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June 14, 2019

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Recommended Citation

INC, HP, "STAPLED JOB FLIP FOR INCREASED OUTPUT CAPACITY IN PRINTER OUTPUT DEVICE", Technical Disclosure Commons, (June 14, 2019)
https://www.tdcommons.org/dpubs_series/2284



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Stapled Job Flip for Increased Output Capacity in Printer Output Devices

Title: Stapled Job Flip for Increased Output Capacity in Printer Output Devices

Short Title: A method of increasing output device stapled job capacity by selectively flipping jobs and stapling them in the opposite corner.

Abstract: The proposed disclosure consists of the printer selectively flipping and reordering a percentage of jobs to be stapled in the adjacent corner. This results in a balanced thickness output stack, which increases the number of stapled jobs that can be stacked in a given height before the output obstructs and causes a failure.

Background: Printer output devices typically offer stapling as one of their functions. The most common location for stapling is an upper corner of a print job (e.g., upper left corner). The thickness of a stapled job is greater in the region where the staple is located, due to the added thickness of the staple. When a large quantity of stapled jobs are output and stacked by the finishing device, the accumulation of staples in the same area causes the stack to grow in height non-uniformly (see Figure 1). As a result, the output capacity of the bin is reduced from the maximum possible.

Prior Solutions: Existing solutions to increase stapled job stack height, or increase the job stack quality related to stapled jobs, are:

1. Job offsetting – Offset the jobs so the stapled corners do not stack immediately one upon the next,
2. Limit stapled job stack height – limit the stapled job stack height, and thus limit the number of jobs that can be printed and stapled before the output bin is declared full, to just a fraction of the overall capacity of the output bin, and
3. Output bin corner adjustment – physically modify the corners of the output bin so that the corners are lower than the rest of the output bin and thus provide extra room for the stapled corner.

The proposed disclosure will increase the height of the output stack so that a greater number of jobs can be printed and stapled before the output bin is declared full, the output stack quality is unacceptable, or the output stack obstructs following jobs. The proposed disclosure can be used in conjunction with any of the existing solutions listed above to increase stack height ever more and provide better stack quality.

Problems Solved: The proposed disclosure increases the number of stapled jobs that can be stacked in a given output bin height. This is particularly beneficial to users that need to print a very large number of stapled jobs.

Advantages: The proposed disclosure does not require any additional hardware or cost. It consists entirely of logic and software/firmware control. This disclosure can be retrofitted and used on any existing printer that has an output device capable of stapling in opposite corners.

Proposed Disclosure Overview: The proposed disclosure consists entirely of logic and firmware control. As stapled jobs are accumulated in the output bin, the printer would keep track of the number of stacked and stapled jobs and staple location. It would then determine how to best optimize the stack size by either alternating job staple orientation between jobs or within a large job consisting of many copies. For example, the printer could print and staple the first job with the staple corner near the front of the printer, and the printer could flip the next job and staple the corner near the rear of the printer. The switching of the staple corner location provides greater stack height and better stack quality.

The goal of the algorithm is to balance the stack by stapling 50% of the jobs in the opposite corners within the output bin (but the same corner of the output document), without unduly affecting the user as they sort their stack. The potential amount of stack height improvement for a balanced job is equal to $\frac{1}{2}$ of the stack tilt (see Figure 2).

In order to accomplish an opposite staple location without changing the absolute staple location within the job, for example, the staple will always be in the upper left corner of the document for all copies, the firmware will need to flip

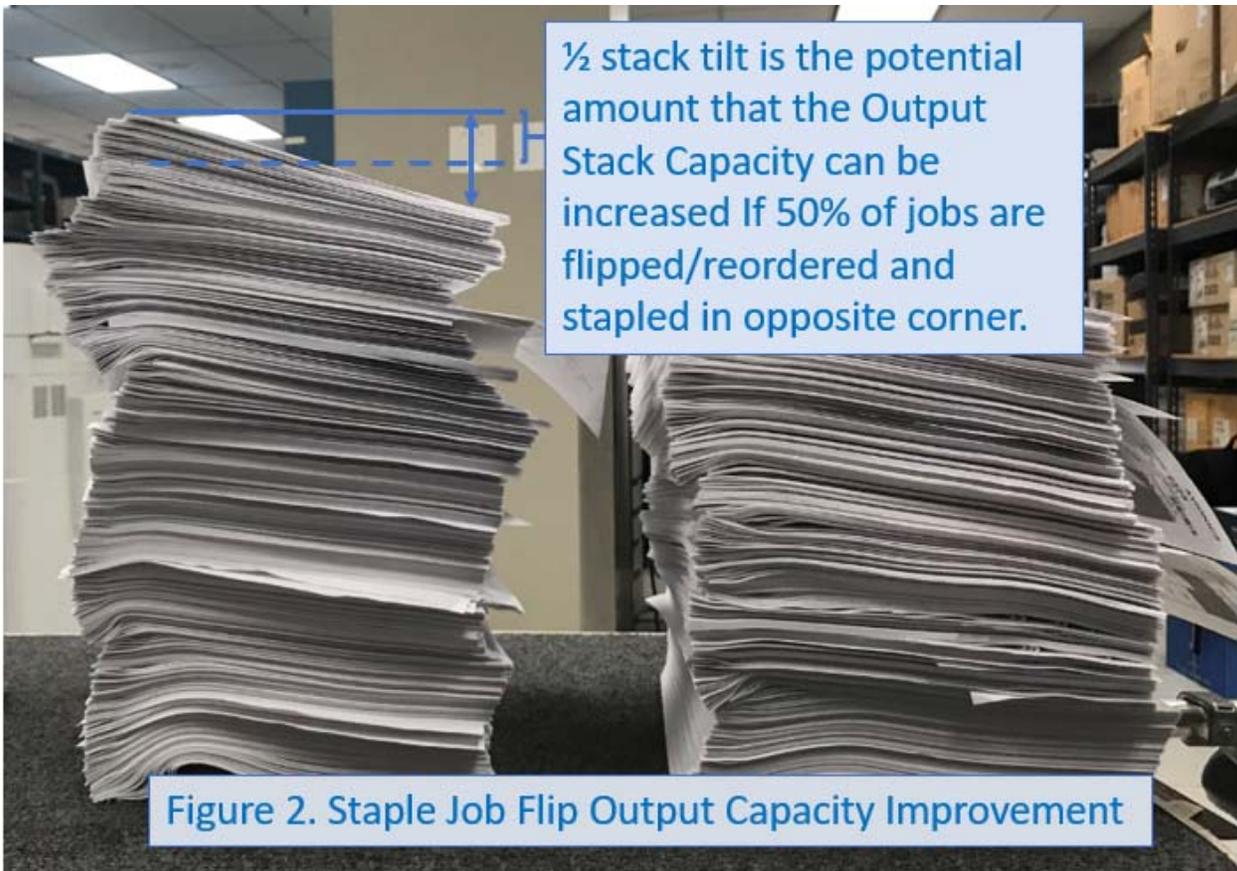
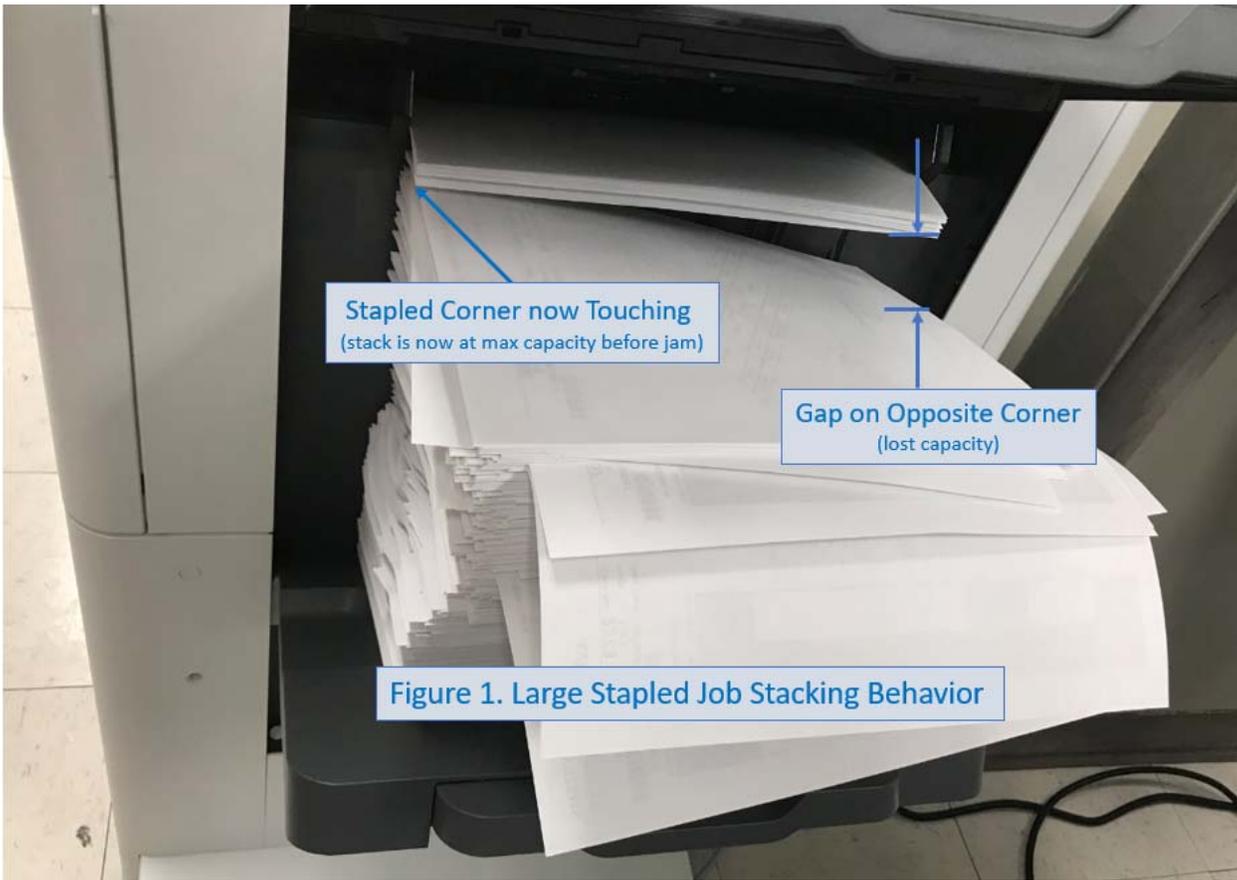
the orientation of the pages of the job and reorder the printing of the pages of the job. This enables a staple to be placed at the opposite corner from the 'normal' job within the output bin, yet at the same corner for the printed output. The net result to the user is that a staple would be oriented in the correct document location for the flipped job, but with its clinch-up, and they would need to re-orient these jobs to be consistent with the normally oriented jobs.

It is envisioned that this functionality would be embedded in the printer firmware and could be selectively enabled or disabled by the user from the control panel. The function could also be selectable in the printer driver software.

Proposed Disclosure Firmware Algorithm: The firmware will need to flip the orientation of the pages of the job and reorder the printing of the pages of job so that the staple corner can be placed at the opposite side of the output bin and yet still place the staple in the same corner of the job (for example, all staples will be applied in the upper left corner of the printed and stapled job). To be able to do this, the pages of the document will need to be rotated 180 degrees, printed face up, and printed in reverse order. To print the pages in reverse order, the print job will have to stored internally within the printer and then printed in reverse order; instead of printing the pages face down and in order 1, 2, 3, 4, the pages will be printed face up and in reverse order 4, 3, 2, 1. Once all pages have been printed, the stapler of the output device will place the staple near the rear of output device, which for the reordered job, will be the upper left corner of the job. See Figure 3.

With the above algorithm, the printed jobs whose staple corner is near the rear of the printer would be printed face up in the output bin with the staple clinch up. The jobs with the staple corner near the front of the printer would continue to print face down as normal. The user would have to rotate the jobs to get them all in the same orientation after retrieving the stack from the printer.

Using this method, the printer will be able to print and staple jobs with the staple in the same corner of the print job, and yet in physically different locations within the output bin. Having the staples in physically different locations of the output bin will increase the stack height, or increase the number of printed jobs, as well as increase the output stack quality of the output device.



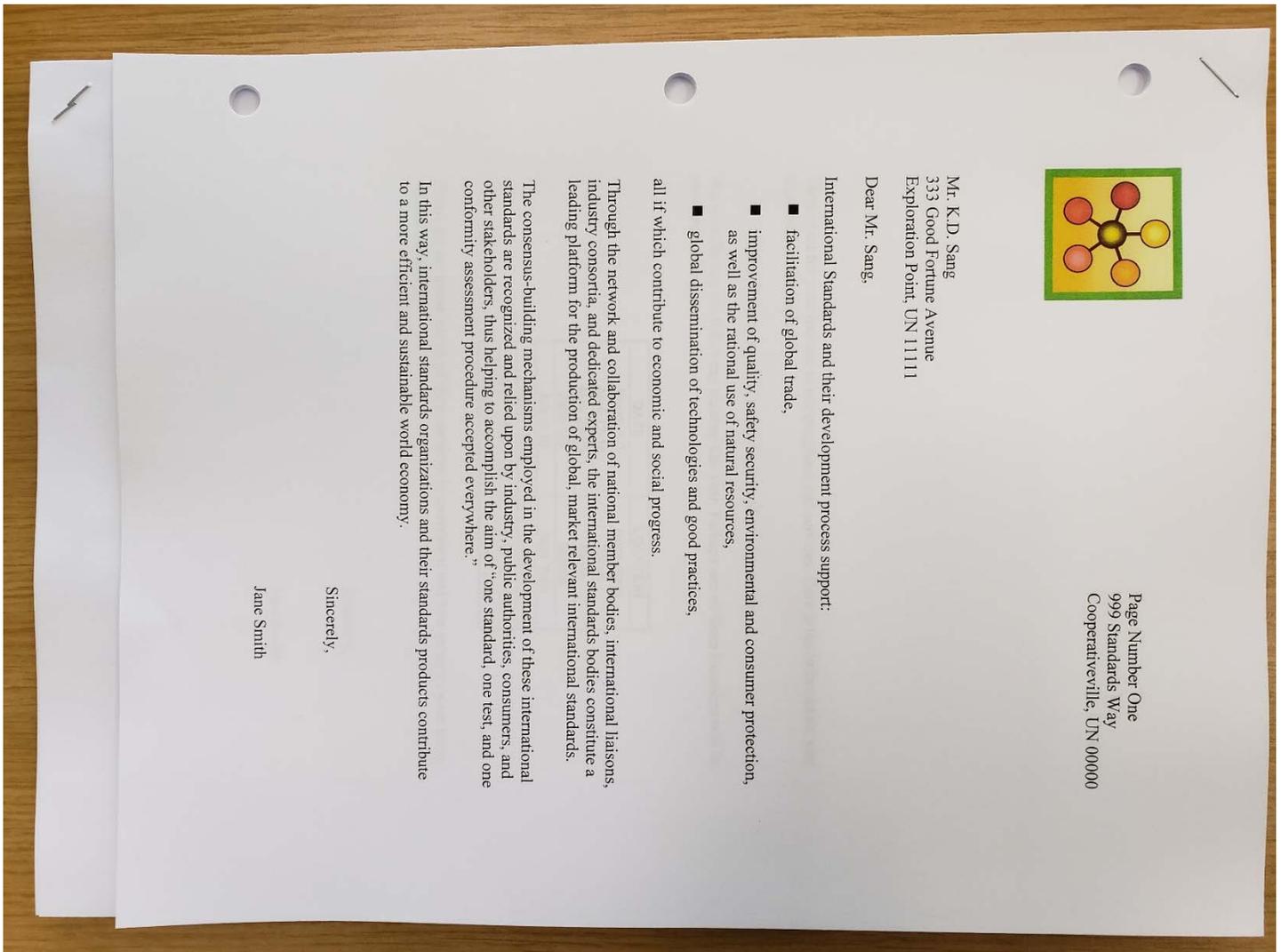


Figure 3 – Output stack

The image in figure 3 shows a potential job stack. The first copy is on the left, face down, and is stapled in the upper left corner of the document. Only a small portion of the first copy is seen. The pages for copy 1 are oriented in ascending order within the output bin – page 1 is at the bottom of the copy and page N is at the top of the copy (i.e., 1, 2, 3, 4, 5 . . .).

The second copy is on top of the stack, is face up, and is also stapled in the upper left corner of the document. The pages for copy 2 are in descending order within the output bin – page 1 is on top of the copy and page N is on the bottom (i.e., . . . 5, 4, 3, 2, 1).

Note: The jobs in this image are offset only for illustration purposes. In the final solution, the jobs would be exactly on top of each other. Also note in the above image the staple on copy two has the clinch-down. But in the final solution, the staple for copy two will have the clinch up like it does for copy 1. With this proposal, the clinch for the staple will be on the front of copy 2 whereas the clinch will be on the back of copy 1.

Disclosed by Robert W Luffel and Gary Godderidge, HP Inc.