edge of the inserts follows the general circumference of one of the rollers, at a slightly different position, causing each successive sheet to stop slightly behind the leading edge of the preceding sheet. The resulting stack of inserts, accordingly, is one where one or more of the leading edges of the sheets do not coincide with one another, which may lead to handling problems downstream in the direction of travel of the stack.

[0009] In accumulating a stack of objects such as discrete paper sheets, it is desirable for the leading edges of the sheets to be in, or form, a flat leading edge of the accumulated stack and not to be staggered at different positions relative to each other. In the past, paper feeders such as rollers, tended to form stacks with such staggered or inclined leading edges.

[0010] Accordingly, it is desirable to provide an improved apparatus and related methods for accumulating discrete paper or film objects such as sheets in a high speed handling machine. It is also desirable to provide a transportation system and related methods that address inherent problems observed with conventional paper systems. Moreover, it is desirable to provide a converting apparatus in the form of an automatic envelope stuffing machine that address the problems of conventional machines for stuffing envelopes, such as the formation of stacks of inserts with staggered edges.

Summary

[0011] To these ends, in some embodiments, an apparatus accumulates discrete paper or film objects to thereby form a stack with a uniform rather than a staggered profile, and which may include accumulator elements that accelerate to match a required speed downstream in the direction of travel of the objects.

[0012] According to a first aspect, there is provided an apparatus for accumulating discrete paper or film objects traveling in a machine direction, comprising: a first accumulator element rotatable about a first axis of rotation; a second accumulator element disposed in confronting relationship with said first accumulator element, said first accumulator element having a first, generally flat surface and a first arcuate surface both rotatable about the first axis of rotation, said first accumulator element having a first angular position with said first flat surface defining a first gap relative to said second accumulator element for receiving the objects there between, and a second angular position with said first arcuate surface defining a second gap relative to the second

accumulator element for moving the objects in the machine direction, said second gap being smaller than said first gap; a stop oriented transverse to said first axis of rotation and rotatable thereabout, said stop being configured to prevent movement of the objects in the machine direction when said first accumulator element is in said first angular position, and said first accumulator element being spaced from said second accumulator element when in both said first and second angular positions, wherein said second accumulator element is rotatable about a second axis of rotation, said first and second accumulator elements being oriented such that said first and second axes of rotation are generally parallel to one another, and wherein said second accumulator element includes a second, generally flat surface and a second arcuate surface, both rotatable about said second axis of rotation.~~More particularly, in one specific embodiment of the invention, an apparatus is provided for accumulating discrete paper or film objects traveling in a machine direction. A first accumulator element of the apparatus is rotatable about a first axis of rotation. A second accumulator element is disposed in confronting relationship with the first accumulator element and has a first, generally flat surface, and a first arcuate surface. Both of these surfaces are rotatable about the first axis of rotation and the first accumulator element has a first angular position that defines a first gap relative to the second accumulator element for receiving the objects there between. The first accumulator element has a second angular position that defines a second gap relative to the second accumulator element for moving the objects in the machine direction, with the second gap~~

~~being smaller than the first gap. A stop of the apparatus is oriented transverse to the first axis of rotation and rotates about that first axis. The stop is configured to prevent movement of the objects in the machine direction when the first accumulator element is in the first angular position.~~

[0013] According to a second aspect, there is provided an apparatus for accumulating discrete paper or film objects traveling in a machine direction, comprising: a first cam rotatable about a first axis of rotation; a second cam disposed in confronting relationship with said first cam and rotatable about a second axis of rotation generally parallel to said first axis of rotation; a first stop oriented transverse to said first axis of rotation and rotatable thereabout; and a second stop oriented transverse to said second axis of rotation and rotatable thereabout, wherein: said first and second cams have a first common angular position defining a first gap between them, and a second common angular position defining a second gap between them, said first gap is wider than said second gap and is configured to receive the objects there between, and said second gap is effective to nip the objects there between to move the objects in the machine direction, and said first and second stops are configured to prevent movement of the objects in the machine direction when the objects are received in said first gap, wherein said first and second cams being oriented such that said first and second axes of rotation are generally parallel to one another, and wherein said second cam includes a second, generally flat surface and a second arcuate surface, both rotatable about said second axis of rotation. ~~In another embodiment, an apparatus is provided for accumulating discrete paper or film objects traveling in a machine direction. The apparatus includes a first cam and a second cam. The first cam is rotatable about a first axis of rotation and the second cam is rotatable about a second axis of rotation that is generally parallel to the first axis of rotation. The second cam is disposed in confronting relationship with the first cam. The apparatus also includes a first stop that is oriented transverse to the first axis of rotation and which is rotatable thereabout. A second stop is oriented transverse to the second axis of rotation and is rotatable about that second axis. The first and second cams have a first common angular position that defines a first gap between them, and a second common angular position that defines a second gap between the cams. The first gap is wider than the second gap and is configured to receive the objects there between, and the second~~

~~gap is effective to nip the objects there between to move the objects in the machine direction. The first and second stops are configured to prevent movement of the objects in the machine direction when the objects are received in the first gap.~~

[0014] According to a third aspect, there is provided an automatic converting apparatus having a first end associated with feeding of a roll of paper in a machine direction, a portion configured to process the roll of paper into discrete paper objects, and a second end associated with feeding of envelopes toward the discrete objects, the converting apparatus further comprising: an accumulating apparatus for accumulating the discrete objects traveling in the machine direction, said accumulating apparatus including (a) first and second accumulator elements disposed in confronting relationship with one another, said first accumulator element being rotatable about a first axis of rotation and having a first angular position defining a first gap relative to said second accumulator element for receiving the discrete objects there between, and a second angular position defining a second gap relative to said second accumulator element for nipping and moving the discrete objects in the machine direction, said second gap being smaller than said first gap; (b) a stop oriented transverse to said first axis of rotation and rotatable thereabout, said stop being configured to prevent movement of the discrete objects in the machine direction when said first accumulator element is in said first angular position; and (c) said first accumulator element being spaced from said second accumulator element when in said first and said second angular positions, wherein said second accumulator element is rotatable about a second axis of rotation, said first and second accumulator elements being oriented such that said first and second axes of rotation are generally parallel to one another, and wherein said second accumulator element includes a second, generally flat surface and a second arcuate surface, both rotatable about said second axis of rotation.~~In another embodiment, an automatic converting apparatus is provided. The converting apparatus has a first end that is associated with feeding of a roll of paper in a machine direction, a portion configured to process the roll of paper into discrete paper objects, and a second end associated with feeding of envelopes toward the discrete objects. The converting apparatus also has an accumulating apparatus that is configured for accumulating the discrete objects traveling in the machine direction. The accumulating apparatus includes first and second accumulator elements disposed in confronting relationship with one another. The first accumulator element is rotatable about a first axis~~

~~of rotation and has a first angular position that defines a first gap relative to the second accumulator element for receiving the discrete objects there between. The first accumulator element also has a second angular position that defines a second gap relative to the second accumulator element for nipping and moving the discrete objects in the machine direction. The second gap is smaller than the first gap. The accumulating apparatus also has a stop that is oriented transverse to the first axis of rotation and which is rotatable about that first axis. The stop is configured to prevent movement of the~~

~~discrete objects in the machine direction when the first accumulator element is in the first angular position.~~

[0015] According to a fourth aspect, there is provided a paper sheet stacking apparatus including: first and second accumulator elements having opposed surfaces defining first and second spaced apart paper receiving nips, said first nip being wider than said second nip; and a stop for blocking leading edges of successively fed paper sheets in the same position and thereby form a stack of sheets having a uniform leading edge, the sheets being oriented within said first nip, said stop oriented in laterally spaced disposition from said nip, wherein said first and second accumulator elements are rotatable about a first and a second axes of rotation respectively, said first and second accumulator elements being oriented such that said first and second axes of rotation are generally parallel to one another, and wherein said second accumulator element includes a second, generally flat surface and a second arcuate surface, both rotatable about said second axis of rotation.~~In yet another embodiment, a paper sheet stacking apparatus is provided. The apparatus includes an accumulator element that has an abutting surface defining first and second paper receiving nips, with the first nip being wider than the second nip. The stacking apparatus also has a stop for blocking leading edges of successively fed paper sheets in generally the same position and thereby form a stack of sheets having a generally uniform leading edge. The sheets are dispensed within the first nip. The accumulator element may be rotatable to define the second nip for engaging and driving the formed stack in a downstream direction.~~

[0016] According to a fifth aspect, there is provided a method for accumulating discrete paper or film objects traveling in a machine direction, the method comprising: defining a first gap between first and second accumulator elements to receive the objects there between, the first gap being associated with a first angular position of the first accumulator element; rotating the first accumulator element to define a second gap between the accumulator elements associated with a second angular position of the first accumulalor element, the second gap being smaller than the first gap, wherein engagement of the objects with surfaces defining the second gap is effective to move the objects in the machine direction; and blocking movement of the objects traveling in the machine direction when the objects are received in the first gap, wherein said first and second accumulator elements are rotatable about a first and a second axes of rotation

respectively, said first and second accumulator elements being oriented such that said first and second axes of rotation are generally parallel to one another, and wherein said second accumulator element includes a second, generally flat surface and a second arcuate surface, both rotatable about said second axis of rotation. ~~In another embodiment, a method is provided for accumulating discrete paper or film objects traveling in a machine direction. The method includes defining a first gap between first and second accumulator elements to receive the objects there between, the first gap being associated with a first angular position of the first accumulator element. The first accumulator element is rotated to define a second gap between the accumulator elements and which is associated with a second angular position of the first accumulator element. The second gap is smaller than the first gap and engagement of the objects with surfaces defining the second gap is effective to move the objects in the machine direction. Movement of the objects traveling in the machine direction is blocked when the objects are received in the first gap.~~

[0017] According to a sixth aspect, there is provided a method for accumulating a plurality of paper or film objects, the method comprising: moving a first one of the objects in a machine direction into a space defined between first and second rotatable accumulator elements in a non-rotating angular position, moving a second one of the objects toward a position above or below the first object to thereby form a stack of the objects; supporting the stack of objects with an apparatus downstream from the accumulator elements and operable to move the stack in the machine direction at a first speed; and accelerating rotation of the accumulator elements from the non-rotating position to a transfer position in which the stack of the objects is moving substantially at the first speed of the apparatus downstream and the stack of the objects is transferred away from engagement with the accumulator elements and into engagement with the apparatus downstream thereof, wherein said first and second accumulator elements are rotatable about a first and a second axes of rotation respectively, said first and second accumulator elements being oriented such that said first and second axes of rotation are generally parallel to one another, and wherein said second accumulator element includes a second, generally flat surface and a second arcuate surface, both rotatable about said second axis of rotation. ~~In yet another embodiment, a method is provided for accumulating a plurality of paper or film objects. A first one of the objects is moved in a machine direction into a space defined between a pair of rotatable accumulator elements that are in~~

~~a non-rotating angular position. A second one of the objects is then moved toward a position above or below the first object to thereby form a stack of the objects. The stack of the objects is supported with an apparatus downstream from the accumulator elements and which is operable to move the stack in the machine direction at a first speed. Rotation of the accumulator elements is accelerated from the non-rotating position to a transfer position in which the stack of the objects is moving substantially at the first speed of the apparatus downstream and the stack of the objects is transferred away from engagement with the accumulator elements and into engagement with the apparatus downstream thereof.~~

[0018] Such apparatus and methods are particularly useful in a paper converting and envelope stuffing system contemplating improved paper converting and sheet