with said set of three colour inks.

3. Printer according to claim 1, characterised in that said printing support (16) is selected in a group consisting of sheets of normal paper, sheets of special paper, continuous forms and thin sheets of transparent plastic.

4. Printer according to claim 1, characterised in that said first black ink has a surface tension comprised between 40 and 60 dyne.cm.

5. Printer according to claim 1, characterised in that said second black ink has a surface tension comprised between 25 and 45 dyne.cm.

6. Printer according to claim 1, characterised in that said set of three colour inks consists of a cyan ink, a magenta ink and a yellow ink.

7. Printer according to claims from 1 to 6, characterised in that said printing means (12, 13) comprise a fixed printing head for printing with said first black ink, with said set of three colour inks, and with said second black ink.

8. Printer according to claims from 1 to 6, further comprising a carriage (10) movable in a first direction (11) in order to cross all the width of said printing support (16), characterised in that said printing means (12, 13) are removably mounted on that carriage.

9. Printer according to claim 8, characterised in that said printing means(12, 13) comprise a printing head for printing with said first black ink, with said set of three colour inks, and with said second black ink.

10. Printer according to claim 8, characterised in that said printing means comprise a first printing head (12) for printing with said first black ink and a second printing head (13) for printing with said set of three colour inks and with said second black ink.

11. Printer according to claim 9, characterised in that said printing head (12, 13) is of a monobloc type, with integrated ink reservoirs.

12. Printer according to claim 9, characterised in that said printing head (12, 13) is of a refilling type, the refiling being done by way of ink reservoirs replacement.

13. Printer according to claim 10, characterised in that said first printing head (12) and said second printing head (13) are of a monobloc type, with integrated ink reservoirs.

14. Printer according to claim 10, characterised in that said first printing head (12) and said second printing head (13) are of a refilling type, the refiling being done by way of ink reservoirs replacement.

15. Printer according to claim 10, characterised in that said first printing head (12) comprises a plurality of

nozzles (120) for issuing drops of said first black ink.

16. Printer according to claim 10, characterised in that said second printing head (13) comprises a first group of nozzles (131) including a first plurality of nozzles (130) for issuing drops of said cyan ink, a second group of nozzles (132) including a second plurality of nozzles for issuing drops of said magenta ink, a third group of nozzles (133) including a third plurality of nozzles for issuing drops of said yellow ink, and a fourth group of nozzles (134) including a fourth plurality of nozzles for issuing drops of said second black ink.

17. Printer according to claim 15, characterised in that said plurality of nozzles (120) for issuing drops of said first black ink consists of 50 nozzles

18. Printer according to claim 16, characterised in that said first plurality of nozzles (131) for issuing drops of said cyan ink consists of 16 nozzles (130), said second plurality of nozzles (132) for issuing drops of said magenta ink consists of 17 nozzles, said third plurality of nozzles (133) for issuing drops of said yellow ink consists of 18 nozzles, and said fourth plurality of nozzles (134) for issuing drops of said second black ink consists of 16 nozzles.

19. Ink-jet printing method for printing colour images on a printing support (16), comprising the steps of:

- analysing the image to be printed in order to identify the pixels to be black printed and those to be colour printed;
- separating said pixels to be black printed into two classes, according to their closeness to said pixels to be colour printed, so that to a first of said two classes belong said pixels to be black printed which have a distance from said pixels to be colour printed shorter than a predefined minimum value, and to a second of said two classes belong the remaining of said pixels to be black printed;

characterised in that said pixels of said second class are printed with a first black ink and said pixels of said first class are printed with a second black ink.

20. Printing method according to claim 19, further comprising the step of printing said pixels to be colour printed with a set of three colour inks, characterised in that said second black ink is chemically and physically compatible with said set of three colour inks.

21. Printing method according to claim 19, characterised in that said set of three colour inks consists of a cyan ink, a magenta ink and a yellow ink.

22. Printing method according to claim 19, characterised in that said first black ink has a surface tension comprised between 40 and 60 dyne.cm, and said second black ink has a surface tension comprised between 25 and 45 dyne.cm.

23. Printing method according to claim 19, characterised in that said predefined minimum value of said distance is not shorter than 5/300th of an inch.

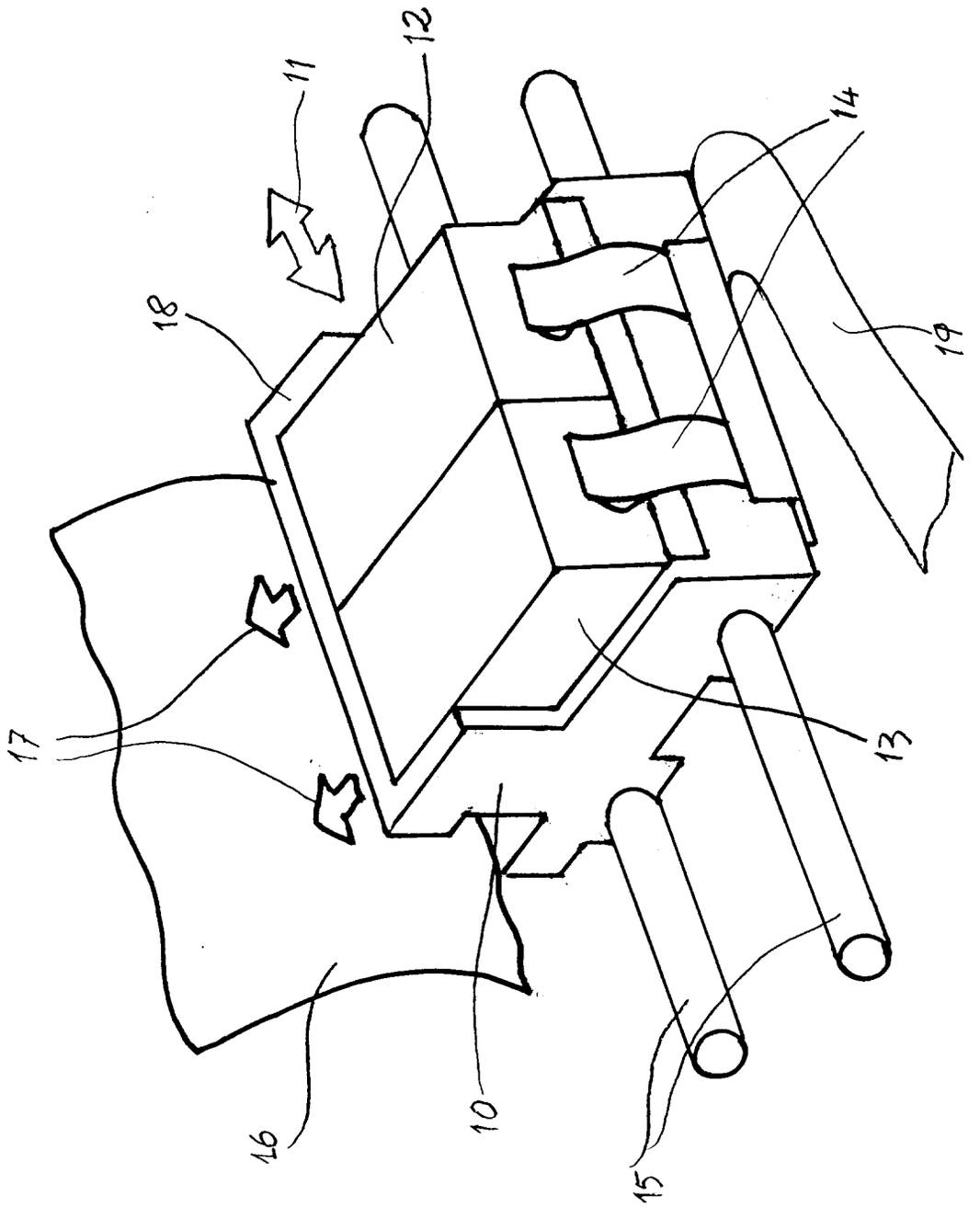

FIG. 1

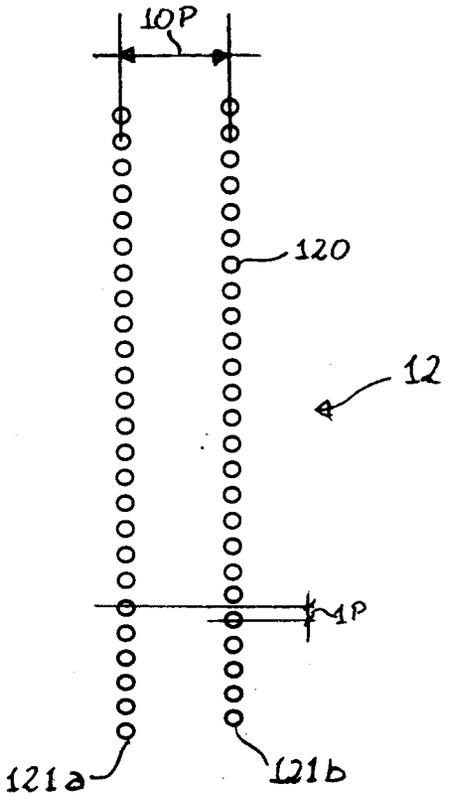

FIG. 2

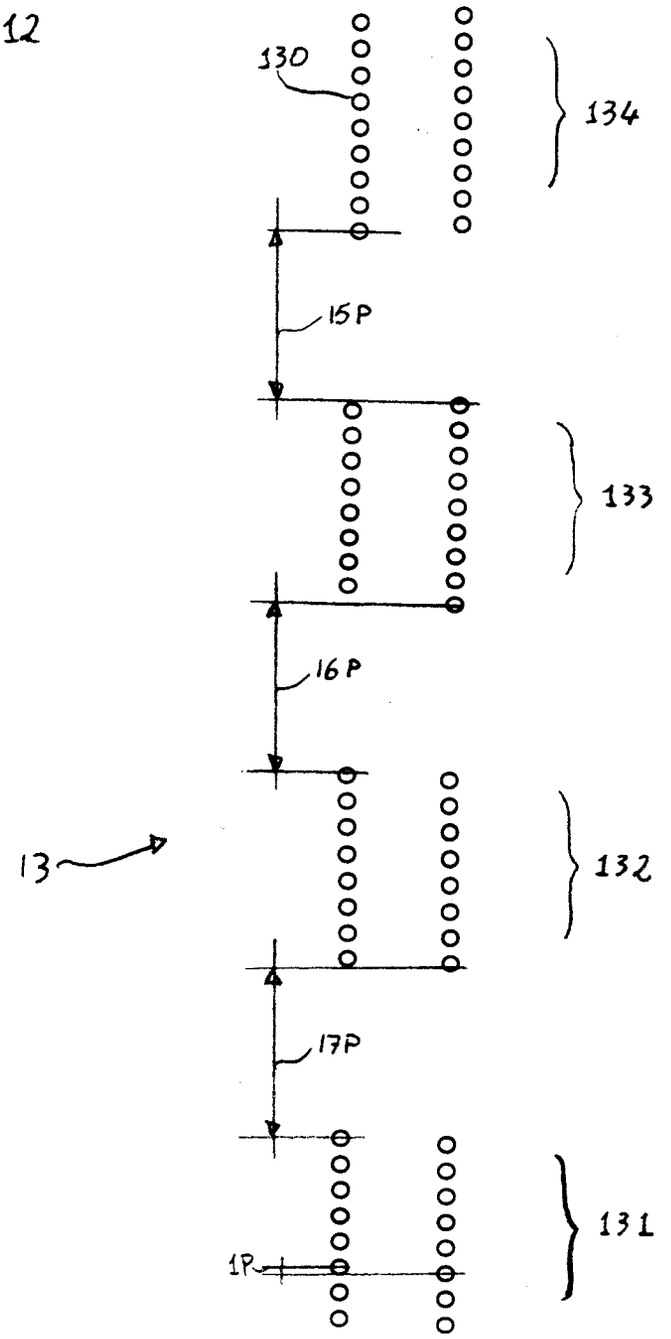

FIG. 3