A buffer device temporarily retains a number of sheets between a printing apparatus and a finisher, such as a stacker-stapler. The device defines a baffle for the passage of sheets therethrough. Arranged in series in the baffle is a set of gates. Each gate is positionable in an open position or a clamping position that causes a sheet passing nearby to be stopped. By clamping each of a set of sheets as it passes through the baffle, and then setting all the gates to the open position, an accumulated set of sheets can be conveyed out of the baffle substantially simultaneously.
SHEET BUFFER WITH A SERIES OF CLAMPING GATES

TECHNICAL FIELD

[0001] The present disclosure relates to sheet buffering systems, as would be used, for example, with printing and finishing (stapling, binding, etc.) apparatus.

BACKGROUND

[0002] In mid- to high-speed office equipment such as printers and copiers, the use of “finishers” is well known. A typical finishing module, which may be separable from or integral with the main portion of the printer, includes devices for printing print sheets, such as forming a single multipage document to be printed, and optionally stapling the compiled sheets. Other known finisher features include folding, hole-punching, booklet making, etc.

[0003] Many types of actions performed by a finisher require an appreciable amount of time to carry out on a single sheet or on a compiled set of sheets. In the context of a digital printer, however, sheets are ejected from the print engine and accepted by the finisher at a generally regular frequency: in the case of a 60 ppm (page per minute) print engine, a sheet is emitted every second; in a 120 ppm engine, a page is emitted every ½ second. A practical problem results when the finisher needs more time to perform an action than is permitted by the output of the engine. Thus, if a finisher requires ¼ of a second to perform a folding or stapling operation, an upstream engine operating at 120 ppm will emit a next sheet into the finisher while the finisher is performing the operation, probably resulting in a malfunction of the machine.

[0004] In the context of printing and finishing, a device called a “buffer” is used to temporarily hold or retain one or more sheets emitted by the print engine from the finisher for a brief period of time so that the finisher can perform an action (such as stapling or folding) on one or more previously-emitted print sheets.

[0005] U.S. Pat. Nos. 5,303,017; 5,383,656; 5,951,004; and 6,332,606 show systems for temporarily retaining sheets in an area between a printing apparatus and a finisher.

SUMMARY

[0006] According to one aspect, there is provided an apparatus comprising a baffle, suitable for passage of sheets in a process direction therethrough. A first gate and a second gate are disposed within the baffle in series along the process direction. Each of the first gate and second gate is positionable in an open position and a clamping position causing a sheet near the gate to be stopped.

[0007] According to another aspect, there is provided an apparatus comprising a baffle, suitable for passage of sheets in a process direction therethrough. A first gate is disposed within the baffle along the process direction. The first gate is positionable in an open position and a clamping position causing a sheet near the gate to be stopped. A sheet can pass relative to the first gate whether the first gate is in the open position or the clamping position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a simplified elevational view showing a buffer in combination with portions of a xerographic printing apparatus and a finisher including a compiler and stapler.

[0009] FIGS. 2-6 illustrate a sequence of events within the buffer for retaining a plurality of sheets.

DETAILED DESCRIPTION

[0010] FIG. 1 is a simplified elevational view showing portions of a xerographic printing apparatus, in combination with a finisher including a compiler and stapler. The xerographic printing apparatus includes an electrostatic复印 image receptor 100 and a fuser 102, the basic functions of which are well known. Sheets receiving images from the printing apparatus travel in a process direction P out of the printing apparatus, toward the finisher. The finisher includes an “uphill” stocker 110, which accumulates sheets to be stapled together, such as with stapler 112. Of course many different designs of finisher, with different capabilities such as stapling, binding, hole-punching, etc. are known in the art.

[0011] As mentioned above, in some cases actions performed by the finisher (e.g., stapling sheets, and then ejecting the stapled set) require more time than is available before a further sheet is emitted from the printing apparatus, so that sheets emitted from the printing apparatus must be temporarily withheld from the finisher until the finisher is clear of previously-emitted sheets. To this end there is provided what can generally be called a “buffer” 10. The overall function of buffer 10 in this embodiment is to receive sheets from the printing apparatus, and as needed hold up to three sheets for a short period of time so that the sheets can then be moved, effectively simultaneously, toward the finisher.

[0012] In the illustrated embodiment, buffer 10 includes a baffle 12, which is basically a defined channel through which sheets can pass. The baffle 12 can be essentially an enclosed box, or can be defined by other structures. The baffle 12 includes therein three gates, indicated as 21, 22, 23, which are arranged in series along the process direction P through which a sheet would pass through baffle 12. Each gate is selectively positionable in an “open” position, allowing a sheet to pass relative thereto, and a “clamping” position, causing a sheet near the gate to be stopped. In the illustrated embodiment, the open position is consistent with the gate being up as shown, while the clamping position is consistent with the gate being down as shown. When the gate is in the down or clamping position, a surface of the gate is effectively urged against a contact surface (in the embodiment, the lower surface) defined by baffle 12. In the clamping position, a gate can thus clamp a sheet against the contact surface of the baffle 12, causing the sheet to stop any motion. However, when a gate is in the clamping position, a subsequent sheet passing through the baffle 12 can move past the gate.

[0013] In a practical embodiment, each gate 21, 22, 23 is independently positionable, and can be moved by any mechanical means (not shown), such as including a small motor, solenoid, plunger, etc. There may further be provided any number of mechanical, optoelectronic, or other sensors (not shown) to monitor positions of sheets within the buffer 10, as inputs to a control system.

[0014] Also as shown in FIG. 1, there is provided upstream of the baffle 12, a drive roll (one or both of the roll pair 26), and downstream of the baffle 12 a drive-slip roll (one or both of pair 28) and a separable pair of drive/idler rolls 30. The various roll pairs are used to convey sheets
singly and collectively to and from the baffle 12, as will be described in detail below. The rolls 30 are separable to engage one or more sheets therewith as needed at various times, and can be considered to include a selectively-engageable drive member, capable of moving at least one sheet out of the baffle 12. All of the roll pairs 26, 28, 30 are controllable and driven through motors and motor control devices (not shown) generally known in the art.

[0015] FIGS. 2-6 illustrate a sequence of events within buffer 10 for retaining a plurality of sheets. In FIG. 2 a first sheet S1 has entered baffle 12, conveyed as needed by roll pairs 26 and 28. As a trail edge of sheet S1 passes near gate 21, gate 21 is moved from an open position to a clamping position as shown in FIG. 2, thus clamping and stopping movement of sheet S1. Incidental to the clamping of sheet S1, roll pairs 26, 30 are controlled to avoid damage to sheet S1. FIG. 2 shows how a subsequent sheet entering the baffle 12 can pass over the gate 21 (in clamping position) and under gate 22 (in open position).

[0016] FIG. 3 shows how the gate 22 can be moved to a clamping position as a trail edge of the second sheet (indicated as S2) passes near it, thus clamping and stopping movement of sheet S2. In FIG. 3, sheet S2 is stacked over sheet S1. FIG. 3 shows how a subsequent sheet entering the baffle 12 can pass over gates 21 and 22 (in clamping position) and under gate 23 (in open position).

[0017] FIG. 4 shows how the gate 23 can be moved to a clamping position as a trail edge of the third sheet (indicated as S3) passes near it, thus clamping and stopping movement of sheet S3. In FIG. 4, sheet S3 is stacked over sheets S2 and S1.

[0018] FIG. 5 shows how a fourth sheet, S4, can pass over each gate 21, 22, 23, in the clamping position and be effectively passed through the baffle 12. S4 is thus positioned above sheets S3, S2, and S1, and the sheets all together form a stack.

[0019] FIG. 6 shows how all of the sheets S1, S2, S3, S4 are removed from baffle 12 substantially simultaneously. Each gate 21, 22, 23 is switched to the open position, thus releasing the sheet that had been clamped. Separable roll pair 30 is activated to contact the stack of sheets and convey the sheets S1, S2, S3, S4 as a stack out of the baffle 12. The sheets in the stack trail each other by a certain distance as they are drawn out of baffle 12, but the stack moves as a unit. The stack of sheets can then be sent to a finisher, such as including uphill stacker 110 shown in FIG. 1.

[0020] Each gate 21, 22, 23 may be provided with an effective surface of a predetermined frictional coefficient, to facilitate proper interaction with sheets being clamped therewith. Each gate may be dimensioned to contact a sheet through substantially the entire width thereof, or some portion or portions of the width. Although three gates are shown in the embodiment, two gates or more than three can be envisioned.

[0021] Although the illustrated series of actions results in the first sheet in the series S1 being clamped by the first gate in the series 21, and the other gates and sheets following in sequence, another possible implementation would have the first fed sheet S1 being clamped by the last gate 23, followed by sheets S2 clamped by gate 22 and sheet S3 clamped by gate 21. The reverse arrangement will result in a stack of sheets being conveyed out of baffle 12 that has sheet S1 leading the other sheets; this may be desirable depending on the architecture of the larger apparatus. Special shaping of functional surfaces on the gates or within the baffle may be required to implement this reverse arrangement.

[0022] The baffle 12 and its associated mechanisms may be provided within a stand-alone printing module (i.e., including a print engine such as including image receptor 100 shown in FIG. 1, but not a finisher), or within a stand-alone finisher (i.e., not including the printing apparatus), as part of an overall modular printing solution. The baffle 12 and its associated mechanisms may also be provided essentially alone as a buffer module, to be interposed between a printing apparatus and a finisher), also as part of an overall modular printing solution. The baffle 12 can be disposed within a combined printing apparatus and finisher.

[0023] The claims, as originally presented and as they may be amended, encompass variations, alternatives, modifications, improvements, equivalents, and substantial equivalents of the embodiments and teachings disclosed herein, including those that are presently unforeseen or unappreciated, and that, for example, may arise from applicants/patentees and others.

1. An apparatus, comprising:

- a baffle, suitable for passage of sheets in a process direction therethrough; and
- a first gate and a second gate, disposed within the baffle in series along the process direction, each of the first gate and second gate being positionable in an open position and a clamping position causing a sheet near the gate to be stopped.

2. The apparatus of claim 1, wherein, for the first gate and the second gate, a sheet can pass relative to the gate whether the gate is in the open position or the clamping position.

3. The apparatus of claim 1, further comprising

- a selectively-engangeable drive member, downstream of the baffle along the process direction, capable of effectively contacting a sheet that is stopped by the first gate.

4. The apparatus of claim 3, the selectively-engangeable drive member capable of moving at least one sheet out of the baffle.

5. The apparatus of claim 3, the selectively-engangeable drive member capable of moving a plurality of sheets out of the baffle substantially simultaneously.

6. The apparatus of claim 1, the first gate being capable of stopping a first sheet and the second gate being capable of stopping a second sheet.

7. The apparatus of claim 6, the first gate being capable of releasing the first sheet and the second gate being capable of releasing the second sheet substantially simultaneously so that the first sheet and second sheet can be moved from the baffle substantially simultaneously.

8. The apparatus of claim 7, wherein, when the first sheet and second sheet are moved from the baffle, the second sheet leads the first sheet.

9. The apparatus of claim 1, the baffle forming a contact surface, and the first gate and the second gate each urging against the contact surface when in the clamping position.

10. The apparatus of claim 1, further comprising a printing apparatus.
11. The apparatus of claim 1, further comprising an electrostatographic image receptor.

12. The apparatus of claim 1, further comprising a finisher.

13. An apparatus, comprising:
   
   a baffle, suitable for passage of sheets in a process direction therethrough; and

   a first gate, disposed within the baffle, positionable in an open position and a clamping position causing a sheet near the gate to be stopped, wherein a sheet can pass relative to the first gate whether the first gate is in the open position or the clamping position.

14. The apparatus of claim 13, the baffle forming a contact surface, and the first gate urging against the contact surface when in the clamping position.

15. The apparatus of claim 13, further comprising a selectably-engageable drive member, downstream of the baffle along the process direction, capable of effectively contacting a sheet that is stopped by the first gate.

16. The apparatus of claim 15, the selectably-engageable drive member capable of moving a plurality of sheets out of the baffle substantially simultaneously.

17. The apparatus of claim 13, further comprising a second gate disposed in series with the first gate within the baffle, the second gate being positionable in an open position and a clamping position causing a sheet near the gate to be stopped, wherein a sheet can pass relative to the second gate whether the second gate is in the open position or the clamping position.

18. The apparatus of claim 17, the first gate being capable of stopping a first sheet and the second gate being capable of stopping a second sheet.

19. The apparatus of claim 17, the first gate being capable of releasing the first sheet and the second gate being capable of releasing the second sheet substantially simultaneously so that the first sheet and second sheet can be moved from the baffle substantially simultaneously.

20. The apparatus of claim 13, further comprising an electrostatographic image receptor.