Patent Claims

1. Method of inkjet printer operation, so that thereby image files of a predetermined color depth of b bpc (bits per color), b ϵ N, can be printed out, whereat, as the case may be, color depth signals specified in an image file are converted from a color system F_1, F_2, F_3, for example Red, Green, Blue, applied there into color depth signals of printing inks D_1, D_2, D_3, etc., for example Cyan, Magenta, Yellow, as well as Black and/or other colors, where applicable, available there so that in a process a resolution used for color depth of b bpc is surviving in the color depth signal referring to a printing color D_μ, whereat for one or several, in particular all printing colors D_μ, in each case at least two inks $T_{h,\mu}$, $T_{d,\mu}$ of the same color D_μ, but of varying color intensity are used, namely at least one lighter ink $T_{h,\mu}$ of a lighter color intensity $J_{h,\mu} > 0$, or even a colorless, brightening ink $T_{f,\mu}$ of a brightening, virtual color intensity $J_{f,\mu} < 0$ and at least one darker ink $T_{d,\mu}$ of a darker color intensity $J_{d,\mu}$, where the following applies:

$$J_{d,\mu} - n * J_{h,\mu} = 0$$

or:

$$J_{d,\mu} + n * J_{f,\mu} = 0$$

with $n \geq 2$; and $\mu = 1, 2, 3 \ldots$;
and whereat on an area assigned one pixel several drops of the same ink $T_{d,\mu}$, $T_{h,\mu}$, $T_{f,\mu}$ can be printed, namely maximal (n - 1) ink drops of the lighter or colorless ink $T_{h,\mu}$, $T_{f,\mu}$, and maximal (m - 1) ink drops of the of the darker ink $T_{d,\mu}$ so that with the darker ink $T_{d,\mu}$ m brightness levels can be accomplished, namely 0 ... $(m * J_{d,\mu})$, and with the lighter ink $T_{h,\mu}$ n brightness levels, namely 0 ... $(n * J_{h,\mu})$, what from altogether (n * m) different brightness levels are resulting, namely 0 ... $[(m - 1) * J_{d,\mu} + (n - 1) * J_{h,\mu})]$, **characterized by the fact**, that n ϵ N, $n = 2^x$, so that the following applies:

$$J_{d,\mu} - 2^x * J_{h,\mu} = 0$$

or:

$$J_{d,\mu} + 2^x * J_{f,\mu} = 0$$

where x ϵ N, can be x $\geq$ 2, for example 2, 3 or 4; then 2^x is in these cases $2^2 = 4$, or $2^3 = 8$, or $2^4 = 16$, and whereat control signals for a printing unit $E_{h,\mu}$ for a lighter or colorless ink $T_{h,\mu}$ are derived from x lower value bits of the color depth signal referenced to the print colors D_μ used in such way, that a number of drops of the lighter or colorless ink $T_{h,\mu}$, $T_{f,\mu}$, which is dependent on a value of the binary number in x lower value bits are shot at frequent intervals in succession, and whereat control signals for a printing unit $E_{d,\mu}$ for the darker ink $T_{d,\mu}$ are derived from not more than (b - x) higher value bits of the color depth signal referenced to the print colors D_μ, while a number of drops of the darker ink $T_{d,\mu}$ corresponding to a binary number in the not more than (b - x) higher value bits are shot at frequent intervals in succession, however time-delayed by a time interval +τ, -τ corresponding to the physical distance +d, -d of both printing units $E_{h,\mu}$ $E_{d,\mu}$ in transport direction of a substrate so that the ink drops of the same ink $T_{d,\mu}$, $T_{h,\mu}$, $T_{f,\mu}$ respectively of the same printing color D_μ can printed immediately on top of one another.

2. Method according to claim 1, characterized by the fact that n = m, so that altogether $(n * n) = n^2 \geq 2^b$ different brightness levels are resulting, namely 0 ... $[(n - 1) * J_{d,\mu} + J_{h,\mu})]$.

3. Method according to claim 2, characterized by the fact that b is even-numbered, therefore b = 2 * x with x ϵ N, x $\geq$ 1, so that with both inks together in total $n^2 = 2^{2x}$ different color depth or brightness levels are resulting, namely 0 ... $[(n - 1) * (J_{d,\mu} + J_{h,\mu})]$.

4. Method according to one of the foregoing claims, characterized by the fact that on one pixel up to $(2^x - 1)$ drops of the same ink can be printed on top of one another so that with the darker ink 2^x brightness levels can be achieved, namely 0 ... $(2^x - 1) * J_{d,\mu}$, and with the lighter ink also 2^x brightness levels, namely 0 ... $(2^x - 1) * J_{h,\mu}$, what from in total $2^x * 2^x = 2^{2x}$ different brightness levels are resulting, namely 0 ... $(2^x - 1) * (J_{d,\mu} + J_{h,\mu})$.

5. Method according to one of the foregoing claims, characterized by the fact that the various color intensity or brightness levels differentiate so that dye concentrations $c_{h,\mu}$, $c_{d,\mu}$ in the ink fulfill the following equation:

$$c_{d,\mu} = n * c_{h,\mu},$$

or

$$c_{d,\mu} = 2^x * c_{h,\mu}.$$

6. Method according to claim 5, characterized by the fact that the dye in the darker ink chemically conforms to the dye contained in the lighter ink.

7. Method according to one of the foregoing claims, characterized by the fact that two printing units for printing inks of the same color, but of different color depth or brightness, are triggered time-delayed by a time interval τ, whereat preferably the following applies:

$$\tau = d / v,$$

with

v = relative transport velocity of the substrate referencing to the printing unit.

8. Method according to one of the foregoing claims, characterized by the fact that a volume of a drop is between 0.5 pl and 20 pl, for example between 1 pl and 10 pl, preferably between 2 pl and 8 pl, in particular between 4 pl and 6 pl.

9. Method according to one of the foregoing claims, characterized by the fact that for generating an inkblot correspondent to an image information for one pixel on the substrate per printing pass and printing color altogether only a number of nozzle openings correspondent to the present color intensities of this printing color are used, of which one is located at the printing unit for a darker ink and another one is located at the printing unit for a lighter ink.

10. Method according to one of the foregoing claims, characterized by the fact that for generating an inkblot correspondent to the image information for one pixel on the substrate the individual ink drops of the same color and same brightness are printed on top of one another.

11. Method according to claim 10, characterized by the fact that the individual ink drops of the same color and same brightness to be printed on top of one another are dispensed in such quick succession that they unite together during their flight and result in only one single color drop per pixel on the printing substrate.

12. Method according to claim 10 or 11, characterized by the fact that the individual ink drops of the same color and same brightness to be printed on top of one another are dispensed in such quick succession that a previous drop has not jet completely come loose from the printing unit, when the following color drop per pixel is already dispensed so that the ink drops do not actually come apart from each other.

13. Method according to one of the foregoing claims, characterized by the fact that one or both of the printing units (2, 3) is capable of dispensing ink drops of various sizes, for example coded via a dual value.

14. Inkjet printer for printing out image files with a specified color depth b bpc, b ϵ N, in photo quality whereat for one or several, in particular all printing colors D_μ, so for example Cyan, Magenta, Yellow, as well as Black, where applicable,

    a) in each case at least two ink supply tanks (4, 5) are provided for different printing inks $T_{d,\mu}$, $T_{h,\mu}$, $T_{f,\mu}$ of the same printing color D_μ, but of different color intensity, namely at least one lighter ink $T_{h,\mu}$ of a lighter color intensity $J_{h,\mu} > 0$, or even a colorless, brightening ink $T_{f,\mu}$ of a brightening, virtual color intensity $J_{f,\mu} < 0$ and at least one darker ink $T_{d,\mu}$ of a darker color intensity $J_{d,\mu}$, where the following applies:

$$J_{d,\mu} - n * J_{h,\mu} = 0$$

or:

$$J_{d,\mu} + n * J_{f,\mu} = 0$$

with $n \in N$, $n \geq 2$; as well as

b) in each case two printing units (2, 3) are provided, of which one is supplied from an ink supply tank (5) for the darker ink $T_{d,\mu}$ the other one however from an ink supply tank (4) for the lighter or colorless ink $T_{d,\mu}$, $T_{f,\mu}$,

characterized by the fact, that $n = 2^x$, so that the following applies:

$$J_{d,\mu} - 2^x * J_{h,\mu} = 0$$

or:

$$J_{d,\mu} + 2^x * J_{f,\mu} = 0$$

where $x \in N$, can be $x \geq 2$, for example 2, 3 or 4; then 2^x is in these cases $2^2 = 4$, or $2^3 = 8$, or $2^4 = 16$, and whereat control signals for a printing unit $E_{h,\mu}$ for a lighter or colorless ink $T_{h,\mu}$ are derived from x lower value bits of a color depth signal referenced to the print colors D_μ used in such way, that a number of drops of the lighter or colorless ink $T_{h,\mu}$, $T_{f,\mu}$, which is dependent on a value of the binary number in x lower value bits are shot at frequent intervals in succession, and whereat control signals for a printing unit $E_{d,\mu}$ for the darker ink $T_{d,\mu}$ are derived from not more than (b - x) higher value bits of the color depth signal referenced to the print colors D_μ, while a number of drops of the darker ink $T_{d,\mu}$ corresponding to the binary number in the not more than (b - x) higher value bits are shot at frequent intervals in succession, however time-delayed by a time interval $+\tau$, $-\tau$ corresponding to the physical distance +d, -d of both printing units $E_{h,\mu}$ $E_{d,\mu}$ in transport direction of a substrate so that ink drops of the same ink $T_{d,\mu}$, $T_{h,\mu}$, $T_{f,\mu}$ respectively of the same printing color D_μ can printed immediately on top of one another and whereat for generating of an inkblot corresponding to an image information for one pixel on the substrate in each case only one single nozzle opening is provided at each printing unit $E_{h,\mu}$, $E_{d,\mu}$.

15. Inkjet printer according to claim 14, characterized by a data splitter that forwards the higher value bits of the color depth signal of a pixel to the

printing unit for the darker ink, the lower value bits of the color depth signal of the same pixel however to the printing unit for the lighter ink.

16. Inkjet printer according to claim 15, characterized by a delay module, which is next in line to only one output of the splitter, not however to the other.

17. Inkjet printer according to one of the claims 14 through 16, characterized by color depth registers for entering the bits of the color depth signal of a pixel allocated to a printer unit (2, 3).

18. Inkjet printer according to claim 17, characterized by a generating component that generates each time a pressure pulse within a specified time pattern as long as the value in the color depth register is greater than zero.

19. Inkjet printer according to claim 18, characterized by a decrementing component, which each time decrements the value stored in a color depth register by one after one of the pressure pulses has been generated.