April 10, 2019

SEQUENCE OF MOVEMENTS OF THE CUT MEDIA TO STACK IT WITHOUT INTERFERING WITH THE PRINTING OF THE NEXT PAGE

HP INC

Sequence of movements of the cut media to stack it without interfering with the printing of the next page

This disclosure relates to the finishing operations in a large format printer. A new sequence of movements of the automatic cutter; the print carriage; the media; and the integrated stacker to cut and stack a finished page without interfering with the printing of the next page achieving the maximum print speed of the print engine is described.

A sequence of separate movements of the first and second pages are performed in parallel in such a way that the maximum throughput of the print engine is achieved. The cutting between the first and second pages is performed in parallel with one of the carriage passes. The first page is moved to the stacker and the trailing edge moved away from the path of the second page before the leading edge of the second page arrives to the stacker.

This idea solves the throughput limitation present in most large format printers due to the stopping of the printing operation while cutting and (in some cases) stacking the media.

The different media movements in most large format printers for cutting and stacking the media are typically performed sequentially. The printing operation must stop for several seconds while they are being performed. The media is advanced to the cutting area and back to the print zone after cutting. The cutter is moved by the print carriage and it is not possible to print and cut simultaneously.

In current large format printers in roll to sheet configuration, after finishing the printing of one page several steps are followed before the printing of next page can begin:

1. The media must be advanced to the cutting position.
2. The print carriage activates the cutter.
3. The media is cut.
4. The finished page is advanced to the stacker.
5. The unprinted media is moved back to the print zone.
6. The printing of the next page can start.

The total time for all these operations is about 8.8 seconds. For a typical large format printer, the total printing time in fast mode for a D-size page is about twenty seconds without considering the steps mentioned above for cutting and stacking. The maximum number of pages (D-size) that could be achieved by the print engine is about three pages per minute but the cutting and stacking operations reduce this number to two pages per minute.

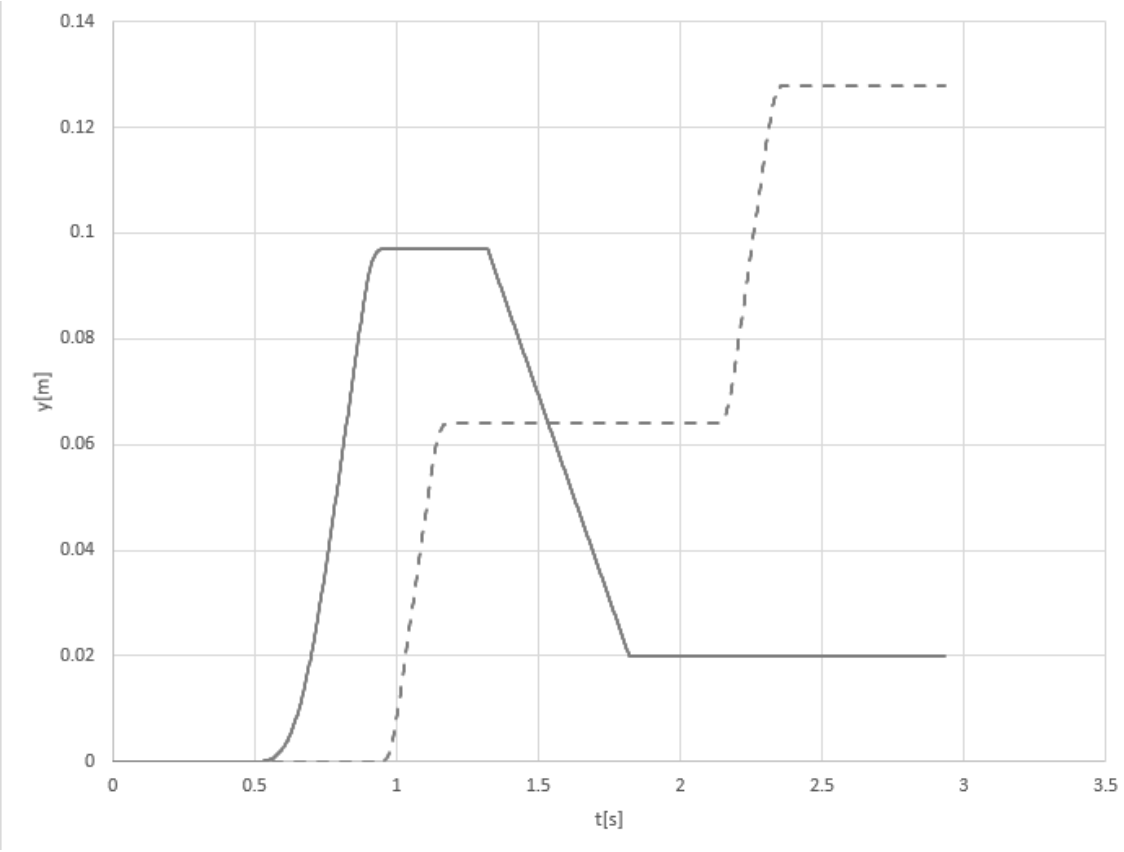
The proposed solution avoids this limitation and the maximum print engine throughput can be achieved.

In the proposed solution, a new motorized cutter that is conveniently positioned in the media path performs the media cutting when the printing of the next page has already started and without affecting the normal sequence of movements of this next page printing.

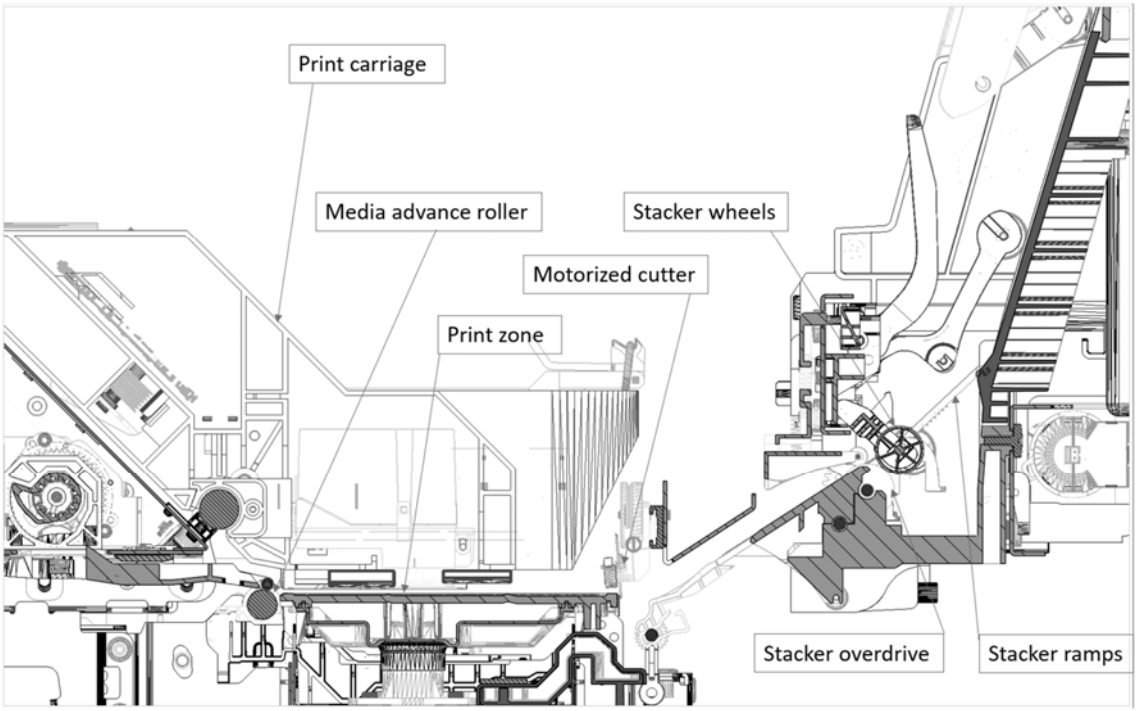
The sequence of movements consists on the following steps:

1. The print carriage finishes the last pass of the first page.
2. The media is advanced, so the beginning of the second page arrives to the print zone. This advance is slightly longer than a normal advance in this print mode because it must leave space between the two pages for the margins. This is the only impact in throughput for cutting and stacking with the proposed sequence. This impact is very small (~0.04s).
3. The print carriage begins printing the first passes of the second page.
4. When the media stops for the carriage to print the second or fourth pass (this depends on the printer) the center of the margin space that has been left unprinted between the first and the second pages lies in the cutting area.
5. Simultaneously with the printing of the third or fifth pass (this again depends on the printer) the independently motorized cutter trims the media between the first and second pages.
6. From now on the movements of the first and second pages are described separately.
7. First page:
    a. Once the cutting operation has ended, the first page starts moving. The overdrive shaft in the stacker accelerates this first page to move it in one single motion into the stacker.
    b. When the trailing edge of this first page has cleared the star wheels that pinch the media on the stacker overdrive, the stacker ramps start to retract.
    c. When the ramps are completely retracted, the trailing edge of the first page falls into the bottom of the stacker pushed by the first set of the stacker wheels.
    d. When the sensor in the first set of stacker wheels detect that the trailing edge of the first page has gone into the stacker the stacker ramps start moving out again to receive the leading edge of the second page.
8. The second page follows the typical movements for this printer and print mode:
    a. When the carriage finishes printing the third or fifth pass (printer dependent), the paper advances for the next pass. In this movement, the second page must not overcome the first page to prevent a possible media jam. This risk is avoided by starting to move the first page a little time in advance of the second page (the cutting time must always be shorter than the time for one pass of the printing carriage) and using a similar (or slightly bigger) acceleration for the first page than for the second one.
    b. The second page stops for the carriage to print the next pass (4^{th} or 6^{th}) of the second page. At this point the leading edge of the second must not have arrived at the stacker overdrive. During this period when the second page is stopped, the stacker ramps must retract and start moving out again (points 7.b. to 7.d.)
    c. In the next advance movement of the second page it may arrive to the stacker overdrive (this is printer dependent). By this time, the stacker ramps should have begun their outward movement.

In the next chart the relative positions of the trailing edge of the first page (solid) and the leading edge of the second page (dash) during the cutting and stacking operations are shown.



Cross section view of one possible implementation



The main advantages of this idea are:

1. About 8.8s savings per D size page. The relevance of this saving is higher in printers with a faster print engine
2. Reduced cost increase (~2%-4% printer DMC increase)

Disclosed by Alberto Arredondo, Ivan Lopez Avila, Daniel Merencio Merencio and Martin Urrutia Nebreda, HP Inc.