As the nozzles and the media substrate move relative to each other, varying the flight time of the droplets shifts the position printed dot on the media surface.

Increasing the size of the nozzle array, or providing several different nozzle arrays will increase print speeds. However, larger nozzle arrays and multiple separate nozzle arrays greatly increase the difficulty to maintain a constant printing gap. Typically, there is a compromise between the production costs associated with fine equipment tolerances, and print quality and or print speed.

9. INK CONDUIT ROUTING

The ink supply to all the nozzles in a nozzle array should be uniform in terms of ink pressure and refill flow rate. Changing these characteristics in the ink supply can alter the drop ejection characteristics of the nozzle. This, of course, can lead to visible artifacts in the print.

Larger nozzle arrays are beneficial in terms of print speed but problematic in terms of ink supply. Nozzles that are relatively remote from the ink feed conduit can be starved of ink because of the consumption of ink by more proximate nozzles.

At a more general level, ink feed lines from the cartridge or other supply tank, to the printhead should be as short as possible. Printhead priming operations need to be configured to the ink color with the longest flow path from the ink reservoir. This means the nozzles in the array fed by other ink reservoirs may prime for longer than needed. This can lead to nozzle floods and wasted ink.

SUMMARY OF THE INVENTION

According to an aspect of the present invention, there is provided a printing system comprising: a print zone; a media path extending through the print zone; a drive roller positioned upstream of the print zone; a vacuum platen assembly comprising a fixed vacuum platen positioned under the print zone for supporting and contacting media in the print zone; a printhead assembly overlaying and spanning the print zone; and a vacuum belt assembly positioned downstream only of the print zone, the vacuum belt assembly being configured to receive media from the fixed vacuum platen, wherein the vacuum belt assembly comprises a plurality of individual moving belts and a vacuum chamber for drawing the media onto the plurality of individual moving belts.

1. PAPER FEED

According to a first ~~aspect~~embodiment, the present invention provides a printing system comprising:

a printhead assembly;

~~This aspect~~The first embodiment of the present invention is suited to use as a wide format printer in which the media path is greater than 432 mm (17 inches) wide.

In one embodiment the media path is between 914mm (36 inches) and 1372mm (54 inches) wide.

In one embodiment the print zone has an area less than 129032 square mm (200 square inches).

In one embodiment, the printing system is configured to generate less than 0.2 psi pressure difference between one surface of the media and the other as the media is fed across the fixed vacuum platen.

In one embodiment the printing system is configured to generate between 0.036 psi to 0.116 psi pressure difference between one surface of the media and the other as the media is fed across the fixed vacuum platen.

In one embodiment the vacuum platen assembly is configured to generate a normal force on the media of between 4 lbs to 13.5 lbs as the media is fed across the fixed vacuum platen.

In one embodiment wherein the individual vacuum belts are configured to transport the media at a faster speed than the drive roller.

In one embodiment the media simultaneously engages both the drive roller and the individual vacuum belts such that the media slips relative to the individual vacuum belts.

According to a second ~~aspect~~embodiment, the present invention provides a printing system comprising:

a print zone;

a drive roller positioned at an input side of the print zone;

~~This aspect~~The second embodiment of the present invention is suited to use as a wide format printer in which the media path is greater than 432 mm (17 inches) wide.

In one embodiment the media path is between 36 inches and 1372 mm (54 inches) wide.

In one embodiment the print zone has an area less than 129032 square mm (200 square inches).

In one embodiment, the printing system is configured to generate less than 0.2 psi pressure difference between one surface of the media and the other as the media is fed across the fixed vacuum platen.

In one embodiment the printing system is configured to generate between 0.036 psi to 0.116 psi pressure difference between one surface of the media and the other as the media is fed across the fixed vacuum platen.

In one embodiment the vacuum platen assembly is configured to generate a normal force on the media of between 4 lbs to 13.5 lbs as the media is fed across the fixed vacuum platen.

In one embodiment wherein the individual vacuum belts are configured to transport the media at a faster speed than the drive roller.

In one embodiment the media simultaneously engages both the drive roller and the individual vacuum belts such that the media slips relative to the individual vacuum belts.

According to a third ~~aspect~~embodiment, the present invention provides a printing system comprising:

a printhead assembly;

a vacuum platen assembly opposite the printhead assembly;

a media path between the printhead assembly and the vacuum platen;

adjacent a section of the media path defining a print zone, the print zone encompassing an area simultaneously printable by the printheads.

~~This aspect~~The third embodiment of the present invention is suited to use as a wide format printer in which the media path is greater than 432 mm (17 inches) wide.

In one embodiment the media path is between 36 inches and 1372 mm (54 inches) wide.

In one embodiment the print zone has an area less than 129032 square mm (200 square inches).

In one embodiment, the printing system is configured to generate less than 0.2 psi pressure difference between one surface of the media and the other as the media is fed across the fixed vacuum platen.

In one embodiment the printing system is configured to generate between 0.036 psi to 0.116 psi pressure difference between one surface of the media and the other as the media is fed across the fixed vacuum platen.

In one embodiment the vacuum platen assembly is configured to generate a normal force on the media of between 4 lbs to 13.5 lbs as the media is fed across the fixed vacuum platen.

In one embodiment wherein the individual vacuum belts are configured to transport the media at a faster speed than the drive roller.

In one embodiment the media simultaneously engages both the drive roller and the individual vacuum belts such that the media slips relative to the individual vacuum belts.

An input drive roller, print zone with printhead assembly and vacuum platen, and a vacuum belt enables the use of vertically activated service modules. This is a more compact

configuration than systems that have laterally displaced servicing stations. Embedding the service modules into the vacuum platen further condenses the overall configuration and simplifies the automation of printhead maintenance.

2. MEDIA FEED ENCODER

According to a fourth ~~aspect~~embodiment, the present invention provides an inkjet printing system comprising:

a vacuum platen assembly;

a printhead assembly spaced from the vacuum platen assembly; and

a media encoder embedded within the vacuum platen assembly.

In one embodiment the inkjet printing system further comprises a media feed axis extending between the printhead assembly and the platen wherein the printhead assembly has a plurality of printheads, and the media encoder is positioned to engage media between two of the printheads.

In one embodiment the inkjet printing system further comprises a print zone between the printhead assembly and the vacuum platen assembly where, during use, media is printed with ink from the printhead assembly, wherein the media encoder is positioned to engage the media proximate an upstream side of the print zone.

In one embodiment the inkjet printing system further comprises:

a drive roller for moving media onto the vacuum platen;

a vacuum belt assembly to move the media away from the vacuum platen; and,

a scanner adjacent the vacuum assembly to capture information from the media for feedback control of the printhead assembly.

In one embodiment the printhead assembly has a staggered array of printheads that, during use, collectively span the media, and the information captured by the scanner is used to align printing from each of the printheads with that of adjacent printheads in the array.

In one embodiment the drive roller moves the media past the printheads along a media feed axis, the printheads being arranged in two rows that are staggered with respect to each other and overlapping in a direction transverse to the media feed axis.

In one embodiment the vacuum platen assembly comprises a plurality of service modules, each with a vacuum platen configured for alignment with a corresponding one of the array of printheads.

In one embodiment the service modules are configured to cross the media path to engage the printhead during a capping or servicing operation.

In one embodiment the vacuum belt assembly includes a plurality of individual vacuum belts.

In one embodiment the vacuum platen assembly further comprises a fixed vacuum platen in which the service modules are embedded, the fixed vacuum platen being positioned adjacent a section of the media path defining a print zone, the print zone encompassing an area simultaneously printable by the printheads.

~~This aspect~~The fourth embodiment of the present invention is suited to use as a wide format printer in which the media path is greater than 432 mm (17 inches) wide.

In one embodiment the media path is between 36 inches and 1372 mm (54 inches) wide.

In one embodiment the print zone has an area less than 129032 square mm (200 square inches).

In one embodiment, the printing system is configured to generate less than 0.2 psi pressure difference between one surface of the media and the other as the media is fed across the fixed vacuum platen.

In one embodiment the printing system is configured to generate between 0.036 psi to 0.116 psi pressure difference between one surface of the media and the other as the media is fed across the fixed vacuum platen.

In one embodiment the vacuum platen assembly is configured to generate a normal force on the media of between 4 lbs to 13.5 lbs as the media is fed across the fixed vacuum platen.

In one embodiment wherein the individual vacuum belts are configured to transport the media at a faster speed than the drive roller.

In one embodiment the media simultaneously engages both the drive roller and the individual vacuum belts such that the media slips relative to the individual vacuum belts.

Embedding the encoder into the vacuum platen within the print zone further condenses the overall configuration by avoiding the use of star wheels and the like.

3. PRINTER OPERATION

According to a fifth ~~aspect~~embodiment, the present invention provides a printing system comprising:

a print zone where droplets of ink print onto media;

a drive roller configured to translate the media into the print zone; and,

a movable media engagement assembly for vacuum engagement of one side of the media to draw the media away from the print zone.

This ~~aspect~~embodiment of the present invention is suited to use as a wide format printer in which the print zone is greater than 432 mm (17 inches) wide.

In one embodiment the movable media engagement assembly has an apertured surface that has a media engagement side and low pressure region at a side opposite the media engagement side.

In one embodiment the printing system further comprises a media feed path extending between the pagewidth printhead assembly and the platen wherein the pagewidth printhead assembly has a plurality of printheads, and the media encoder is positioned to engage media between two of the printheads.

In one embodiment the media encoder is positioned to engage the media proximate an upstream side of the print zone. In one embodiment the platen is a vacuum platen.

In one embodiment the printing system further comprises a scanner adjacent the vacuum belt to capture information from the media for feedback control of the pagewidth printhead assembly.

In one embodiment the information captured by the scanner is used to align printing from each of the printheads with that of adjacent printheads in the array.

In one embodiment the vacuum platen comprises a plurality of individual vacuum platens that are each aligned with a corresponding one of the printheads, each of the individual vacuum platens being movable relative to the printheads.

In one embodiment the vacuum platen includes a plurality of service modules each corresponding to one of the printheads and configured to cross the media path to engage the printhead during a capping or servicing operation.

According to a sixth ~~aspect~~embodiment, the present invention provides a method of printing comprising the steps of:

translating media across a print zone at a first speed based upon the angular velocity of a drive roller; and,

subsequently translating the media at a second speed determined by a movable media engagement assembly configured to engage one side of the media.

In one embodiment the method further comprises the step of providing service modules in the vacuum platen, the service modules each corresponding to one of the printheads and configured to cross the media path to engage the printhead during a capping or servicing operation.

The use of a vacuum belt allows some slippage with the media but draws it out of the print zone at a speed faster than the input roller feeds it into the print zone. This maintains the media flush against the platen during printing and avoids the need for precise synchronization between the input and put drive on either side of the print zone.

According to a seventh ~~aspect~~embodiment, the present invention provides a printing system comprising:

a drive roller configured to engage and push media into a print zone; and,

a movable media engagement assembly configured to engage one side of the media and pull the media while the drive roller remains engaged with the media.

This ~~aspect~~embodiment of the present invention is suited to use as a wide format printer in which the print zone is greater than 432 mm (17 inches) wide.

In one embodiment the movable media engagement assembly has an apertured surface that has a media engagement side and low pressure region at a side opposite the media engagement side.

In one embodiment the movable media engagement assembly has a vacuum belt configured to receive the media from the print zone.

In one embodiment a leading edge of the media traverses from the drive roller to the vacuum belt during the first time period.

In one embodiment the drive roller is configured to control a media translation speed until the media disengages from the drive roller.

In one embodiment the printing system further comprises a scanner adjacent the vacuum belt to capture information from the media for feedback control of the pagewidth printhead assembly. In one embodiment the information captured by the scanner is used to align printing from each of the printheads with that of adjacent printheads in the array.

In one embodiment the vacuum platen comprises a plurality of individual vacuum platens that are each aligned with a corresponding one of the printheads, each of the individual vacuum platens being movable relative to the printheads. In one embodiment the vacuum platen includes a plurality of service modules each corresponding to one of the printheads and configured to cross the media path to engage the printhead during a capping or servicing operation.

Using two feed mechanisms to transport media through a print zone yields a compact but high performance pagewidth printing system that effectively avoids media buckling. Service modules embedded in a platen below the printhead assembly consolidate the design. Having the input drive roller control media speed until it disengages the media substrate reduces visible artifacts. The encoder wheel monitors the media substrate speed before and after media speed control switches from the input drive roller to the vacuum belts and this manages the media speed change with minimal visual impact on print quality.

4. SERVICE MODULES

According to an eighth ~~aspect~~embodiment, the present invention provides a printing system comprising:

a printhead assembly for printing media fed along a media path; and,

a plurality of service modules for the printhead assembly, each of the service modules being configured to operate in a plurality of different modes; wherein,

each of the service modules are independently operable.

This ~~aspect~~embodiment of the invention is well suited for use as a wide format printer in which the media path is wider than 432 mm (17 inches).

control the media transport speed subsequent to disengagement of the media from the input roller.

In one embodiment the printing system further comprises a media encoder positioned in the vacuum platen and configured to produce timing signals for operating the printhead assembly.

In one embodiment the printing system further comprises a scanner adjacent the vacuum belt to capture information from the media for feedback control of the pagewidth printhead assembly. In one embodiment the information captured by the scanner is used to align printing from each of the printheads with that of adjacent printheads in the array.

In one embodiment the vacuum platen comprises a plurality of individual vacuum platens that are each aligned with a corresponding one of the printheads, each of the individual vacuum platens being movable relative to the printheads. In one embodiment the service modules are configured to cross the media path to engage the printheads during a capping or servicing operation.

According to a ninth ~~aspect~~embodiment, the present invention provides a printing system comprising:

a media transport system configured to transport media along a media path;

a printhead assembly fixed relative to the media path; and,

a plurality of service modules for the printhead assembly, each of the service modules being independently movable relative to the media path.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the media path is wider than 432 mm (17 inches).

In one embodiment each of the service modules is configured to operate in a plurality of different modes. In one embodiment the printhead assembly has a plurality of printheads positioned to span the media path, each of the service modules configured to service one of the printheads respectively. In one embodiment the printing system further comprises a platen

In one embodiment the printing system further comprises a scanner adjacent the vacuum belt to capture information from the media for feedback control of the pagewidth printhead assembly.

In one embodiment the information captured by the scanner is used to align printing from each of the printheads with that of adjacent printheads in the array.

In one embodiment the vacuum platen comprises a plurality of individual vacuum platens that are each aligned with a corresponding one of the printheads, each of the individual vacuum platens being movable relative to the printheads.

According to a tenth ~~aspect~~embodiment, the present invention provides a printing system comprising:

a media transport system configured to transport media of differing dimensions along a media path;

a printhead assembly for printing media transported along the media path, the media path having differing widths depending on the dimensions of the media; and,

a plurality of service modules for the printhead assembly, each of the service modules being configured to operate in a plurality of different modes; wherein during use,

the media path extends between the printhead assembly and at least some of the service modules configured to operate in one of the modes while any of the service modules beyond the media path operate in another of the modes.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the media path is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the printhead assembly has a plurality of printheads positioned to span the media path, each of the service modules configured to service one of the printheads respectively.

assembly. In one embodiment the printing system further comprises a scanner adjacent the vacuum belt to capture information from the media for feedback control of the pagewidth printhead assembly.

In one embodiment the information captured by the scanner is used to align printing from each of the printheads with that of adjacent printheads in the array. In one embodiment the vacuum platen comprises a plurality of individual vacuum platens that are each aligned with a corresponding one of the printheads, each of the individual vacuum platens being movable relative to the printheads. In one embodiment the service modules are configured to cross the media path to engage the printheads during a capping or servicing operation.

By maintaining the printhead assembly using a number of independently operable service modules, individual parts of the printhead assembly can be replaced without re-priming the entire printhead. Similarly, sections of the printhead can remain capped if not required for printing media of a particular size.

5. AEROSOL REMOVAL

According to an eleventh ~~aspect~~embodiment, the present invention provides a printing system comprising:

a media feed assembly for feeding different sizes of media along a media path, the media path having a width corresponding to a maximum width of media that can be printed by the printing system;

a printhead assembly positioned on a first side of the media path and spanning the width of the media path;

an aerosol collection duct with an opening on the first side of the media path; and,

a spittoon system positioned on a second side of the media path opposing the first side; wherein,

the printhead assembly is configured to eject non-printing ink drops from any section not required to print media that is less than the maximum width, and the spittoon system is configured to collect the non-printing ink drops.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the media path is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the media feed assembly feeds media along the media path in a media feed direction and the printhead assembly has a plurality of printheads arranged into a group of leading printheads and a group of trailing printheads, the leading printheads being upstream of the trailing printheads with respect to the media feed direction. In one embodiment the opening of the aerosol collection duct is downstream of the trailing printheads.

In one embodiment the spittoon system is at least one service module operating in a spittoon mode.

In one embodiment the printing system further comprises a plurality of the service modules, one of the service modules being provided for each of the printheads respectively wherein during use, any of the printheads not fully required to print media that is less than the maximum width, have the corresponding service module operating in the spittoon mode. In one embodiment the service modules are configured to operate in a platen mode when all the corresponding printhead is printing the media. In one embodiment the service modules are independently operable.

In one embodiment the printhead assembly has a plurality of printheads positioned to span the media path, each of the service modules configured to service one of the printheads respectively.

In one embodiment the printing system further comprises a platen having an apertured platen face, wherein the service modules are positioned for accessing the printheads through the apertured platen face. In one embodiment the apertured platen face has an aperture for each one of the plurality of service modules respectively.

In one embodiment one of the modes is a capping mode for use when the printhead corresponding to the service module is inactive. In one embodiment one of the modes is a priming mode for use when the printhead corresponding to the service module is a newly installed replacement printhead. In one embodiment the service modules that do not correspond to the newly installed replacement printhead are configured to operate in the capping mode while the newly installed replacement printhead is primed.

In one embodiment the printing system further comprises:

a drive roller configured to engage and push media into a print zone; and,

a movable media engagement assembly configured to engage one side of the media and pull the media while the drive roller remains engaged with the media.

In one embodiment the movable media engagement assembly has an apertured surface that has a media engagement side and low pressure region at a side opposite the media engagement side. In one embodiment the movable media engagement assembly has a vacuum belt configured to receive the media from the print zone. In one embodiment the drive roller is configured to control a media translation speed until the media disengages from the drive roller. In one embodiment the vacuum belt is configured to control the media transport speed subsequent to disengagement of the media from the drive roller.

In one embodiment the printing system further comprises a media encoder positioned in the platen and configured to produce timing signals for operating the printhead assembly.

In one embodiment the printing system further comprises a scanner adjacent the vacuum belt to capture information from the media for feedback control of the pagewidth printhead assembly.

According to a twelfth ~~aspect~~embodiment, the present invention provides a printing system comprising:

an inkjet printhead assembly for printing media fed along a media path;

an aerosol collection system for collecting ink aerosol generated by the printhead assembly; wherein,

the printhead assembly is positioned on a first side of the media path and the aerosol collection system has a first aerosol collection opening positioned on the first side of the media path and a second aerosol collection opening positioned on a second side of the media path.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the media path is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the printing system further comprises:

a platen for supporting the media during printing; wherein,

the platen has a spittoon system for collecting non-printing drops of ink ejected from the inkjet printhead assembly.

In one embodiment the printhead assembly has a plurality of separate printheads fixed relative to the media path and the spittoon system has a corresponding plurality of service modules for each of the printheads respectively, the service modules being configured to operate in a spittoon mode when the corresponding printhead ejects non-printing drops of ink.

In one embodiment the printing system further comprises a media feed assembly for feeding different sizes of the media along the media path in a media feed direction, the media path having a width corresponding to a maximum width of media that can be printed by the printing system; wherein,

any of the printheads not fully required to print media that is less than the maximum width, have the corresponding service module operating in the spittoon mode.

In one embodiment the service modules are configured to operate in a platen mode when all the corresponding printheads are printing the media. In one embodiment the service modules are configured to operate in a capped mode when the corresponding printhead is not required for printing the media. In one embodiment the aerosol collection system is configured to collect ink aerosol from the first and second aerosol collection openings when the media being printed is less than the maximum width.

In one embodiment the printing system further comprises a scanner adjacent the vacuum belt to capture information from the media for feedback control of the pagewidth printhead assembly.

According to a thirteenth ~~aspect~~embodiment, the present invention provides a printing system comprising:

a drive roller for feeding different sizes of media along a media path;

an inkjet printhead assembly for printing the media; and,

an ink aerosol collection system for removing ink aerosol from areas adjacent the media path; wherein,

the ink aerosol collection system is configured to remove aerosol at a greater rate in response to an increase in the media size.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the media path is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the printhead assembly is positioned on a first side of the media path and the aerosol collection system has a first aerosol collection opening positioned on the first side of the media path and a second aerosol collection opening positioned on a second side of the media path.

In one embodiment the media path has a width corresponding to a maximum width of media that can be printed by the printing system and the aerosol collection system is configured to collect ink aerosol from the first and second aerosol collection openings when the media being printed is less than the maximum width.

In one embodiment the printing system further comprises:

a platen for supporting the media during printing; wherein,

the platen has a spittoon system for collecting non-printing drops of ink ejected from the inkjet printhead assembly.

a vacuum belt configured to receive the media from the print zone. In one embodiment the drive roller is configured to control a media translation speed until the media disengages from the drive roller. In one embodiment the vacuum belt is configured to control the media transport speed subsequent to disengagement of the media from the drive roller.

In one embodiment the printer system further comprises a media encoder positioned configured to produce timing signals for operating the printhead assembly.

This printing system effectively removes ink aerosol from a printing system having a fixed printhead assembly that spans the media path regardless of whether the media fully spans the media width and regardless of whether the printheads are ejecting non-printing drops for the purposes of preventing the nozzles from clogging.

6. INK DELIVERY

According to a fourteenth ~~aspect~~embodiment, the present invention provides a printing system comprising:

a printhead assembly with nozzles for ejecting ink;

a plurality of ink containers;

a plurality accumulator reservoirs, each having an inlet for connection to one of the ink containers, an outlet for connection to the printhead assembly and a fluid level regulator for maintaining fluid levels in the reservoir within a controlled fluid level range; wherein during use,

the plurality of ink accumulator reservoirs are mounted at a fixed elevation relative to the nozzles such that hydrostatic fluid pressure at the nozzles is maintained within a predetermined range.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the media path is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

generators. Priming is more reliable when ink is fed from both ends as trapped air bubbles are less likely to form. Feeding ink to both longitudinal ends also reduces any pressure drops and flow constrictions caused by long printhead. These pressure drops can be enough to deprime nozzles and starve them of refill ink.

According to a fifteenth ~~aspect~~embodiment, the present invention provides a printing system comprising:

an ink supply;

a feed line coupled to the ink supply;

a return line coupled to the ink supply;

a plurality of printheads each fluidically coupled to the feed and the return lines via separate couplings; wherein during printing,

each of the printheads receives ink from both the feed and the return lines.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the printheads span a media path that is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the printing system further comprises a valve for selectively opening or closing fluid communication between the feed and return lines.

In one embodiment the printing system further comprises a plurality of ink containers and a plurality accumulator reservoirs, wherein each of the printheads have nozzles for ejecting ink and each of the accumulator reservoirs has an inlet for connection to one of the ink containers, an outlet for connection to the printheads and a fluid level regulator for maintaining fluid levels in the reservoir within a controlled fluid level range; wherein during use,

the plurality of ink accumulator reservoirs are mounted at a fixed elevation relative to the nozzles such that hydrostatic fluid pressure at the nozzles is maintained within a predetermined range.

the platen has a spittoon system for collecting non-printing drops of ink ejected from the inkjet printhead assembly.

In one embodiment the printing system further comprises a plurality of service modules, wherein the printhead assembly has a plurality of separate printheads fixed relative to the media path and one of the service modules corresponding to each of the printhead respectively, the service modules being configured to operate in a spittoon mode to provide the spittoon system. In one embodiment any of the printheads not fully required to print media that is less than the maximum width, have the corresponding service module operating in the spittoon mode. In one embodiment the service modules are configured to operate in a platen mode when all the corresponding printhead is printing the media. In one embodiment the service modules are configured to operate in a capped mode when the corresponding printhead is not required for printing the media. In one embodiment the service modules are independently operable. In one embodiment the printing system further comprises a vacuum platen opposite the printhead assembly, the vacuum platen having a plurality of apertures in which the services modules are positioned.

According to a sixteenth ~~aspect~~embodiment, the present invention provides a printing system comprising:

an ink supply;

a feed line coupled to the ink supply;

a return line coupled to the ink supply;

a plurality of printheads each fluidically coupled to the first and return lines; and,

a bypass line coupling the feed line to the return line.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the printheads span a media path that is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the return line is configured to receive ink from the ink supply through the bypass line during a printing operation.

In one embodiment the printheads are positioned on a first side of the media path and the aerosol collection system has a first aerosol collection opening positioned on the first side of the media path and a second aerosol collection opening positioned on a second side of the media path. In one embodiment the media path has a width corresponding to a maximum width of media that can be printed by the printing system and the aerosol collection system is configured to collect ink aerosol from the first and second aerosol collection openings when the media being printed is less than the maximum width.

In one embodiment the printing system further comprises:

a platen for supporting the media during printing; wherein,

the platen has a spittoon system for collecting non-printing drops of ink ejected from the printheads.

In one embodiment the printing system further comprises a plurality of service modules, one of the service modules corresponding to each of the printheads respectively, the service modules being configured to operate in a spittoon mode to provide the spittoon system. In one embodiment any of the printheads not fully required to print media that is less than the maximum width, have the corresponding service module operating in the spittoon mode. In one embodiment the service modules are configured to operate in a platen mode when all the corresponding printhead is printing the media. In one embodiment the service modules are configured to operate in a capped mode when the corresponding printhead is not required for printing the media. In one embodiment the service modules are independently operable.

In one embodiment the printing system further comprises a vacuum platen opposite the printhead assembly, the vacuum platen having a plurality of apertures in which the services modules are positioned.

According to a seventeenth ~~aspect~~embodiment, the present invention provides a printing system comprising:

an ink supply;

an accumulator reservoir;

a valve coupling the accumulator reservoir to the ink supply, the valve being configured to open when the ink level in the accumulator reservoir reaches a lower limit of a predetermined ink level range, and close when the ink level in the accumulator reservoir reaches an upper limit of the ink level range; and,

a plurality of printheads in fluid communication with the accumulator reservoir, each of the printheads having nozzles for ejecting ink onto media; wherein during printing,

the accumulator reservoir is fixed relative to the printheads such that hydrostatic ink pressure at the nozzles is generated by the elevation of the ink level in the accumulator reservoir relative to the elevation of the of the nozzles.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the printheads span a media path that is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the valve is a float valve with a float that is buoyant on the ink in the accumulator reservoir to open the valve when the ink level reaches the lower limit and close the valve as the ink level approaches the upper limit.

In one embodiment the printing system further comprises a feed line coupled to the accumulator reservoir and a return line coupled to the accumulator reservoir, each of the printheads being connected to both the feed line and the return line via separate couplings.

In one embodiment the printing system further comprises a bypass line coupling the feed line to the return line. In one embodiment the return line is configured to receive ink from the ink supply through the bypass line during a printing operation.

In one embodiment the printing system further comprises a bypass valve in the bypass line for selectively opening or closing fluid communication between the feed and return lines.

In one embodiment each of the accumulator reservoirs has an inlet for connection to one of the ink containers, an outlet for connection to the printheads and a fluid level regulator

the platen has a spittoon system for collecting non-printing drops of ink ejected from the printheads.

In one embodiment the printing system further comprises a plurality of service modules, one of the service modules corresponding to each of the printheads respectively, the service modules being configured to operate in a spittoon mode to provide the spittoon system.

In one embodiment any of the printheads not fully required to print media that is less than the maximum width, have the corresponding service module operating in the spittoon mode. In one embodiment the service modules are configured to operate in a platen mode when all the corresponding printhead is printing the media. In one embodiment the service modules are configured to operate in a capped mode when the corresponding printhead is not required for printing the media. In one embodiment the service modules are independently operable.

In one embodiment the printing system further comprises a vacuum platen opposite the printhead assembly, the vacuum platen having a plurality of apertures in which the services modules are positioned.

Using an accumulator reservoir intermediate the ink tank and the printhead allows a depleted tank to be 'hot swapped' for a fresh tank while the printer is in operation. Hot swapping avoids printer downtime.

7. PRIMING/DE-PRIMING AND AIR BUBBLE REMOVAL

According to an eighteenth ~~aspect~~embodiment, the present invention provides a printing system comprising:

an ink supply;

a feed line coupled to the ink supply;

a return line coupled to the ink supply;

a plurality of printheads each coupled to the feed line and the return line; and,

a pumping system configured to generate fluid flow from the feed line to the return line via the printheads to prime the printheads.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the printheads span a media path that is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the printing system further comprises a plurality of variable flow constrictors configured to allow the pumping system to prime the printheads sequentially. In one embodiment the variable flow constrictors are pinch valves. In one embodiment the printing system further comprises an accumulator reservoir and a valve coupling the accumulator reservoir to the ink supply, the valve being configured to open when the ink level in the accumulator reservoir reaches a lower limit of a predetermined ink level range, and close when the ink level in the accumulator reservoir reaches an upper limit of the ink level range, wherein the printheads are in fluid communication with the accumulator reservoir, each of the printheads having nozzles for ejecting ink onto media; wherein during printing,

the accumulator reservoir is fixed relative to the printheads such that hydrostatic ink pressure at the nozzles is generated by the elevation of the ink level in the accumulator reservoir relative to the elevation of the of the nozzles.

In one embodiment the valve is a float valve with a float that is buoyant on the ink in the accumulator reservoir to open the valve when the ink level reaches the lower limit and close the valve as the ink level approaches the upper limit.

In one embodiment the printing system further comprises a feed line coupled to the accumulator reservoir and a return line coupled to the accumulator reservoir, each of the printheads being connected to both the feed line and the return line via separate couplings. In one embodiment the further comprises a bypass line coupling the feed line to the return line. In one embodiment the return line is configured to receive ink from the ink supply through the bypass line during a printing operation. In one embodiment the printing system further comprises a bypass valve in the bypass line for selectively opening or closing fluid communication between the feed and return lines.

In one embodiment the printing system further comprises a vacuum platen opposite the printhead assembly, the vacuum platen having a plurality of apertures in which the services modules are positioned.

According to a nineteenth ~~aspect~~embodiment, the present invention provides a printing system comprising:

an ink supply;

a feed line coupled to the ink supply;

a return line coupled to the ink supply;

a plurality of printheads each coupled to the feed line and the return line; and,

a pumping system to generate a pressure difference between the feed line and the return line during a printhead replacement operation.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the printheads span a media path that is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the pumping system is inoperative during a printing operation.

In one embodiment the pumping system is configured to individually de-prime a printhead prior to removal of the printhead from the printing system. In one embodiment the pumping system is configured to individually prime any one of the printheads after installation. In one embodiment the pumping system is configured to purge bubbles from any of the printheads through the return line. In one embodiment the printing system further comprises a plurality of accumulator reservoirs, one of the accumulator reservoirs being connected to each of the printheads respectively, wherein during use, the accumulator reservoirs receive air from the respective printheads during a priming operation.

In one embodiment the printing system further comprises a bypass line connecting the feed and the return lines such that ink can bypass the printheads when flowing from the feed line to the return line.

width of media that can be printed by the printing system and the aerosol collection system is configured to collect ink aerosol from the first and second aerosol collection openings when the media being printed is less than the maximum width.

In one embodiment the printing system according to claim 16 further comprises:

a platen for supporting the media during printing; wherein,

the platen has a spittoon system for collecting non-printing drops of ink ejected from the printheads.

In one embodiment the printing system further comprises a plurality of service modules, one of the service modules corresponding to each of the printheads respectively, the service modules being configured to operate in a spittoon mode to provide the spittoon system.

In one embodiment any of the printheads not fully required to print media that is less than the maximum width, have the corresponding service module operating in the spittoon mode. In one embodiment the service modules are configured to operate in a platen mode when all the corresponding printhead is printing the media.

According to a twentieth ~~aspect~~embodiment, the present invention provides a printing system comprising:

an ink supply;

a feed line coupled to the ink supply;

a return line coupled to the ink supply;

a plurality of printheads each fluidically coupled to the feed and the return lines;

a bypass line coupling the feed line to the return line; and,

a pumping system configured to initially prime ink through the feed line, the return line, and the bypass line before priming each of the printheads.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the printheads span a media path that is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

8. CARRIER ASSEMBLY

According to a twenty-first ~~aspect~~embodiment, the present invention provides a printing system comprising:

a print zone;

a media path extending through the print zone along a paper axis;

a printhead carriage for mounting a plurality of printhead modules adjacent the print zone such that the printhead modules collectively span the media path and are staggered with respect to the paper axis, the printhead modules each having nozzles arranged in parallel rows; and,

a plurality of datum features for holding the printhead carriage such that the parallel rows extend normal to the paper feed axis.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the media path is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the printhead carriage has a floor section for supporting the printhead modules and the datum features are secured to the floor section. In one embodiment the printheads modules are staggered with respect to the paper feed axis as well as a direction transverse to the paper feed axis to span the media path. In one embodiment each of the printhead modules has a series of elongate printhead integrated circuits positioned end to end and extending parallel to the direction transverse to the paper axis. In one embodiment the printhead cartridge has three of the datum features, two of the datum features being positioned to one side of the printhead modules and the remaining datum feature being positioned on the opposing side of the printhead modules with respect to the direction transverse to the paper axis. In one embodiment the printing system further comprises three datum points for engaging the datum features, two of the datum points are positioned on one side of the media path and the remaining datum point positioned on the opposite side of the media path.

In one embodiment the printing system further comprises:

In one embodiment any of the printheads not fully required to print media that is less than the maximum width, have the corresponding service module operating in the spittoon mode.

In one embodiment the service modules are configured to operate in a platen mode when all the corresponding printhead is printing the media.

The use of datum features provides accurate control of the print gap across the entire pagewidth printhead while allowing the printheads to be periodically moved away from the platen for access to paper jams and so on.

9. CARRIAGE ASSEMBLY TUBE ROUTING

According to a twenty-second ~~aspect~~embodiment, the present invention provides an inkjet printer comprising:

a print zone;

a media path extending through the print zone along a paper axis;

a printhead carriage with a plurality of printhead mounting sites for mounting a plurality of printhead modules adjacent the print zone such that the printhead modules collectively span the media path; and,

a plurality of interfaces for supplying ink to, and receiving ink from each of the printhead modules respectively.

In one embodiment each of the interfaces are configured to supply different ink colors to the printhead modules. In one embodiment each of the interfaces has two separate fluid couplings, each of the fluid couplings has a plurality of conduits, each of the conduits being for one of the different ink colors only. In one embodiment one of the fluid couplings supplies ink to the printhead module and the other receives ink from the printhead module. In one embodiment the mounting sites each have electrodes for engaging contact pads on each of the printhead modules respectively, the electrodes engaging the contact pads along a first longitudinal side of the printhead module and the interface engaging a second longitudinal

elongate printhead integrated circuits positioned end to end and extending parallel to the direction transverse to the paper axis. In one embodiment the printhead carriage has three of the datum features, two of the datum features being positioned to one side of the printhead modules and the remaining datum feature being positioned on the opposing side of the printhead modules with respect to the direction transverse to the paper axis.

In one embodiment the inkjet printer further comprising three datum points for engaging the datum features, two of the datum points are positioned on one side of the media path and the remaining datum point positioned on the opposite side of the media path.

In one embodiment the inkjet printer further comprises:

an ink supply;

a feed line coupled to one of the fluid couplings on each of the interfaces; and,

a return line coupled to the other of the fluid couplings on the interfaces.

Individual ink supply interfaces for each of the printhead modules allows individual removal and replacement of any defective modules. This eliminates the need to replace an entire pagewidth printhead which consumes a lot of ink when primed.

According to a twenty-third ~~aspect~~embodiment, the present invention provides a printing system comprising:

a print zone;

a media path extending through the print zone along a paper axis;

a printhead carriage with a plurality of printhead mounting sites for mounting a plurality of printhead modules adjacent the print zone such that the printhead modules collectively span the media path, the printhead carriage having a long side extending transverse to the paper axis, the long side having access formations for ink conduits; and,

a plurality of interfaces for connection to the ink conduits to supply ink to each of the printhead modules respectively; wherein,

all ink for the plurality of printhead modules is supplied by ink conduits extending through the access formations on said long side of the printhead carriage.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the media path is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment each of the interfaces has a fluid coupler configured to supply different inks to the printhead modules. In one embodiment the ink conduits are a plurality of tube bundles each coupled to a corresponding fluid coupler and configured to route ink from a single side of the printhead carriage. In one embodiment the ink interfaces are also configured to receive ink from the printhead modules. In one embodiment each of the interfaces has two separate fluid couplings, each of the fluid couplings has a plurality of conduits, each of the conduits being for one of the different ink colors only. In one embodiment one of the fluid couplings supplies ink to the printhead module and the other receives ink from the printhead module.

In one embodiment the mounting sites each have electrodes for engaging contact pads on each of the printhead modules respectively, the electrodes engaging the contact pads along a first longitudinal side of the printhead module and the interface engaging a second longitudinal side of the printhead module, the first longitudinal side being opposite the second longitudinal side. In one embodiment the fluid couplings are movable between a retracted position and an extended position, the extended position being closer to the first longitudinal side than the retracted position.

In one embodiment the printer system further comprises a plurality of printhead driver printed circuit boards (PCB's) for each of the printhead modules respectively, each of the printhead driver PCB's having a print engine controller for controlling the operation of the nozzles on the printhead module to which it is connected during use. In one embodiment the printer system further comprises a supervising driver PCB connected to the plurality of printhead driver PCB's for transferring print data to each of the printhead modules. In one embodiment the printhead modules each have an array of nozzles for ejecting ink, and each of the mounting sites has a datum surface for engaging the printhead module at that mounting site to control relative positioning of the nozzle arrays on all the printhead modules. In one embodiment the mounting sites are staggered with respect to the paper axis. In one

embodiment the nozzles on each of the printhead modules overlaps the nozzles on at least one other of the printhead modules in a direction transverse to the paper axis. In one embodiment the supervising PCB apportions the print data corresponding to the overlaps between the printhead modules.

In one embodiment the printhead modules each have nozzles arranged in parallel rows and the printhead carriage has a plurality of datum features for holding the printhead carriage such that the parallel rows extend normal to the paper feed axis. In one embodiment the printhead carriage has a floor section for supporting the printhead modules and the datum features are secured to the floor section. In one embodiment the printheads modules are staggered with respect to the paper feed axis as well as a direction transverse to the paper feed axis to span the media path. In one embodiment each of the printhead modules has a series of elongate printhead integrated circuits positioned end to end and extending parallel to the direction transverse to the paper axis.

In one embodiment the printhead carriage has three of the datum features, two of the datum features being positioned to one side of the printhead modules and the remaining datum feature being positioned on the opposing side of the printhead modules with respect to the direction transverse to the paper axis.

In one embodiment the printer system further comprises three datum points for engaging the datum features, two of the datum points are positioned on one side of the media path and the remaining datum point positioned on the opposite side of the media path.

According to a twenty-fourth ~~aspect~~embodiment, the present invention provides a print engine for an inkjet printer defining a media path extending past a printhead assembly along a paper axis, the print engine comprising:

an elongate printhead carriage extending transverse to the paper axis;

a series of interfaces for supplying ink to respective printhead modules spaced along the printhead carriage such that during use, the printhead modules span the media path; and,

ink conduits connected to the interfaces for feeding ink to the printhead modules;

wherein,

the printhead carriage has a series formations to position the ink conduits such that they all extend away from the interfaces in a direction transverse to the long axis to a common side of the printhead carriage.

This ~~aspect~~embodiment of the invention is well suited to use as a wide format printer in which the media path is wider than 432 mm (17 inches) and typically from 36 inches to 1372 mm (54 inches).

In one embodiment the common side of the printhead carriage is a side wall and the formations are apertures in the side wall. In one embodiment each the interfaces are spaced from an adjacent one of the interfaces along the paper axis. In one embodiment the interfaces are divided into two groups, a first group that is relatively upstream with respect to the paper axis and a second group that is relatively downstream with respect to the paper axis, the interfaces in each group being aligned with each other on a line normal to the paper axis. In one embodiment\ each of the interfaces is configured to feed ink into and receive ink from the printhead module to which it is connected. In one embodiment each of the interfaces has a plurality of fluid couplers, each fluid coupler corresponds to one of the apertures in the side wall.

In one embodiment the ink conduits are flexible tubes and the flexible tubes that connect to any one of the fluid couplers are gathered into a tube bundle, each of the tube bundles extending through one of the apertures in the side wall respectively. In one embodiment the fluid couplings are movable between a retracted position and an extended position, the extended position being closer to the first longitudinal side than the retracted position.

In one embodiment the print engine further comprises a plurality of printhead driver printed circuit boards (PCB's) for each of the printhead modules respectively, each of the printhead driver PCB's having a print engine controller for controlling the operation of the nozzles on the printhead module to which it is connected during use.