Apparatuses and methods are provided for improving handling of sheet articles during processing within sheet processing machines, particularly for apparatuses and methods for registering sheet articles within a sheet or mail processing machine. A registration apparatus can be provided that aligns sheet articles, such as envelopes, by using negative pressure to register the sheet articles. The registration apparatus can have an elongated housing defining a slit therein for receiving a sheet article. At least a portion of a sheet article may be advanced within the slit of the registration apparatus. A negative pressure may be applied within the housing to pull the sheet article into alignment within the registration apparatus.
APPARATUS AND METHODS FOR REGISTERING SHEET ARTICLES

RELATED APPLICATIONS

[0001] This application relates to the U.S. patent application Ser. No. ______, entitled "INERTER SYSTEMS AND METHODS" filed simultaneously, the disclosure of which is incorporated herein by reference in its entirety. Further, this application relates to the U.S. patent application Ser. No. ______, entitled "APPARATUS AND METHODS FOR VARIBLY OPENING ENVELOPES" and to U.S. patent application Ser. No. ______, entitled "CREASE ROLLER APPLIATUS AND METHODS FOR USING SAME," also filed simultaneously, the disclosures of which are also incorporated herein by reference in their entirety.

TECHNICAL FIELD

[0002] The subject matter disclosed herein relates generally to handling of sheet articles for processing. More particularly, the subject matter disclosed herein relates to apparatuses and methods for registering sheet articles within a sheet or mail processing machine.

BACKGROUND

[0003] Increasingly, a widespread need exists in commercial and governmental institutions for sheet processing machines, particularly mail processing machines, capable of operating at higher operation speeds with high reliabilities and short down-times. Operating sheet processing machines at or near their maximum capability is critical for optimizing output and throughput. Delays or inefficiencies in any operation in the processing of sheet articles can undesirably affect further operations downstream. Since such operation is typically synchronized to the others, delays in feeding time, as well as in other operations, can be perpetuated throughout an entire sheet processing sequence or line.

[0004] Speeds and efficiencies of a sheet processing machine in high speed operations can be greatly affected by the handling of the sheet articles within the sheet processing machine. For example, demands on accuracy of sheet article positioning and alignment in the course of handling of sheet articles are greatly increased in high speed sheet or mail processing machines. False or inadequate alignment or registrations can result in misfeeds of sheet articles that can cause delays in processing.

[0005] A further example relates to processing of creased sheet articles. When processing creased sheet articles within a sheet processing machine, particular attention needs to be paid to the handling of the creased sheet articles. The crease of a sheet article can cause the sheet article to assume a non-planar position. Thus, the creased sheet article may become harder to process within a sheet processing machine. When filling an envelope within an inserter system, for example, the fold of the flap of the envelope along its hinge line often causes the envelope to assume a non-planar position, which makes handling within the inserter system more difficult. Also, the fold of the flap often causes the flap to block the mouth of the envelope. Thus, it is desirable to have the envelope assume a more planar position during processing within a sheet processing machine. Complicated mechanisms are currently used within sheet processing machines to force envelopes to assume a more planar position during processing. These mechanisms used to force envelopes to assume a more planar position during processing can slow down processing and also cause delays and inefficiencies.

[0006] Another example of where the handling of sheet articles within an inserter system can affect delays or inefficiencies relates to the filling of envelopes. The processes and apparatuses used for opening envelopes can create a bottle neck within an inserter system. Any delays or inefficiencies in such processes or apparatuses will likely affect production through the entire inserter system. Thus, any improvement in speeds or efficiencies can greatly affect production of the inserter system. For example, early steps for preparing the envelopes for insertion may be beneficial. Also, processing the envelope in a more effective manner can improve throughput of the inserter system. For instance, maximizing the amount that an envelope is held open is desirable to prevent unneeded contraction of the sides of the envelope that can result in misfeeds of insert material, while still holding the envelope opened wide enough to permit the filling of the envelope. Such an improvement could increase efficiencies in insertion of insert material into envelopes.

[0007] In light of the above, needs exist for improved handling of sheet articles within sheet processing systems, such as mail processing systems, particularly with regard to improving throughput and increasing efficiencies within a sheet processing machine.

SUMMARY

[0008] In accordance with this disclosure, novel apparatuses and methods are provided for improving handling of sheet articles during processing within sheet or mail processing machines, particularly for apparatuses and methods for registering sheet articles within a sheet or mail processing machine. A registration apparatus may be provided that aligns sheet articles, such as envelopes, by using negative pressure to register the sheet articles.

[0009] Some of the objects having been stated hereinabove and are addressed in whole or in part by the present subject matter. Other objects will become evident as the description proceeds when taken in connection with the accompanying drawings as best described hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] A full and enabling disclosure of the present subject matter including the best mode thereof to one of ordinary skill of the art is set forth more particularly in the remainder of the specification, including reference to the accompanying figures, in which:

[0011] FIG. 1 illustrates a schematic view of an embodiment of an inserter system that can employ an embodiment of the present subject matter;

[0012] FIG. 2 illustrates a perspective view of an embodiment of an inserter station that can employ an embodiment of the present subject matter;

[0013] FIG. 3 illustrates a perspective view of embodiments of a variable enveloper apparatus, a registration apparatus, and a crease roller apparatus according to the present subject matter;

[0014] FIG. 4A illustrates a top plan view of an envelope entering the crease roller apparatus and preparing to enter the registration apparatus according to FIG. 3;

[0015] FIG. 4B illustrates a top plan view of the envelope residing in the registration apparatus according to FIG. 3;
FIG. 5 illustrates a perspective side view of the embodiments of crease roller apparatus and registration apparatus of FIG. 3;

FIG. 6A illustrates an exploded view of an embodiment of the registration apparatus according to the FIG. 3;

FIG. 6B illustrates a magnified view of the section 1-1 of FIG. 6A showing a first end of the registration apparatus;

FIG. 6C illustrates a side view of the first end of the registration apparatus shown in FIG. 6A;

FIG. 6D illustrates a side view of another embodiment of a registration apparatus according to the present subject matter;

FIG. 6E illustrates a side view of a further embodiment of a registration apparatus according to the present subject matter;

FIG. 7A illustrates a cross-sectional side view of the registration apparatus of FIG. 3;

FIG. 7B illustrates a perspective view of the registration apparatus of FIG. 3;

FIG. 8 illustrates a schematic cross-sectional view of an embodiment of a housing of a registration apparatus according to the present subject matter;

FIG. 9 illustrates a further perspective view of the registration apparatus of FIG. 3; and

FIG. 10 illustrates a top plan view of the embodiment of the registration apparatus according to FIG. 3.

DETAILED DESCRIPTION

Reference will now be made in detail to presently preferred embodiments of the present subject matter, one or more examples of which are shown in the various figures. Each example is provided to explain the subject matter and not as a limitation. In fact, features illustrated or described as part of one embodiment can be used in another embodiment to yield still yet another embodiment. It is intended that the present subject matter covers such modifications and variations.

The term “sheet article” is used herein to designate any sheet article, and can include, for example and without limitation, envelopes, sheet inserts folded or unfolded for insertion into an envelope or folder, and any other sheet materials.

The term “mail article” is used herein to designate any article for possible insert into a mailing package, and can include, for example and without limitation, computer disks, compact disks, promotional items, or the like, as wells any sheet articles.

The term “document set” is used herein to designate one or more sheet articles and/or mail articles grouped together for processing.

As defined herein, the term “insert material” can be any material to be inserted into a package, and can include, for example and without limitation, one or more document sets, sheet articles, mail articles or combinations thereof.

The present subject matter relates to sheet processing, such as, for example, mail inserting systems, mail sorting systems, and any other sheet processing systems. For example, FIG. 1 illustrates a plan schematic view of an inserter system, generally designated IS. The inserter system IS can comprise different modules that can be assembled in different arrangements for inserting material into envelopes. The different modules and inserter system IS can be controlled by a controller 600. The controller 600 can be computer hardware or software. For example, the controller 600 can include one or more computers, mini-computers, programmable logic controllers or the like.

Inserter system IS can include, for example, an envelope feeder module, generally designated as 100, which feeds envelopes in a direction A into an inserting station module, generally designated as 300. An assembly station module 800 can be used to collect one or more sheet articles and/or one or more mail articles from upstream into a first document set that can be sent to a staging station 900 before being conveyed in a direction B toward inserting station module 300. In front of or behind each first document set on a conveying path of the inserter system IS, one or more sheet articles and/or mail articles can be fed on the conveying path to form second document sets as the first document sets move in direction B so that each first document set and corresponding second document sets can be combined together into insert material for insertion into an envelope.

The second document sets are fed into the conveying path to be combined with the first document sets by one or more modules 1000 of enclosure feeders EF1, EF2. Each enclosure feeder module EF1, EF2 can include one or more station feeders for providing second document sets to be included in insert material to fill the envelope. Enclosure feeders EF1, EF2 can feed second document sets in front of the first document set or behind the first document set. Further, enclosure feeders EF1, EF2 can feed sheet articles and/or mail articles on top of the first document set.

In the examples shown, a collating apparatus module 2000, as shown and described in U.S. patent application Ser. No. 11/240,604, filed Sep. 30, 2005, the disclosure of which is incorporated herein by reference in entirety, can be provided to collate the first and second document sets together before being feed to the inserting station module 300 where the material can then be placed into an envelope. Each filled envelope can then be directed in direction C1 into a sealer module 700 after insertion has occurred. The envelopes can be sealed in the sealer module 700 before they are sent out for metering and mailing. Further, the inserting station module can include an apparatus for diverting defects in a direction C2 out of the inserter system IS.

Other modules can be included in the inserter system IS. For example, a sheet feeder SF for feeding in sheet articles to be collected in the assembly station 800 is normally positioned upstream of the assembly station 800. Assembly station 800 can be followed by staging station 900. Further, other modules can be placed inside the inserter system IS such as a folder module FM, reader module R and an accumulator module AM as are commonly used within the art. These modules can be placed anywhere within inserter system IS where they may be needed for a desired use.

Reader R can be used to read and collect information from sheets passing under it, for example, from bar codes. Reader R can be in direct communication with controller 600. Reader R can read information from sheet articles and/or mail articles to be used by controller 600 to control inserter system IS. The information read by reader R can help determine how a grouping of sheet articles and/or mail articles in a document set will be processed within inserter system IS. Further, the information can be used to determine what other document sets may be needed in the insert material for any particular envelope. Accordingly, the
information can also be used to determine the amount of insert material to be received in each envelope.

[0038] According to certain aspects of the present subject matter, a registration apparatus for aligning a sheet article is provided. The registration apparatus includes an elongated housing defining a slit along at least a portion of a length of the housing for receiving at least a portion of a sheet article. The housing further defines an interior in communication with the slit. A vacuum connection can be attached to the housing and can be in communication with the interior of the housing. The vacuum connection can be configured for pulling a portion of a sheet article within the slit to align the sheet article.

[0039] According to other aspects of the present subject matter, a method of registering a sheet article within a sheet processing machine is provided. The method includes providing a registration apparatus having a slit therein for receiving a sheet article. A sheet article can be advanced at least partially within the slit of the registration apparatus. A negative pressure can be applied within the registration apparatus to pull the sheet article into alignment within the registration apparatus.

[0040] Inserting station module 300 is shown in more detail in FIG. 2. Inserting station 300 can include a variable envelope opener apparatus, generally designated as 400, for opening the envelope for receipt of the insert material therein. Variable envelope opener apparatus 400 can operate to permit an envelope to be opened in different widths depending on the characteristics of the insert material to be inserted into the envelope. As envelopes are fed into variable envelope opener apparatus 400, the envelopes can pass through a crease roller apparatus, generally designated as 200, to help ensure the flap of the envelope entering the variable envelope opener apparatus 400 does not interfere with the insertion of the insert material into the envelope. When an envelope is in the variable envelope opener apparatus 400, insert material can travel on the conveying path including atop deck 410, which helps to direct the insert material into an envelope within the variable envelope opener apparatus 400. Once the insert material has been inserted into the envelope, the envelope is conveyed down inserting station 300 to a right-angle-turn apparatus, generally designated as 310, where the filled envelope can then be conveyed into sealer module 700 as described above or can be diverted out of the inserted system IS in direction C2 as shown in FIG. 1 if a defect or problem is detected with the envelope.

[0041] FIG. 3 illustrates a perspective view of variable envelope opener apparatus 400 and the crease roller apparatus 200. The variable envelope opener apparatus 400 includes deck 410 having a first end 412 and a second end 414. Deck 410 further includes a top side 416 that is configured to provide a conveying path 418 for insert material to be conveyed long toward an envelope in which it shall be inserted. Deck 410 can include one or more elongated slots 420 for pusher members 422.

[0042] As shown in the illustrated embodiment, a pair of elongated slots 420 can be aligned down the conveying path 418 or deck 410. In such an embodiment, a pair of insertion pusher members 422, such as pusher pins or picks, can be conveyed down the parallel slot 420 such that the insertion pusher members 422 are conveyed parallel to one another to register the insert material and push the insert material into an envelope. Insertion pusher members 422 can then convey the envelope onto the right-angle-turn apparatus 310 to be conveyed to sealing module 700 or be diverted out of the inserter system if there is a defect therein. The deck 410 can also include elongated slots 424 in which collecting pusher members (not shown) from downstream in the inserter system IS can be conveyed. In such an embodiment, collecting pusher members can convey the insert material along conveying path 418 from upstream until such point that insertion pusher members 422 pick up the insert material to be conveyed toward the envelope. At such point, the collecting pusher members descend below conveying path 418 and deck 410.

[0043] The deck 410 can include a first platform 427 which overlays a second platform 428 and a third platform 429 to form the top surface 416 of the deck 410. Top side 416 can have insert guides 430 on either side of the conveying path 418 to help guide the insert material toward the envelope. Insert guides 430 can be adjustable to accommodate different sized insert material thereby helping to funnel the insert material toward the envelope. Flexible tabs 432 can be positioned above top side 416 of deck 410 such that the insert material can pass between the tabs 432 and top side 416 for the deck 410. Tabs 432 can be attached to the insert guide such that tabs 432 moves with insert guides 430. Tabs 432 can extend under the flap of the envelope but not into the mouth of the envelope in which the insert material is to be received.

[0044] Envelopes fed in direction A can be fed under crease roller apparatus 200 by sets of feed rollers 202, 206. The crease roller apparatus can score envelopes entering the variable envelope opener apparatus 400 along the fold of flaps of the envelope to bend the flaps of the envelopes against the fold. This scoring helps to keep the envelopes open for insertion of material as described in more detail below.

[0045] The sets of feed rollers 202, 206 feed the envelopes into a registration apparatus, generally designated as 440, that includes a housing 442 and a vacuum connection 444. Registration apparatus 440 registers the envelopes fed therein by the feed rollers to align the envelopes. The registration apparatus 440 and a flat plate 446 hold the envelopes fed into the registration apparatus 444 in a staging position. Flat plate 446 can be moved back and forth by an actuator 448 between an extended position and a retracted position. When flat plate 446 is extended, flat plate 446 is in a holding location. When flat plate 446 is retracted, flat plate is in an entry location. A first drop bar 450 is positioned above flat plate 446 and a second drop bar 452 is placed above the staging position between flat plate 446 and registration apparatus 440. As flat plate 446 is moved from the holding location to the entry location, first drop bar 450 and second drop bar 452 push each envelope into an insertion position where a holding system holds that envelope. A feeding guide, generally designated as 454, which can include a rotary actuator 456 can rotate fingers into the mouth of each envelope in the inserter position to hold it open while insertion pusher members 422 push the insert material into the envelope and then carry the envelope to right-angle-turn apparatus 310 shown in FIG. 2. Depending on the amount of material to be inserted into the envelopes, envelopes can be held open in various degrees by shifting deck 410 and feeding guide 454 between different locations.

[0046] Although the registration apparatus 440 is described relative to operation with an envelope, other sheet
articles, for example, folded sheet articles, will operate in a similar manner. FIGS. 4A and 4B illustrate the feeding of an envelope E into a staging position, generally designated as 460, within variable envelope apparatus 440. Envelope E has a body portion BP and a flap F. A fold FL is created between body portion BP and flap F along a crease or hinge line HL. Body portion BP can have a face side FS on which an address window usually resides or an address is usually printed. Body portion BP also has a backside. The backside of the body portion BP is where flap F can be secured to body portion BP to close envelope E.

[0047] Envelope E can be fed from the envelope feeder apparatus 100 (see FIG. 1) such that envelope E has face side FS of body portion BP of envelope E facing upward. The operation of the registration apparatus 440 is not affected by the flap orientation (flap up or down) nor is it affected by the location of the address window or address printing (top or bottom of the envelope). Flap F of envelope E extends outward from hinge line HL away from body portion BP of envelope E. The first set of feed rollers 202 transports envelope E and, along with the second set of 206 feed rollers, feed envelope E into registration apparatus 440 such that flap F resided on flap plate 446. A negative pressure can be created through housing 442 of registration apparatus 440 by vacuum connection 444 to register envelope E within registration apparatus 440. As shown in FIG. 4B, envelope E is, at this point, aligned under first drop bar 450 and second drop bar 452. First drop bar 450 and second drop bar 452 can be used to help push envelope E from staging position 460 into an insertion position. The envelope is extruded from the registration device before insertion of material into the envelope by the downward action of the second drop bar 452. While envelope E is being fed by the sets of feed rollers 202 and 206, the envelope enters the registration apparatus 440, crease roller apparatus 200 can score envelope E along the hinge line HL to bend flap F of envelope E in an inverted direction from that of the original fold along hinge line HL.

[0048] After the envelope has been scored by crease roller apparatus 200, the envelope can be fed into registration apparatus 440 for registering within variable envelope opener apparatus 400. As can be seen in FIGS. 4A, 4B, and 5, crease roller apparatus 200 and the sets of feed rollers 202, 206 are aligned to feed the envelope along direction A so that the rear end of the envelope resides in registration apparatus 440 and the flap end of the envelope resides on flap plate 446, thereby holding the envelope in a staging position 460. As mentioned above, registration apparatus 440 can include housing 442 and vacuum connection 444. Housing 442 defines a slit 462 at least a portion of the length of housing 442 for receiving a portion of an envelope being fed into housing 442. Slit 462 can be in a straight line within housing 442. Further, slit 462 can have a convex or a concave shape. Housing 442 can have a first end 464 and a second end, generally designated as 466. Vacuum connection 444 can be attached to housing 442 at second end 466 of housing 442. Those skilled in the art may attach the vacuum source at other locations along the housing 442, instead of using an end cap as shown, without affecting the performance of the registration apparatus.

[0049] First end 464 of housing 442 can define an entrance 468 for slit 462 for receiving an envelope fed by the set of feed rollers 206. Vacuum connection 444 can provide a negative pressure from a vacuum source within housing 442 that aligns the envelope within the slit 462. A sensor 470 can detect the presence of an envelope within staging position 460 when the envelope resides in registration apparatus 440 and on top of flap plate 446. Once the envelope is received within staging position 460, first drop bar 450 and second drop bar 452 can be readied to push the envelope out of staging position 460 and into the insertion position within variable envelope opener apparatus 400. The vacuum source can be left on during the extraction of the envelope from the registration device. Alternatively, the vacuum source can be turned off when the drop bar 452 is actuated to extract the envelope and put it into the insertion position.

[0050] As can be seen in the exploded view of FIG. 6A, housing 442 can be a tubing having a front wall 472, a back wall 474, a top wall 476 and a bottom wall 478. The front, back, top and bottom walls 472, 474, 476, 478 can define a chamber, generally designated as 480, that can run length L of housing 442. Housing 442 also can define an opening 482 on first end 464 and an opening 484 on second end 466, both of which are in communication with chamber 480. Slit 462 can reside in front wall 472 to provide access to chamber 480.

[0051] Chamber 480 can extend the full length L of housing 442 or it can extend for a partial distance within length L. Similarly, the slit 492 can extend the full length L of housing 442 or it can extend only a partial distance along the length L. Slit 462 can also extend only along a portion of the length of chamber 480. As previously mentioned, housing 442 can define a convex slit 499A or a concave slit 499B as shown in FIGS. 6D and 6E respectively. By using these alternative shaped slits 499A and 499B, the beam strength of the envelope in the staging area 460 can be increased, if required.

[0052] As in the embodiment shown in FIGS. 6A and 6B, a sealing block 486 can be secured within opening 482 of first end 464 of housing 444. Sealing block 486 can help direct the pull of the negative pressure created through vacuum connection 444 and also help direct the envelope into slit 462 and chamber 480.

[0053] One or more holding pins 488 can be inserted above slit 462 through at least one of front wall 472 or back wall 474. Holding pins 488 can help to prevent the envelope from sliding up chamber 480 when a vacuum is applied within housing 442. Holding pins 488 can be screws, shoulder bolts, pins, or the like. Holding pins 488 can be inserted through apertures 490 defined either in front wall 472, back wall 474, or both. A plurality of holding pins 480 can ensure that the envelope within registration apparatus 440 is properly registered before the envelope is removed from the staging position into the insertion position for insertion of the insert material into the envelope.

[0054] As can be seen in FIG. 6C, housing 442 can define entrance 468 such that entrance 468 is wider than slit 462. The entrance can be chamfered so as to converge from its wider width W1 to slot width W2. Width W2 at the beginning of entrance 468 provides a greater opportunity for envelopes being fed into registration apparatus 440 to correctly enter slit 462 thereby reducing the possibility of jams within the inserter station 300. By having entrance 468 converge toward slit 462, an errant envelope is more likely to be caught and directed into slit 462. Further, as shown in FIG. 6D, sealing block 486 can have a bottom wall which is cut at an angle to match the chamfer of entrance 468 leading into slit 462.
Vacuum connection 444 of registration apparatus 440 can take on many different forms. The only requirement of vacuum connection 444 is that it provides enough negative pressure within housing 442 to properly align, or register, the envelopes that enter housing 442. An example of an embodiment of the vacuum connection is shown in the figures. Vacuum connection 444 of registration apparatus 440 can include a housing fitting 492 having a housing opening 494 disposed therein to engage housing 442 about second end 466. Housing opening 494 within housing fitting 492 can securely fit around second end 466 of housing 442 such that, when a negative pressure is pulled through housing fitting 492, it is also pulled through chamber 480 of housing 442. Housing fitting 492 can further include a connector opening 496 which is in communication with housing opening 494.

Vacuum connection 444 can further include a connector fitting 498, which can be received in connector opening 496 of housing fitting 492. Vacuum connection 444 can further include a vacuum tube 500, which can be secured to a vacuum source 502 that provides the negative pressure to housing 442. Vacuum tube 500 can be securely fitted to connector fitting 498 and also to vacuum source 502. Vacuum source 502 can be any structure that can create a negative pressure within a range that will properly align the envelope within registration apparatus 440. For example, vacuum source 502 can be a Gast blower, Model R 3105-1, manufactured by Gast Manufacturing, Inc., of Bay Harbor, Mich. Such a blower can create a negative pressure of up to about 0.5 pounds per square inch for use within registration apparatus 440. However, a lesser or greater negative pressure may be used to register envelopes or other sheet articles.

Figs. 7A and 7B show an envelope E with its rear end R disposed within housing 442 of registration apparatus 440. Registration apparatus 440 can further include a stopper 504 that stops the progress of envelope E as it enters slit 462 of housing 442. As envelope E enters slot 462, vacuum connection 444 can apply negative pressure within housing 442 to align envelope E within staging position 460 before it is to be moved into an insertion position for receipt of insert material. Vacuum source 502 can supply a constant negative pressure within housing 442. As pointed out above, the pressure should be great enough to properly align envelope E within registration apparatus 440 but not so great as to interfere with the removal of envelope E from staging position 460 into an insertion position. Rear end R of envelope E enters entrance 468 of housing 442 and into slit 462. Entrance 468 and slit 462 guide rear end R of envelope E under holding pins 488 that pass through back wall 474 and front wall 472 above slit 462 into hollow chamber 480. The negative pressure provided by vacuum source 502 through vacuum tube 500, connector fitting 498 and housing fitting 492 can pull rear end R of envelope E against an interior 475 of the back wall 474 to align envelope E so that the mouth of envelope E is in a position to be opened for receipt of the insert material when envelope E is moved to the insertion position. Stopper 504 can also facilitate proper alignment of envelope E in staging position 460 before being moved to the insertion position for receipt of insert material.

Vacuum connection 444 can include just a vacuum tube connected to the housing 442 and a vacuum source 502 or it can take on other forms. Further, the opening within the housing around which the vacuum connection is secured can be at other locations provided that the opening can provide the negative pressure into the chamber of the housing for registration of the envelope. The chamber can also be any desired shape that facilitates registration of envelope within the housing. For example, the chamber can be just a rear portion of slit 462.

FIG. 8 shows an enlarged view of a hollow chamber 480 within a housing 442. An envelope E resides in slit 462 with a rear end R of envelope E (opposite flap F of envelope E) registered against the interior 475 of back wall 474 of housing 442. The spacing between the holding pins 488 and the envelope may be adjustable to prevent the rear end from curling upward inside the chamber.

FIG. 9 shows registration apparatus 440 as it forms a portion of variable envelope opener apparatus 400 (see FIG. 3). Registration apparatus 440 can further include a depth adjuster 506. Depth adjuster 506 can move registration apparatus 440 relative to other portions of variable envelope opener 400 to permit different-sized envelopes to be processed within inserter station 300 (see FIG. 2). Depth adjuster 506 can include a frame 508 through which a pair of lead screws 510 can reside. A holding bar 512 can be secured to top wall 476 of housing 442. Holding bar 512 can further reside on lead screws 510, which can be aligned parallel to one another. Holding bar 512 can include a pair of actuating mechanisms 514 with each actuating mechanism 514 engaging one of the lead screws 510 to permit movement of holding bar 512 along lead screws 510. An adjustment wheel 516 can be secured to depth adjuster 506 such that, when adjustment wheel 516 is turned, holding bar 512 through the actuating mechanisms 514 will move in a direction G along screws 510 when adjustment wheel 516 is turned one way and will move in a direction H when adjustment wheel 516 is turned in the other direction. As holding bar 512 moves along lead screws 510, registration apparatus 440 including housing 442 and at least a portion of vacuum connection 444 move along with holding bar 512, while keeping a proper orientation with respect to the flap plate (not shown) and first drop bar 450 and second drop bar 452. In this manner, different-sized envelopes can be processed by moving registration apparatus 440 back and forth within variable envelope opener apparatus 400.

For example, as shown in FIG. 9, registration apparatus 440 can be moved to a back position for acceptance of a flats envelope. If a smaller envelope is used, the adjustment wheel 516 can be turned so as to bring the registration apparatus 440 closer to the flat plate (not shown) and first and second drop bars 450, 452. Similarly, the stopper 504 can be fixed within variable envelope opener apparatus 400 at a position where any envelope processed no matter what the size will come in contact with stopper 504.

Once an envelope E is registered within housing 442 of registration apparatus 440, envelope E can reside in staging position 460 as shown in FIG. 10. Envelope E can enter staging position 460 with the face side FS of the body portion BP facing upward away from the inserter station 300. As discussed above, envelope E is held in staging position 460 by registration housing 442 and flap plate 446. Registration housing 442, which has registered the envelope, holds rear end R of envelope E, while flap F of envelope E resides on flap plate 446. When it is time for the envelope to enter the insertion position, flap plate 446 can be moved in a direction I by actuator 448. First drop bar 450 and second
drop bar 452 can be then activated by actuators 451 and 453, respectively, to push envelope E out of staging position 460 into the insertion position.

While described in conjunction with a variable envelope opener apparatus, registration apparatus 440, described herein, can be used in any sheet or envelope handling apparatus. The registration apparatus only needs a housing into which sheets or envelopes can enter and a vacuum connection that provides a negative pressure to the housing to register the sheets or envelopes. For example, the registration apparatus can be in another location within a sheet processing machine, wherein folded sheets pass through a slit in the registration housing. As the folded sheets are passing through the slit, a negative pressure can pull the folded sheets against the housing to register the folded sheets. The utility of registration apparatus is not limited to the processes described herein in the context of examples used.

The embodiments of the present disclosure shown in the drawings and described above are exemplary of numerous embodiments that can be made within the scope of the appending claims. It is contemplated that the configurations for apparatuses for registering sheet articles within a sheet processing machine can comprise numerous configurations other than those specifically disclosed. The scope of a patent issuing from this disclosure will be defined by the appended claims.

What is claimed is:

1. A registration apparatus for aligning a sheet article, the registration apparatus comprising:
   (a) an elongated housing defining a slit along at least a portion of a length of the housing for receiving at least a portion of a sheet article, the housing further defining an interior in communication with the slit, and
   (b) a vacuum connection attached to the housing and in communication with the interior of the housing, the vacuum connection configured for pulling a portion of a sheet article within the slit to align the sheet article.

2. The registration apparatus according to claim 1, wherein the slit in the housing extends in a straight plane.

3. The registration apparatus according to claim 1, wherein the slit in the housing extends in a concave or convex shape.

4. The registration apparatus according to claim 1, wherein the interior of the housing comprises a hollow chamber running along the length of the housing, the chamber being in communication with the slit and the opening.

5. The registration apparatus according to claim 4, wherein the housing comprises a front wall, back wall, top wall and bottom wall that define the chamber.

6. The registration apparatus according to claim 5, wherein the slit is defined in the front wall of the housing.

7. The registration apparatus according to claim 6, wherein the housing and the vacuum connection are configured for creating negative pressure within the housing whereby the vacuum connection can pull a sheet article against an interior of the back wall of the housing.

8. The registration apparatus according to claim 4, wherein the housing comprises a first end and a second end with an opening leading into the chamber defined in both the first and second ends, the opening on the second end having the vacuum connection attached thereto.

9. The registration apparatus according to claim 8, wherein the slit extends through the first end of the housing defining an entrance in which the sheet article is received.

10. The registration apparatus according to claim 9, wherein the width of the entrance is greater than the width of the slit.

11. The registration apparatus according to claim 8, wherein the entrance converges to the slit.

12. The registration apparatus according to claim 9, wherein the slit extends across the length of the housing.

13. The registration apparatus according to claim 4, further comprising a plurality of holding pins disposed in the housing proximal to the slit.

14. The registration apparatus according to claim 1, further comprising a sensor disposed on the housing for determining the presence of a sheet article within the slit in the housing.

15. The registration apparatus according to claim 1, further comprising a stopper device positioned proximal to the slit within the housing configured to stop the envelope after entry of the sheet article into the slit.

16. The registration apparatus according to claim 1, further comprising a depth adjuster configured to move the registration apparatus between different positions to accommodate for different sized sheet articles.

17. The registration apparatus according to claim 1, wherein a length of the slit in the housing is greater than a length of a sheet article to be received therein.

18. A registration apparatus for aligning an envelope in an inserter system, the registration apparatus comprising:
   (a) an elongated housing having a front wall, back wall, top wall and bottom wall forming a chamber within the housing running along a length of the housing, the housing defining an opening at a first end and a second end of the housing and the housing defining a slit along at least a portion of the length that extends through the first end of the housing to define an entrance therein, the slit and the entrance being configured to receive an envelope;
   (b) a plurality of holding pins disposed in the housing proximal to the slit; and
   (c) a vacuum connection communicating with the chamber of the housing whereby the vacuum connection can cause a negative pressure within the housing for pulling an envelope into the slit to align the envelope within the housing by pulling the envelope against an interior of the back wall of the housing.

19. A method of registering a sheet article within a sheet processing machine, the method comprising the steps of:
   (a) providing a registration apparatus having a slit therein for receiving a sheet article;
   (b) advancing a sheet article at least partially within the slit of the registration apparatus; and
   (c) applying a negative pressure within the registration apparatus to pull the sheet article into alignment within the registration apparatus.

20. The method according to claim 19, wherein the negative pressure is continuously applied within an interior of the housing.

21. The method according to claim 19, wherein the negative pressure is removed when the sheet article is removed from the slit of the registration apparatus.
22. The method according to claim 19, further comprising stopping the sheet article once it is fed into the slit of the registration apparatus before the step (c) of applying a negative pressure.

23. The method according to claim 19, further comprising detecting the presence of a sheet article within the registration apparatus.

24. The method according to claim 23, wherein, if no sheet article is detected, step (b) of feeding a sheet article into the slit of registration apparatus occurs.

25. The method according to claim 19, further comprising adjusting the position of the registration apparatus to accommodate for different sized sheet articles.

26. A method of registering an envelope within an inserter system, the method comprising the steps of:

(a) providing a registration apparatus having a slit therein for receiving envelopes;

(b) advancing an envelope within the slit of the registration apparatus;

(c) detecting the presence of an envelope within the registration apparatus;

(d) stopping the envelope once it is fed into the slit of the registration apparatus; and

(e) applying a negative pressure within the registration apparatus, whereby the envelope is pulled into alignment within the registration apparatus.

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