January 2020

HIGH CAPACITY INK COLLECTOR FOR TEXTILE PRINTING ON POROUS MEDIAS BASED ON SLOPING PLATES

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High capacity Ink collector for textile printing on porous medias based on sloping plates

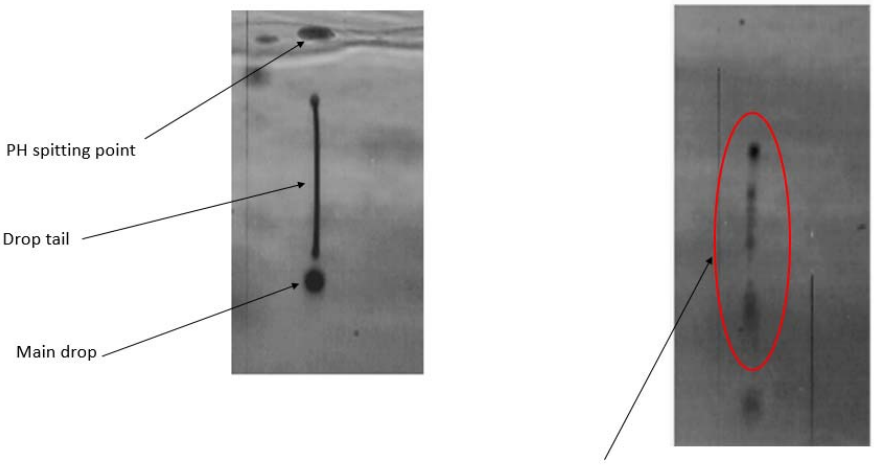
Abstract:

Textile printing, and specifically digital textile printing is becoming more important in the industry the last years mostly because of the improvement in the versatility, customization and time reduction between first designs and the introduction to the market. In some application (e.g. dye sublimation) the workflow requires to print in some paper media and transfer the ink to the textiles by means of a calender (external machine). On the other hand, in some other applications, direct printing ("Direct To Fabric" or DTF) on the textile media is possible (e.g. fashion, decor, some soft signage). In some of these DTF applications (e.g. flags), the media used to print on is porous. Thus, printers must be able to collect and manage the rest of ink that pass through the media.

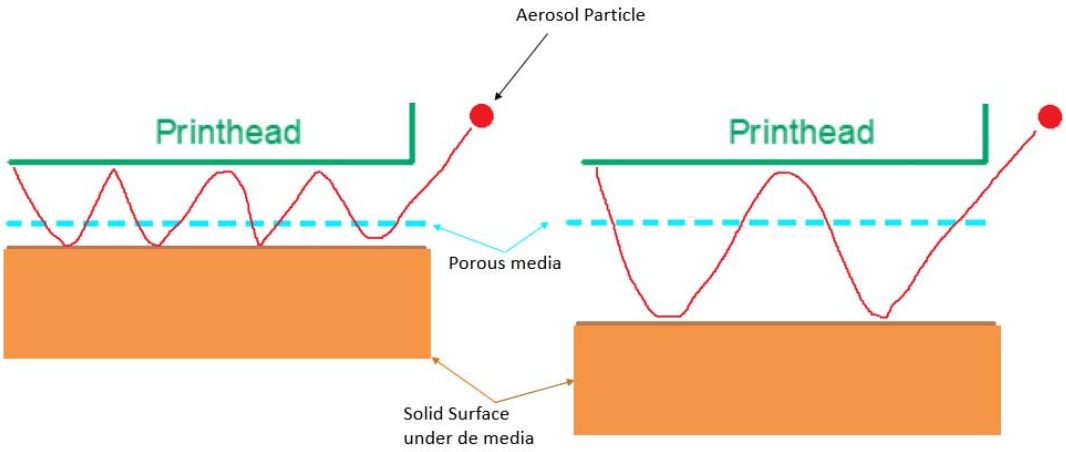
Depending on the application, the porosity of the media may be higher or lower, and the amount of ink that will run through the media can vary between 0% and near the 100%. This fact makes necessary some kind of ink collector system under the printing area (where the ink drops are spit) to recollect all the waste ink.

Moreover, the space between the Printhead (where the drop is spit) and the solid surface where the drop is fixed, called drop traveled distance, is critical for the aerosol generation. In porous medias, this drop traveled distance is the one from the Printhead to the solid surface below the porous media (see more details in attached documentation).

Thus, the higher the drop traveled distance is, the higher amount of aerosol the printer will generate, and the higher undesirable dirtiness the printer will suffer. The reason is because drops are easily disintegrated becoming spray. In addition, with a larger traveled distance aerosol has less possibility to get stuck on the Printhead surface or solid surface (less bounces), and more possibilities to “escape” and to get dirty other parts of the printer. Aerosol causes not only “cosmetic” dirtiness, but also can cause failure modes in optical sensors, encoder readers, electrical contacts, etc.

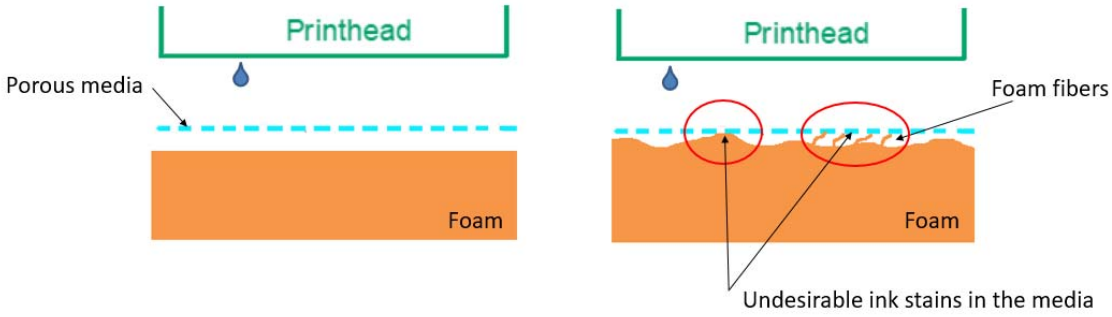


While the traveled distance is increased the drop tail, and even the main drop, is easily disintegrated becoming spray and aerosol.

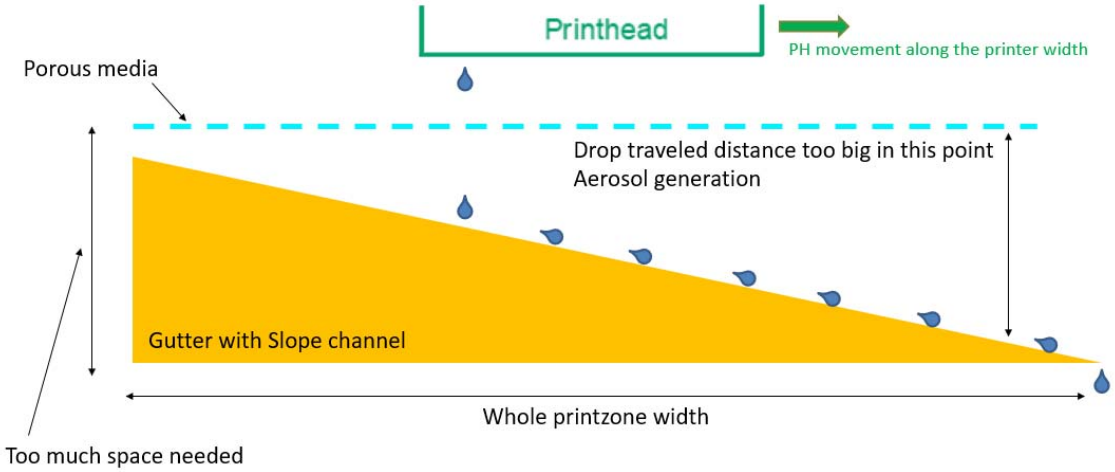


Due to these high variability of printing applications, a high valuable printer for customers are versatile printers capable of printing in both paper-based and textile-based materials. In order to handle with these porous medias, current printers commonly use some accessories based on removable foams as an ink collector. When these foams are ink-saturated, they are removed and replaced by some new ones. The problem with the foams is that they are not a very clean solution and it requires a high user/service intervention. Foams are usually a consumable parts, so they are not a very environment-friendly solution as far as sustainability is concerned either.

Moreover, while foams are absorbing more ink, they are expanding its size. Because of the fact that these foams must be placed as close as possible to the media (below it) to reduce drop traveled distances and aerosol, it is common that at some point, some dirty fibers from the foam or even some part of the foam itself touches the media and stain it.



Other solutions current printers commonly use, are kind of gutters that allow to channel the ink from the whole printing area to a specific point where it is accumulated or drained. If this ink flow is done by the gravity, the gutter must have enough slope to avoid holding back the ink (slopes higher than 30%). If this slope covers the whole printzone width, it means that printer would need too much space and the distance to the printhead would be too big in its lower position.



On the other hand, if the ink is accumulated in the gutter (no slope), this gutter would need enough space to accumulate enough ink. This will require big drop traveled distance, high levels of aerosol, and high user/service intervention in cleaning the gutter… in conclusion, high level of dirtiness.

The proposed invention is a removable print surface based on several smaller sloping plates, placed under the printing media, that allow to collect all ink that pass through the porous media by gravity, and at the same time, it does not require too much space and it significantly reduces the drop traveled distance. This print surface can be composed by several identic sections, so the whole printer width could be covered (no matter how wide the printer is).

Once the ink reaches the sloping plates, it flows to another cavity through some holes. Here, the ink could be accumulated (for a future emptying), or drained through a tube pipe or similar component (using gravity of even some pump) depending on the viscosity and rheological properties.

This way to collect the ink is most effective in terms of user/service intervention and could be even unlimited. Moreover, it does not require foams (avoiding replacing them) and the space between the media and the surface where the drops are fixed (sloping plates) could be minimum because there are no fibers that could stain the media. Thus, the drop traveled distance could be reduced and the possible aerosol generation is also reduced.

Moreover, this print surfaces could be removable and interchangeable with a solid common Printzone to get a totally versatile printer able to print porous and non-porous media.

Problems Solved:

As said before, the proposed invention is a “free-consumable” solution that solves the undesirable use of foams in the ink collector when porous medias are used in printing. The use of foams is suitable for versatile printers where the use of porous medias is poor (almost negligible). In that cases, the replacement of the foams is not so often and the costs per printer are acceptable. However, in application where the use of porous medias is more important, foams are not the best option for the high service cost and high replacement. Other solutions like ink channels (gutters) have other limitation such a high amount of aerosol, dry ink in the channel because of not enough slope… Other solutions like motorized scrapers are more complex, more expensive and would need too much space to get a minimum drop traveled distance.

The invention solves the problem in a most sustainable and cost-effective way that current expensive methods avoiding replacement components like unsustainable foams and increasing the life of the ink collector. This invention allows to build a completely versatile printers for printing on both paper-based and textile-based materials, even on porous materials without aerosol issues (because the sloping surfaces are placed very close to the media and there is a vacuum system absorbing any possible aerosol particle), without stain issues (because the distance from the surfaces to the media is very stable), and without foam issues (continuous replacements, fibers affecting Printhead reliability, ink stains).

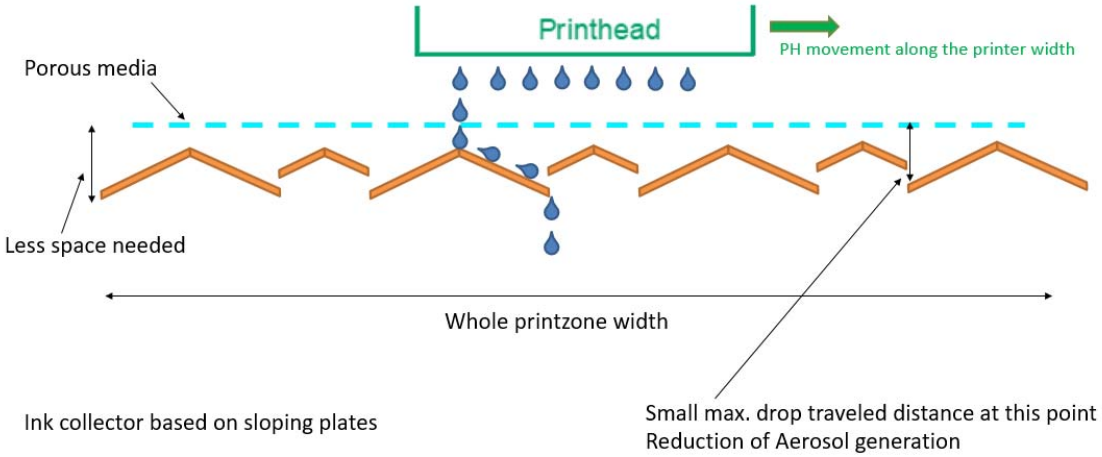
Prior Solutions:

As said before, currently, printers that can print on porous media have some system (accessory if the printers are versatile) to allow them to collect all waste ink that pass through the medias. These systems are commonly based on foams that must be replaced once they are ink-saturated. Depending on the use of the printer, these foams must be replaced too often and the user/service intervention rate are high, increasing the cost of the printer maintenance and getting worst customer perception. Moreover, foam-based ink collectors have important issues as fibers, foams increase their size while they absorb ink, foam surface are not easy to be controlled and they easily can touch the media and stain it. To solve this problem, some printers add some expensive systems that allow to modify the distance from the media and the foams.

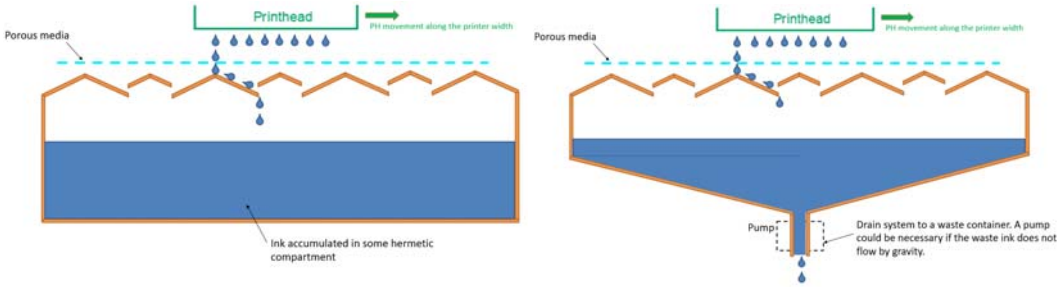
Other current solutions such an ink gutters are not so versatile options due to ink handle issues and the more space required, so they are more suitable for exclusive DTF printers (e.g. Mimaki TX300P). Even though, they have some other limitations: The gutter needs either some slope to avoid ink blockage, some user intervention to clean the gutter, or some complex mechanism like motorized scraper to clean the gutter. Moreover, if the ink gutter is too deep (in order to increase ink capacity), the printer generates too much aerosol because of a high drop traveled distance.

Description:

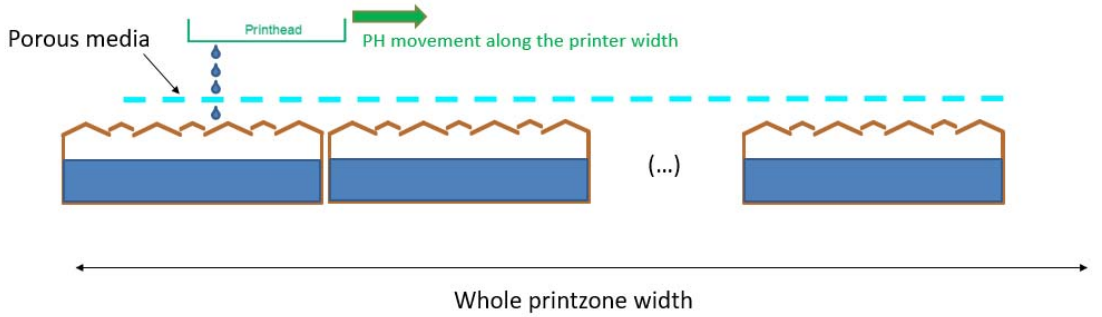
The invention basically consists on a removable (or not) set with a sloping plates-based top surface, placed in cross-web direction (perpendicular to the media advance) and covering the whole width of the Printzone. These units are placed under the porous media with a minimum gap (max. 5mm) without touching it. The sloping plates also cover the length of the printing zone (printing swath) in order to collect all ink that pass through the media.



Under the sloping surfaces, after the ink is evacuated from the top surface by some holes, the ink could be accumulated in some hermetic compartment (with enough capacity to reduce the replacements) or could also be drained using a drain system into a waste container (part to be replaced when it is full). The drain system is out of the scope of this disclosure, but it could be based on a simple hole, a pipe or tube, and a pump system if the gravity is not enough to evacuate the ink (depending on the viscosity and the rheological properties of the waste ink).



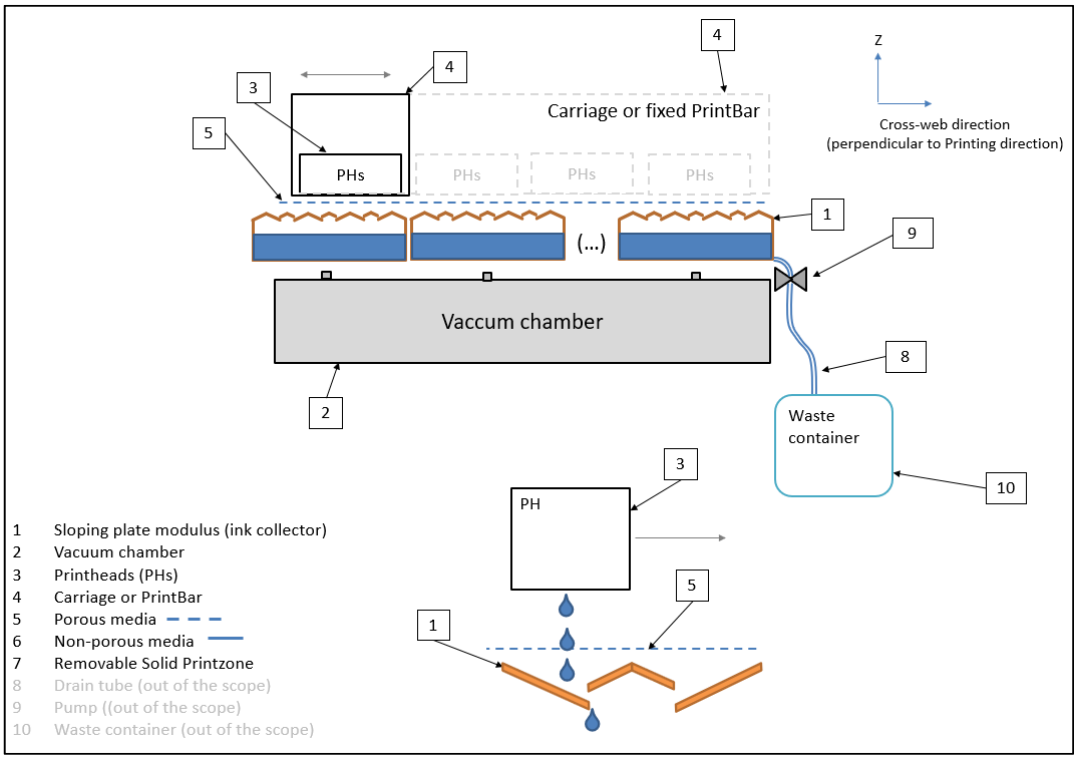
Moreover, it could be a single set or could also consist on various modulus placed in shunt configuration to cover the whole width of the printer.

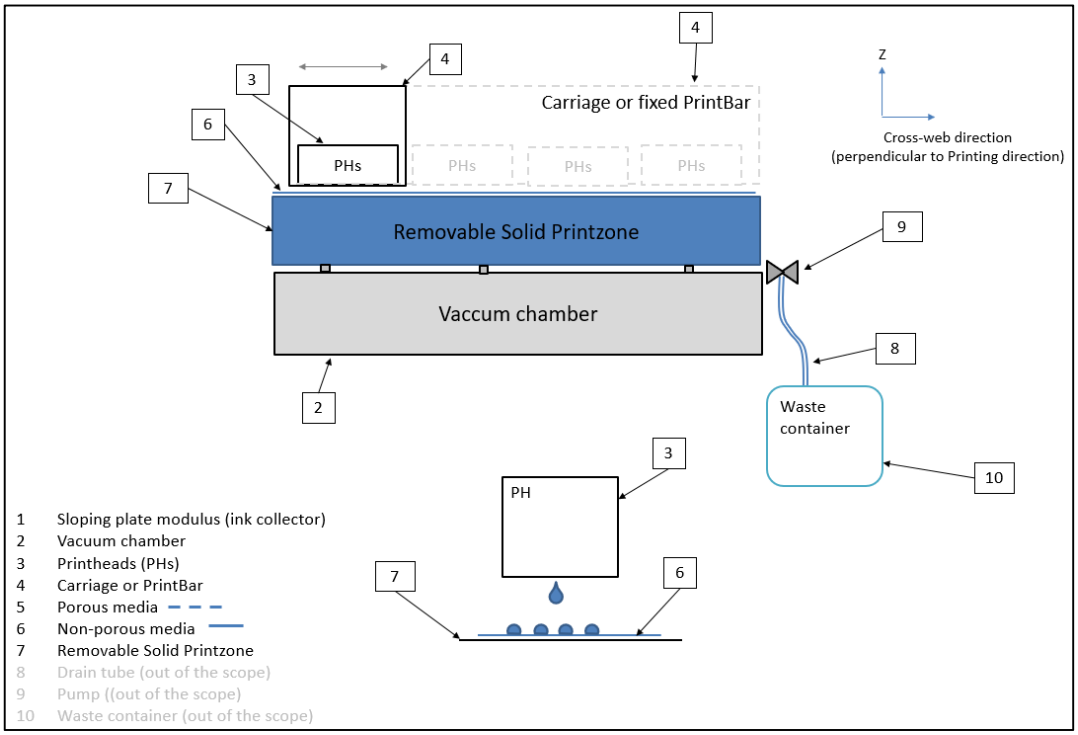


As seen in the images, the sloping plates could be placed very close to the porous media (without touching it) to minimize de drop travel distance with the printhead. This distance could be the minimum possible to avoid touching the media (max 5 mm) and it would be very stable. Consequently, minimum aerosol would be generated.

A vacuum chamber could also be placed fixed with the printer (not removable). Although vacuum is not effective with porous medias, the vacuum system could be (or not) connected with the sloping plates components by some vacuum channels in order to absorb the small quantity of aerosol that could be produced during printing. In this case, a filter or other stuck system would be needed to attract the aerosol particles.

On the other hand, it is known that non-porous media needs some vacuum to be properly printed. If a solid printzone (instead of the sloping plates-based solution) is installed in versatile printers to print non-porous media, the vacuum chamber could have some features to fit this printzone too. Consequently, the vacuum chamber would be connected to the solid Printzone and the required vacuum could be obtained to control de non-porous media. For this reason, the invention that is described allow to build a fully versatile printer by easily exchange the ink collector by a solid Printzone with vacuum.

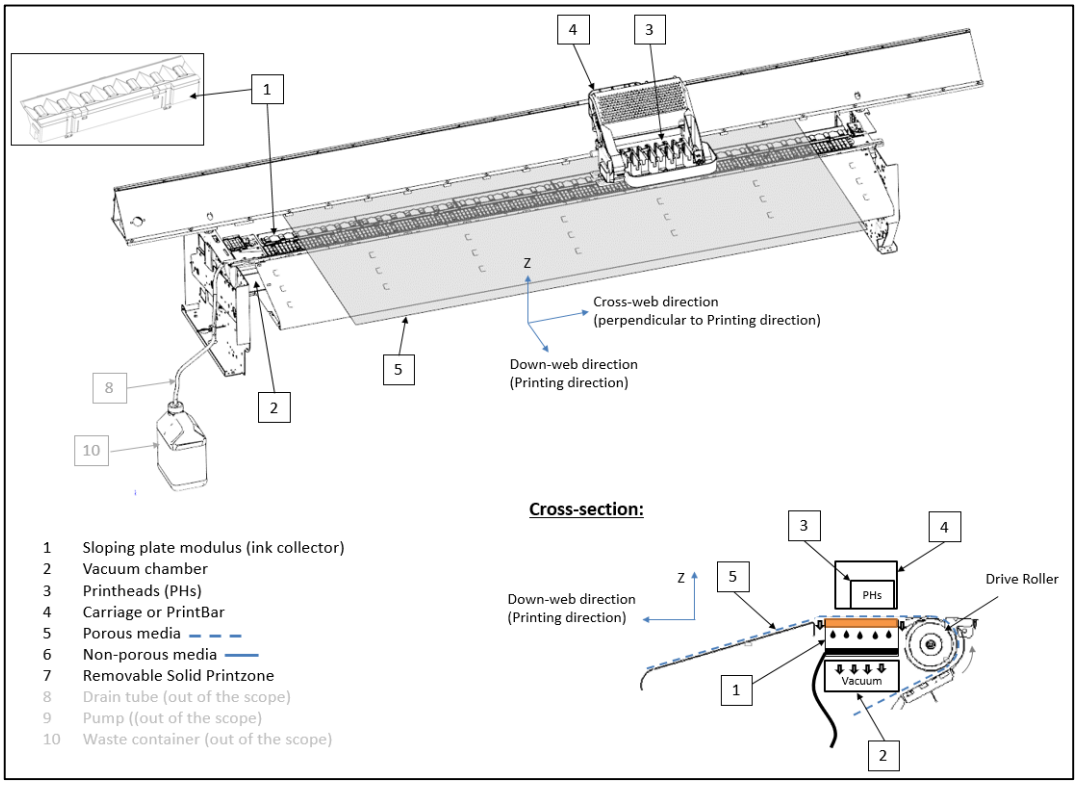




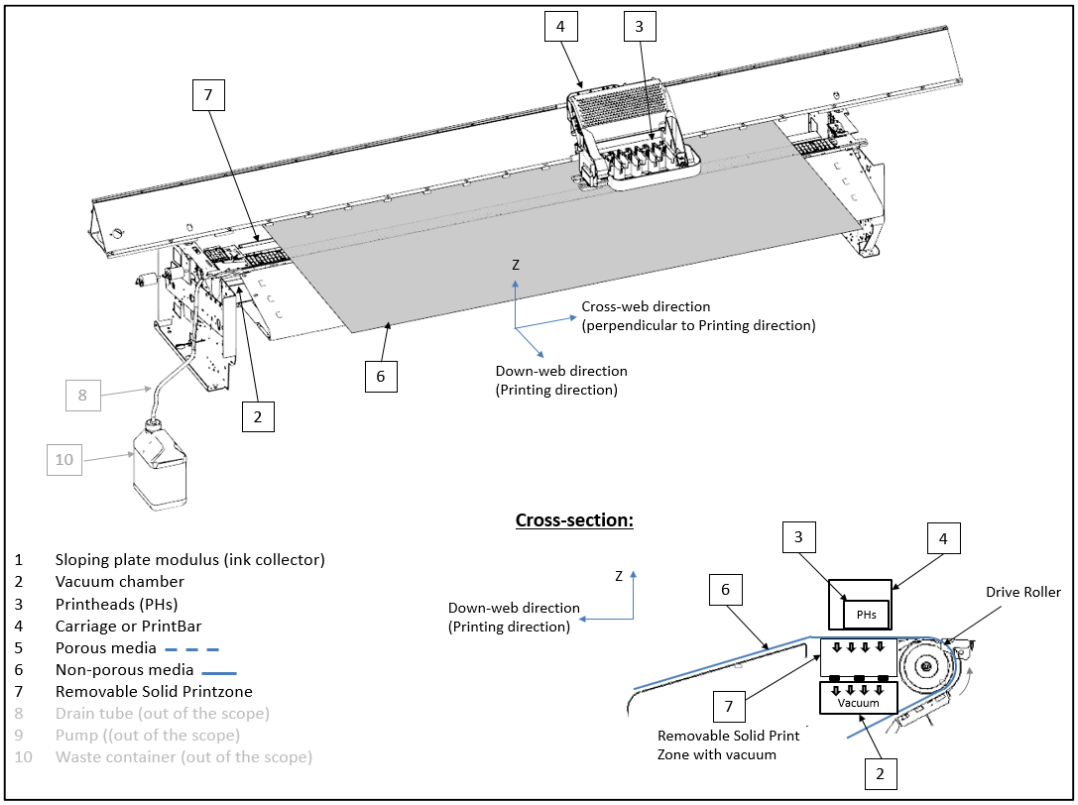
Advantages:

Main advantages of this invention are:

- Easy, clean and cost-effective method to use in versatile printers for printing on both paper-based and textiles-based medias, or exclusive DTF printers.
- No need to use foams: reduce issues with fibers, stain marks
- Reduce the consumable parts (no foams), so more sustainable and environment-friendly solution.
- High capacity ink collector. Reduction user/service intervention rate in applications where porous medias are used.
- Possibility to build a Versatile printer by easily exchange the ink collector by a solid PrintZone with vacuum.
- Less space required in comparison with current solutions.
- Easier waste ink management (easier to manage the waste ink in a bottle or tank, rather than ink-stained foams).
- Modular solution that can be adapted in different printer widths.
- “Ink collector” solution for porous media is fully compatible with “solid printzone” for paper and non-porous medias with a single Printhead-to-media distance. No need for lifter systems to modify it depending on the application.



1 Sloping plate modulus (ink collector)
2 Vacuum chamber
3 Printheads (PHs)
4 Carriage or PrintBar
5 Porous media
6 Non-porous media
7 Removable Solid Printzone
8 Drain tube (out of the scope)
9 Pump ((out of the scope)
10 Waste container (out of the scope)



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Disclosed by Ignasi Bonjoch, Niels Sanchez and Diego Lopez, HP Inc.