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(54) Apparatus and methods for registering sheet articles

(57) 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 (442) defining a slit (462) 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.

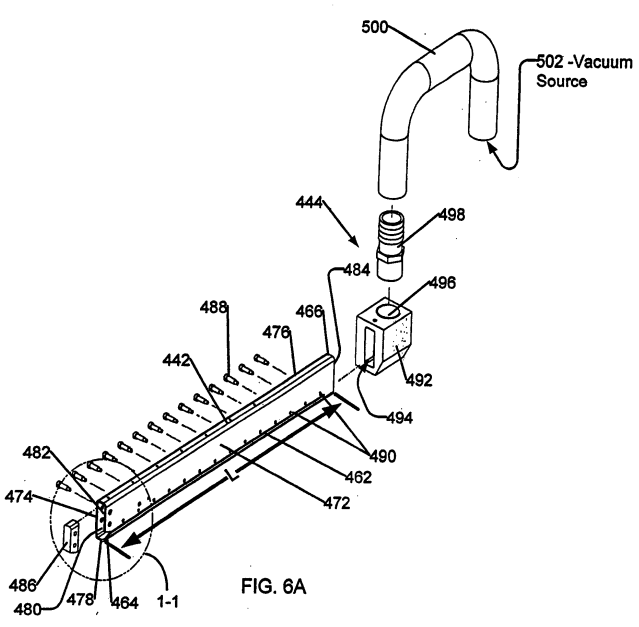

FIG. 6A

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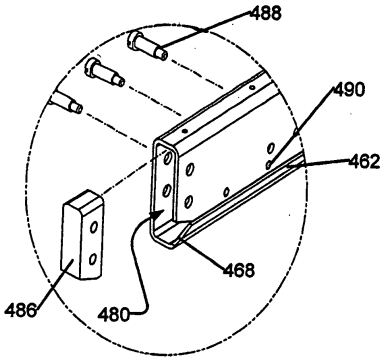


FIG. 6B

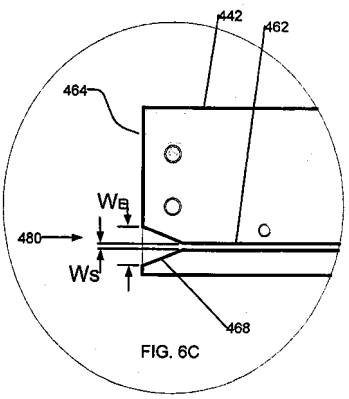


FIG. 6C

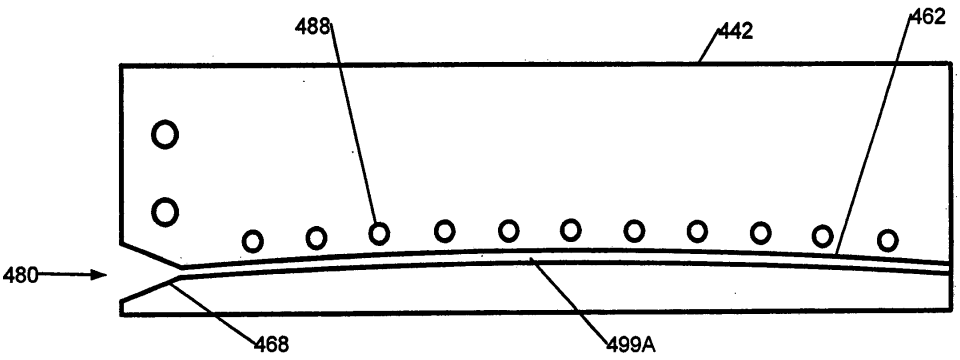


FIG. 6D

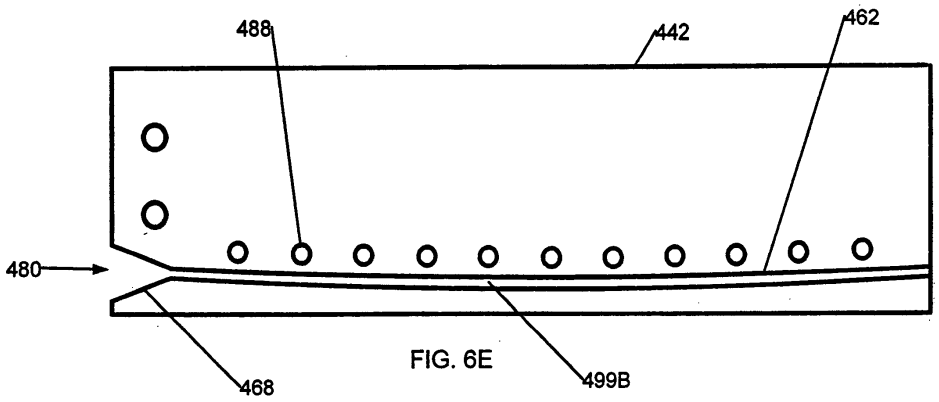


FIG. 6E

Description

RELATED APPLICATIONS

[0001] This application relates to the U.S. Patent Application Serial Number 11/546,535, entitled "INSERTER 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 Serial Number 11/546,556, entitled "APPARATUSES AND METHODS FOR VARIABLY OPENING ENVELOPES" and to U.S. Patent Application Serial Number 11/546,555, entitled "CREASE ROLLER APPARATUSES AND METHODS FOR USING SAME", also filed simultaneously, the disclosures of which are also incorporated herein by reference in their entireties.

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 each 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:

Figure 1 illustrates a schematic view of an embodiment of an inserter system that can employ an embodiment of the present subject matter,

Figure 2 illustrates a perspective view of an embodiment of an inserter station that can employ an embodiment of the present subject matter,

Figure 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;

Figure 4A illustrates a top plan view of an envelope entering the crease roller apparatus and preparing to enter the registration apparatus according to Figure 3;

Figure 4B illustrates a top plan view of the envelope residing in the registration apparatus according to Figure 3;

Figure 5 illustrates a perspective side view of the embodiments of crease roller apparatus and registration apparatus of Figure 3;

Figure 6A illustrates an exploded view of an embodiment of the registration apparatus according to the figure 3;

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

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

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

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

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

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

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

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

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

DETAILED DESCRIPTION

[0011] 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.

[0012] 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.

[0013] 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.

[0014] The term "document set" is used herein to designate one or more sheet articles and/or mail articles grouped together for processing.

[0015] As defined herein, the term "insert material" can be any material to be inserted into an envelope, and can include, for example and without limitation, one or more document sets, sheet articles, mail articles or combinations thereof.

[0016] 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, Figure 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.

[0017] 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.

[0018] 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 $\mathbf{EF_1}$,

EF_2. Each enclosure feeder module EF_1, EF_2 can include one or more station feeders for providing second document sets to be included in insert material to fill the envelope. Enclosure feeders EF_1, EF_2 can feed second document sets in front of the first document set or behind the first document set. Further, enclosure feeders EF_1, EF_2 can feed sheet articles and/or mail articles on top of the first document set.

[0019] In the examples shown, a collating apparatus module 2000, as shown and described in U.S. Patent Application Serial Number 11/240,604, filed September 30, 2005, the disclosure of which is incorporated herein by reference in its 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 C_1 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 C_2 out of the inserter system **IS**.

[0020] 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.

[0021] 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 insertion 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.

[0022] 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.

[0023] According to other certain 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.

[0024] Inserting station module **300** is shown in more detail in Figure 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-angte-tum 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 C_2 as shown in Figure 1 if a defect or problem is detected with the envelope.

[0025] Figure 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**.

[0026] 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**.

[0027] 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.

[0028] 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.

[0029] 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 Figure 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.

[0030] 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. Figures 4A and 4B illustrate the feeding of an envelope **E** into a staging position, generally designated as **460**, within variable envelope apparatus **400**. 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**.

[0031] Envelope **E** can be fed from the envelope feeder apparatus **100** (see Figure 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** resides 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 Figure 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 extracted 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, 206** into 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.**

[0032] After the envelope has been scored by crease roll apparatus **200,** the envelope can be fed into registration apparatus **440** for registering within variable envelope opener apparatus **400.** As can be seen in Figure 4A, 4B, and 5, crease roll 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** along 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.

[0033] 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.

[0034] As can be seen in the exploded view of Figure 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.**

[0035] 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 **462** 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 Figures 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.

[0036] As in the embodiment shown in Figure 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.**

[0037] 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.

[0038] As can be seen in Figure 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 $\mathbf{W_E}$ to slot width $\mathbf{W_S}$. Width $\mathbf{W_E}$ 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 Figure 6B, 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.**

[0039] 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.**

[0040] 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 Bent Harbor, Michigan. 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.

[0041] Figures 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.

[0042] 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.**

[0043] Figure 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.

[0044] Figure 9 shows registration apparatus **440** as it forms a portion of variable envelope opener apparatus **400** (see Figure 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 Figure 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 adjuster wheel **516** is turned, holding bar **512** through the actuating mechanisms **514** will move in a direction **G** along screws **510** when adjuster 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.**

[0045] For example, as shown in Figure 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.**

[0046] Once an envelope **E** is registered within housing **442** of registration apparatus **440,** envelope **E** can reside in staging position **460** as shown in Figure 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.

[0047] 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 proc-

esses described here in the context of examples used.

[0048] 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.

Claims

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.

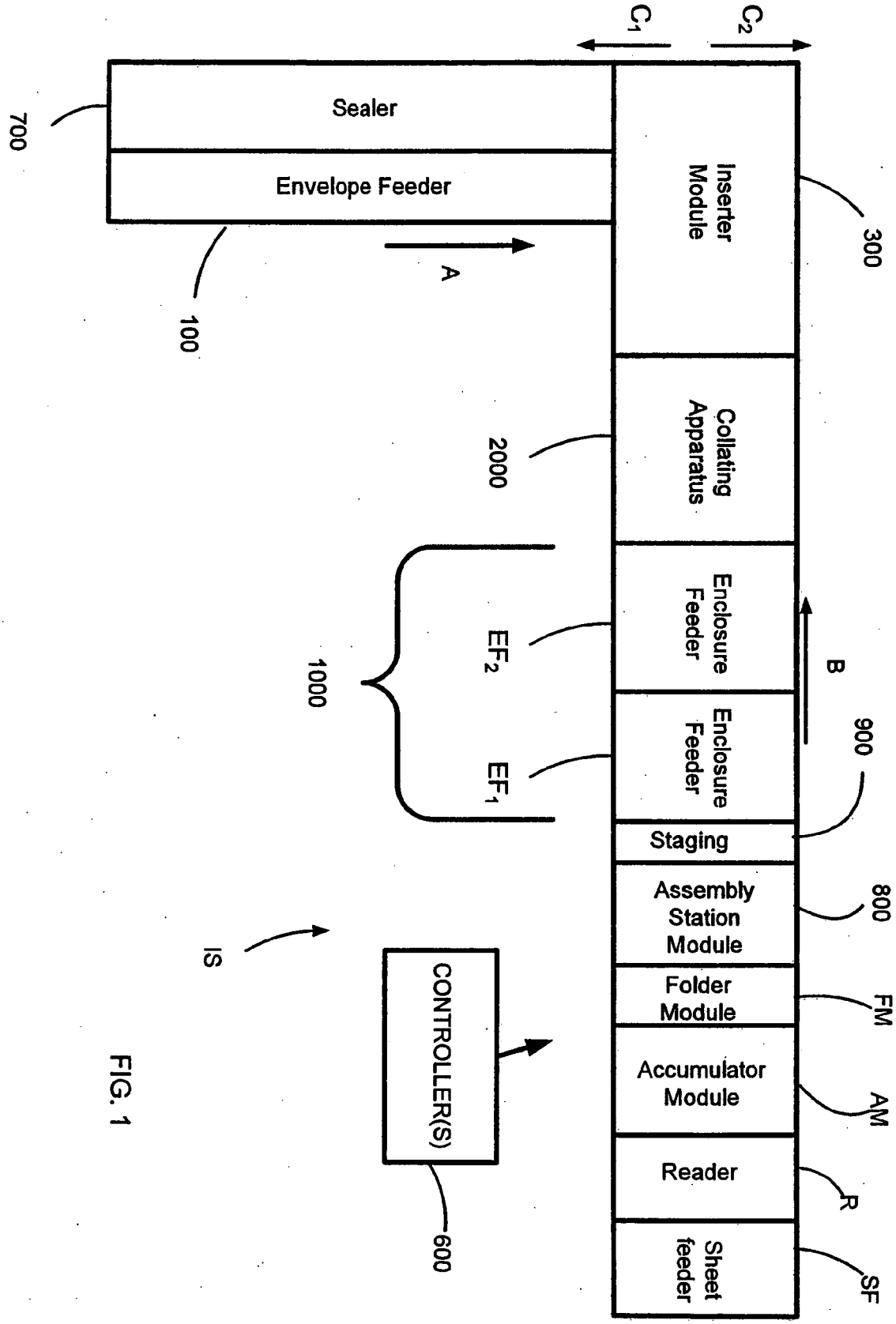

C1
C2
Sealer
Envelope Feeder
700
100
A
Inserter Module
300
Collating Apparatus
2000
Enclosure Feeder
EF2
1000
Enclosure Feeder
EF1
B
900
Staging
Assembly Station Module
800
Folder Module
FM
Accumulator Module
AM
Reader
R
Sheet feeder
SF
IS
CONTROLLER(S)
600

FIG. 1

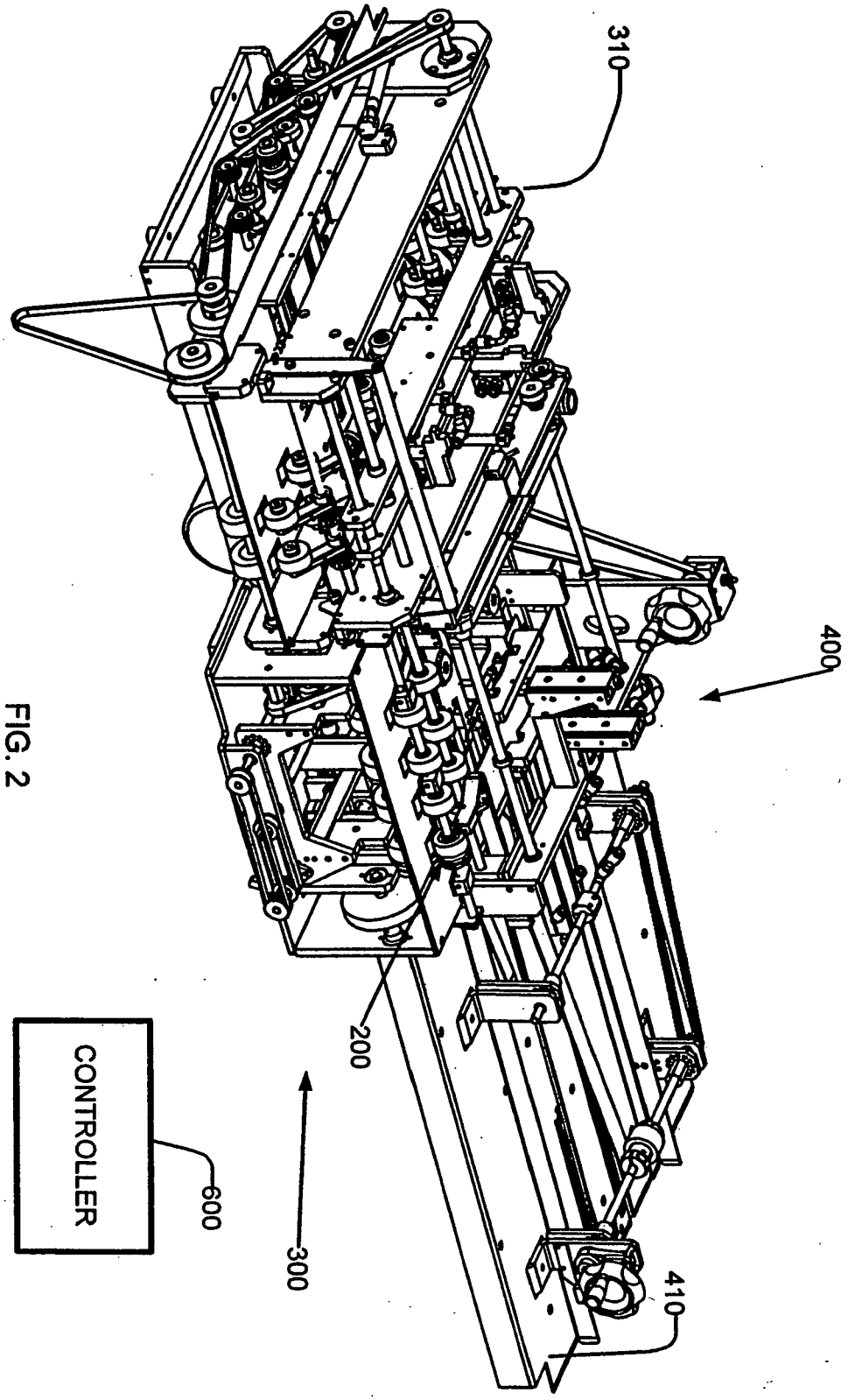


FIG. 2

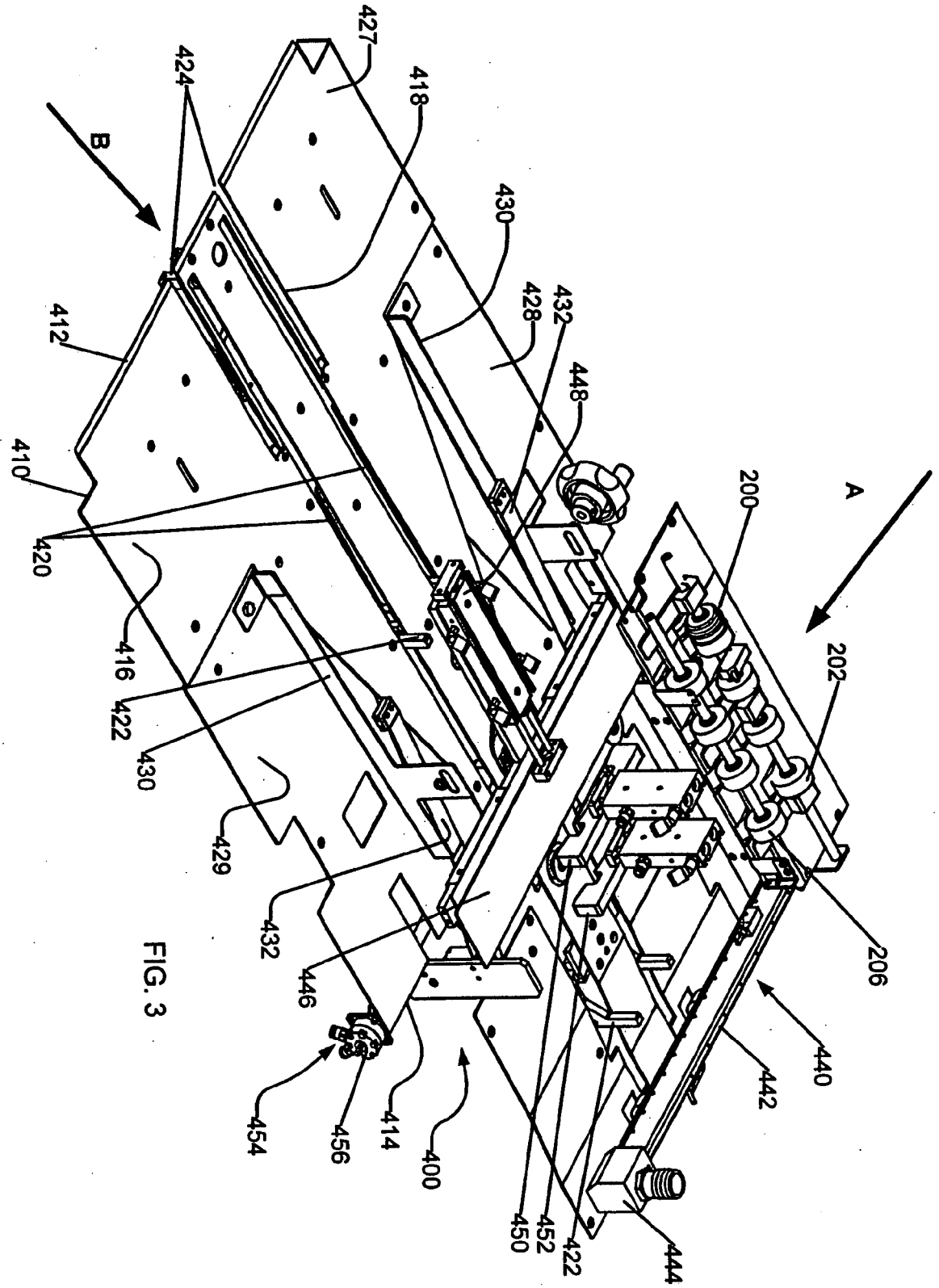

427
424
418
B
430
428
432
412
448
410
200
A
420
202
416
422
430
429
206
432
446
440
442
454
456
414
400
450
452
422
444

FIG. 3

FIG. 4A

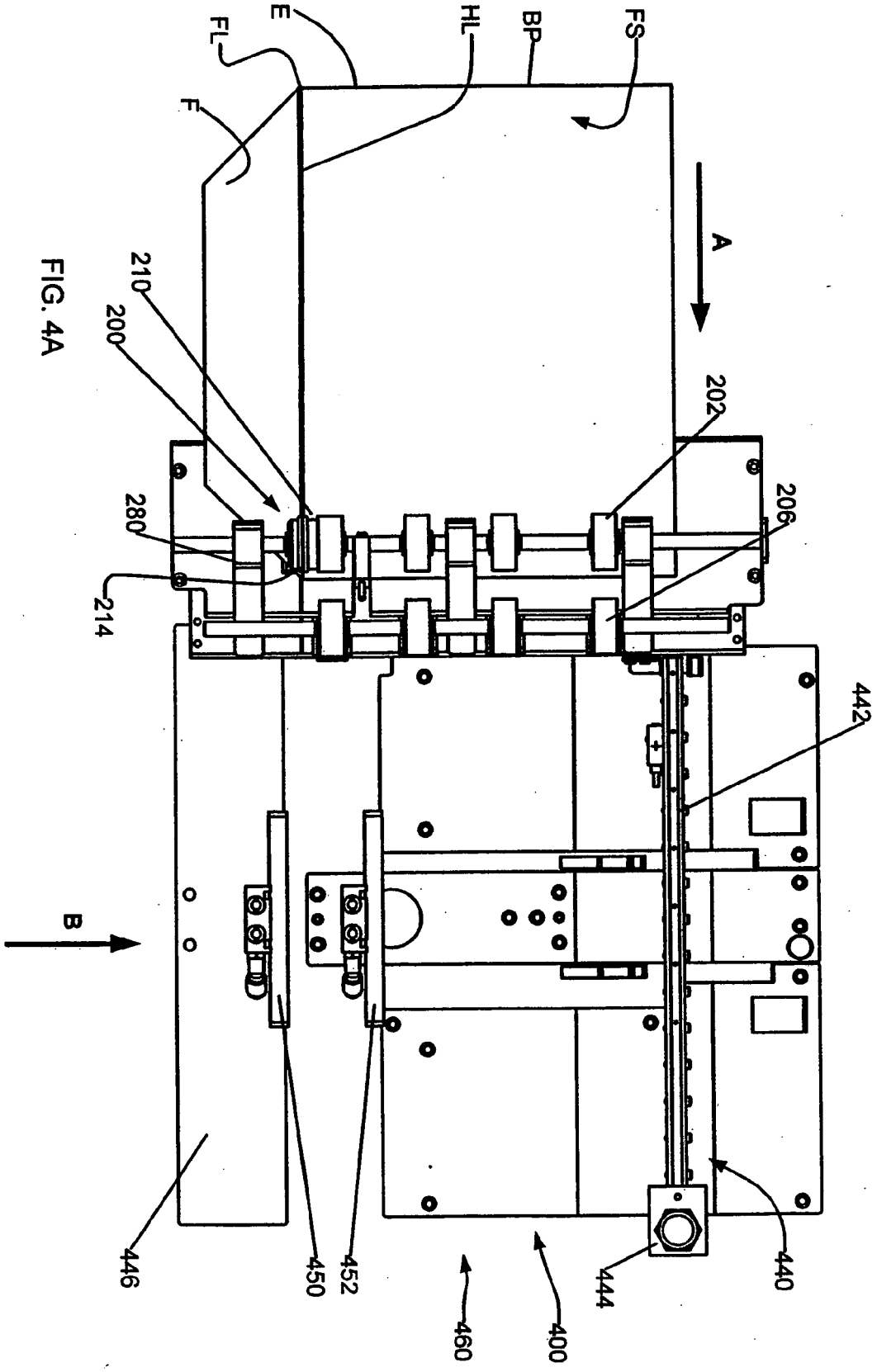
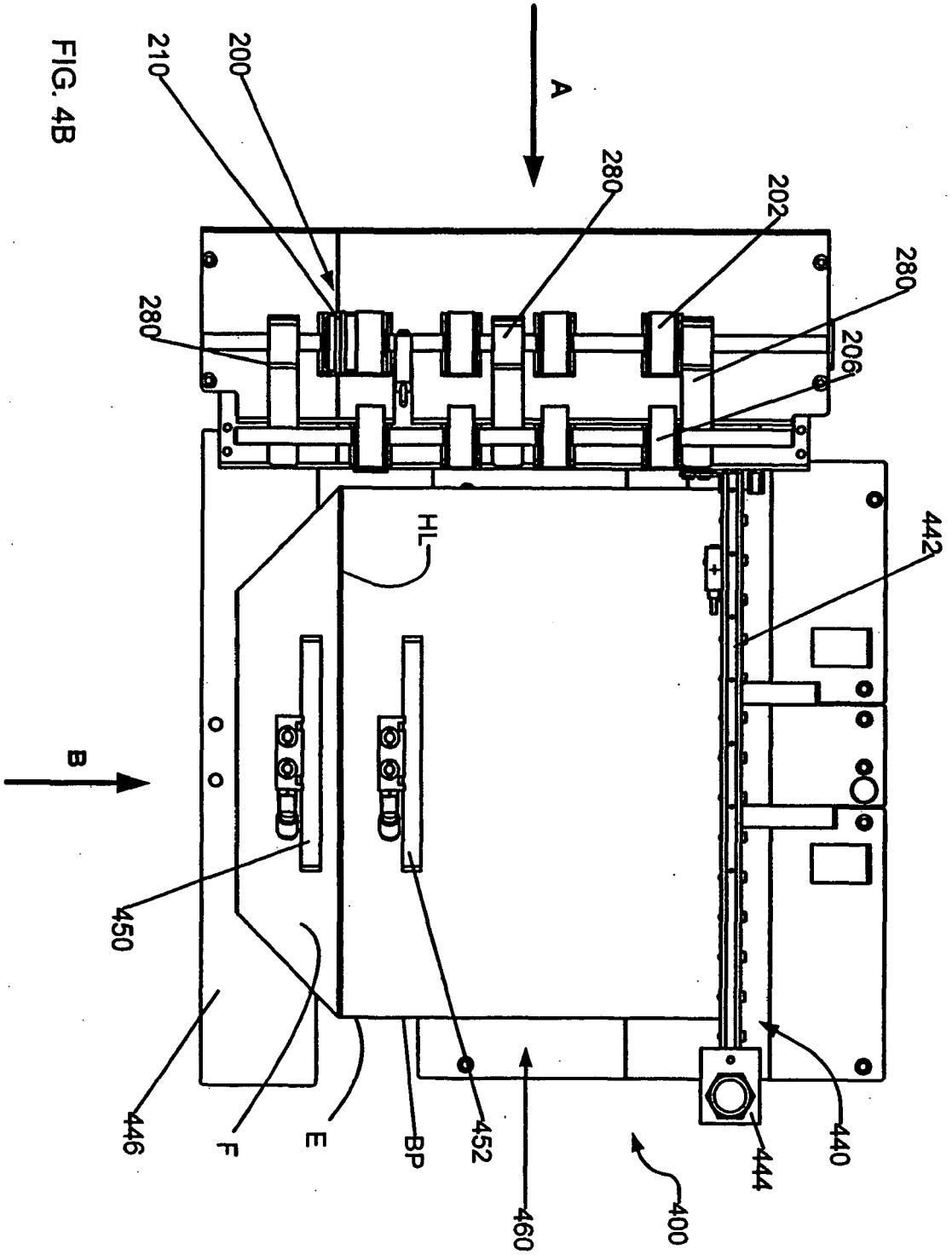

E
FL
F
HL
BP
FS
A
210
200
202
206
280
214
442
B
446
450
452
460
400
444
440

FIG. 4B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BP
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460
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440

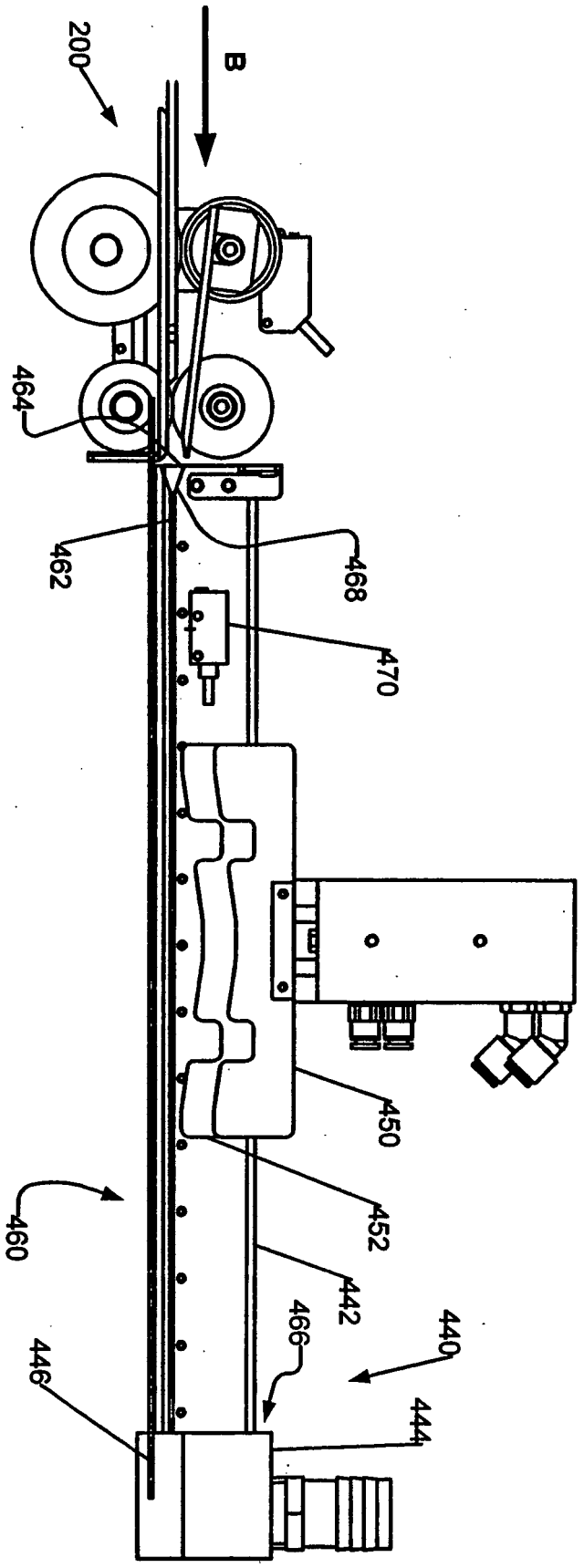
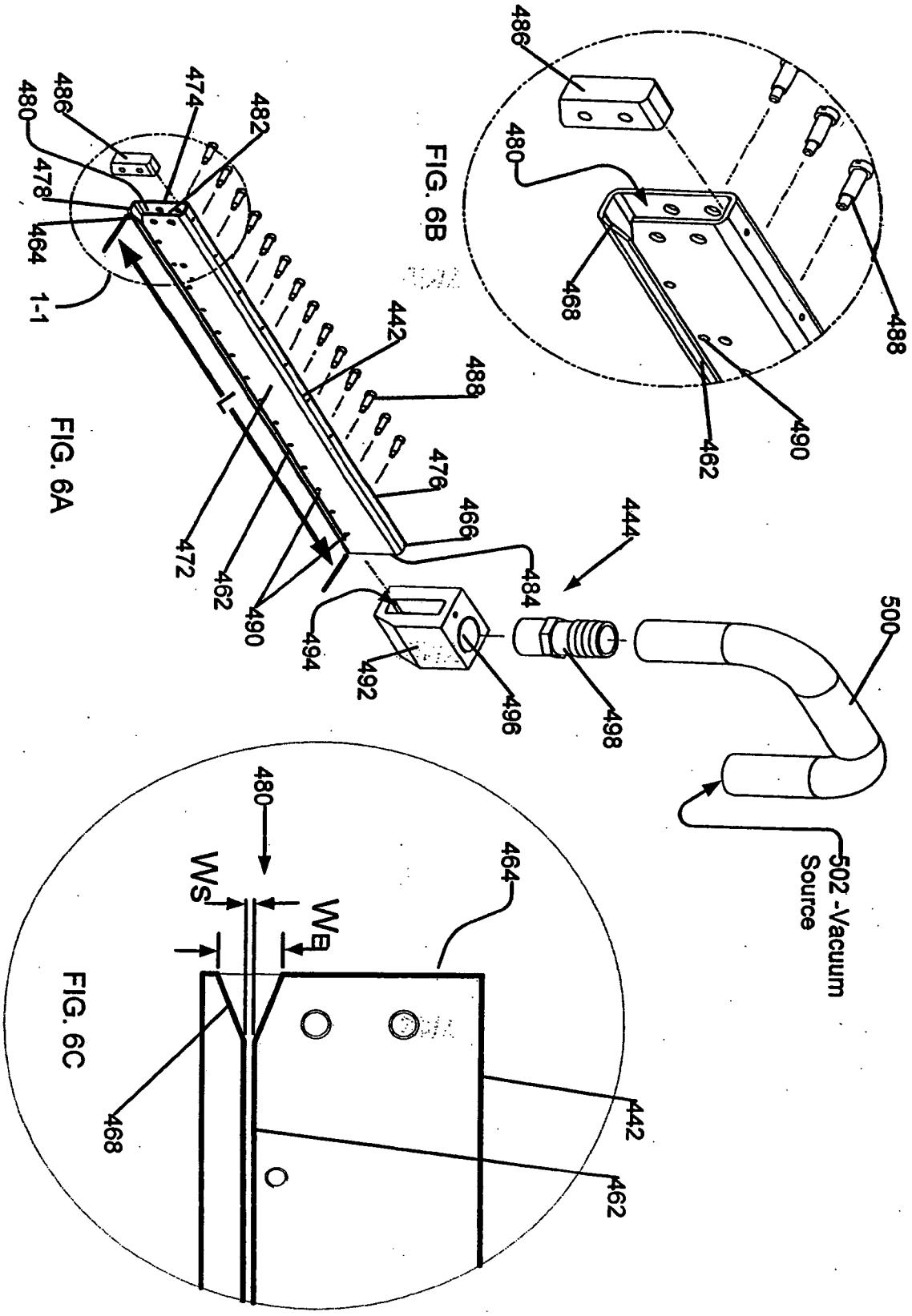


FIG. 5


486
480
468
488
462
490
FIG. 6B
474
482
486
480
478
464
1-1
442
488
476
466
472
462
490
494
492
484
444
496
498
500
502 -Vacuum Source
FIG. 6A
480
464
Ws
WB
468
442
462
FIG. 6C

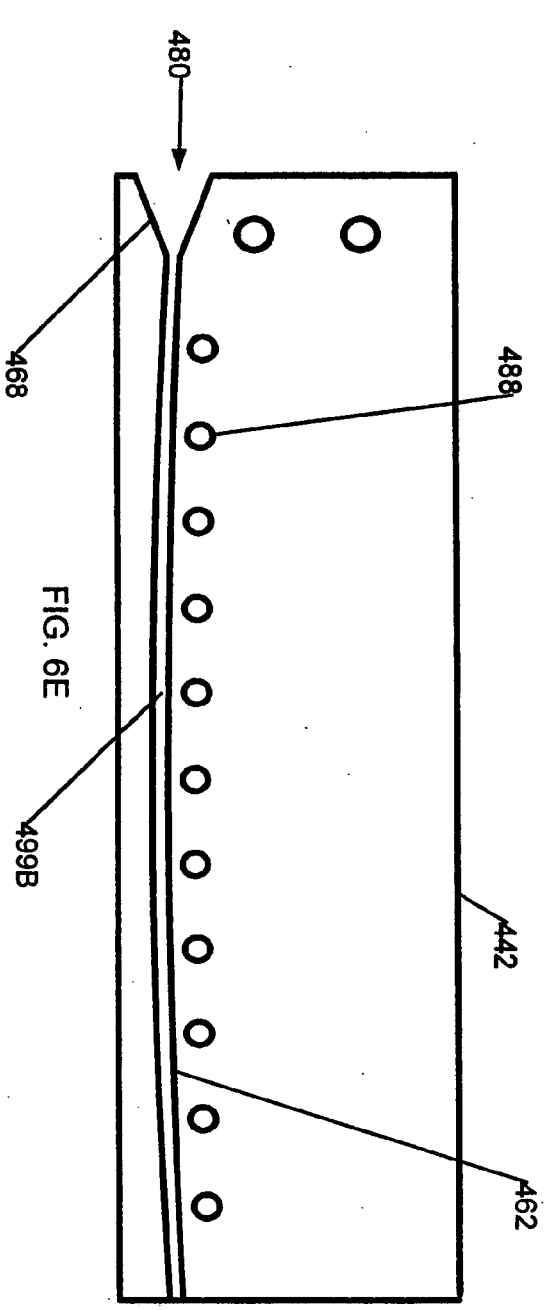


FIG. 6E

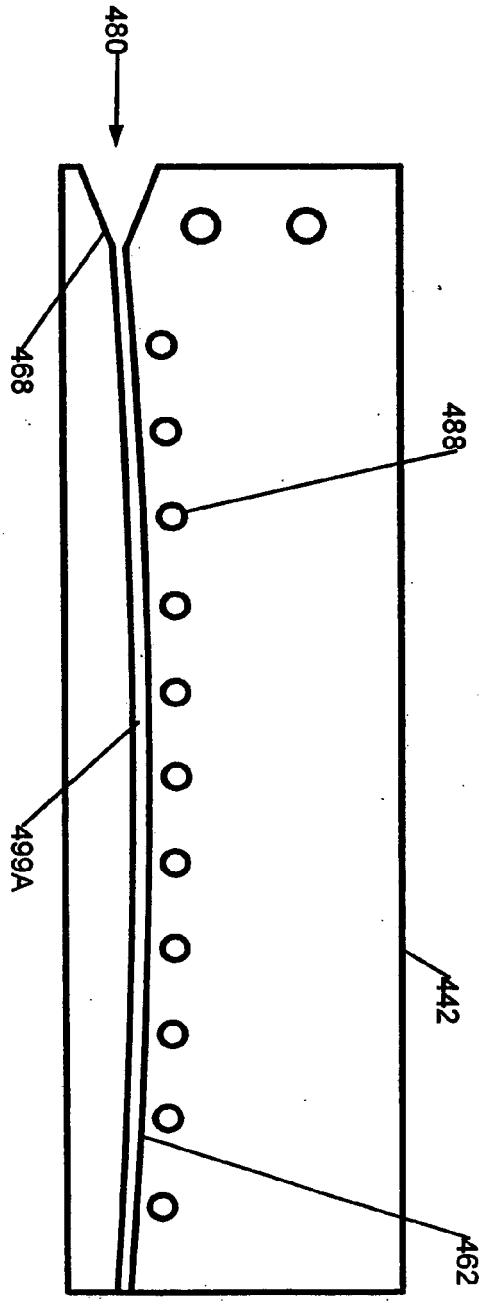
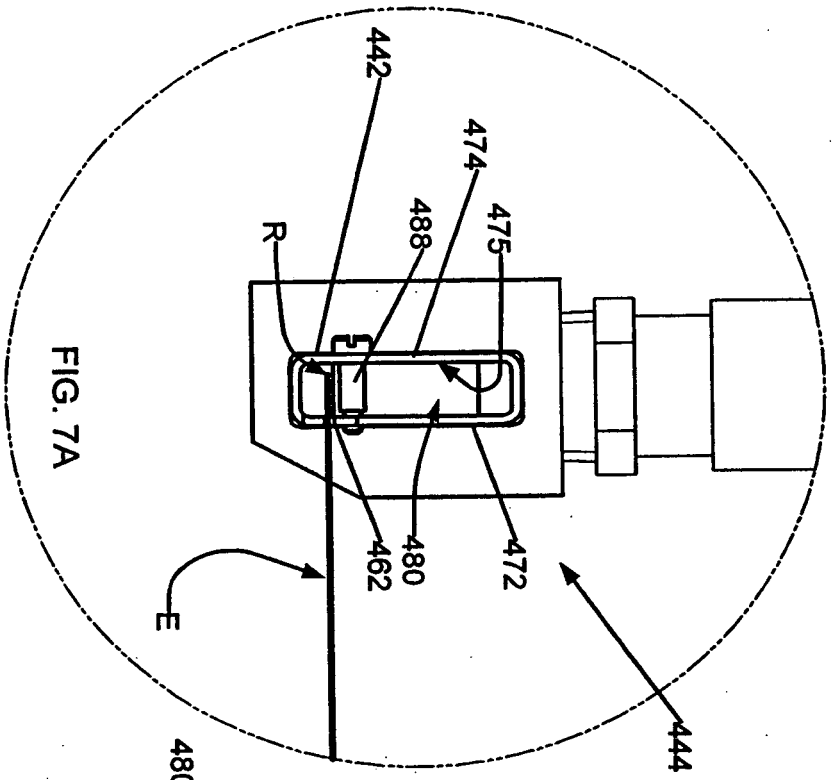


FIG. 6D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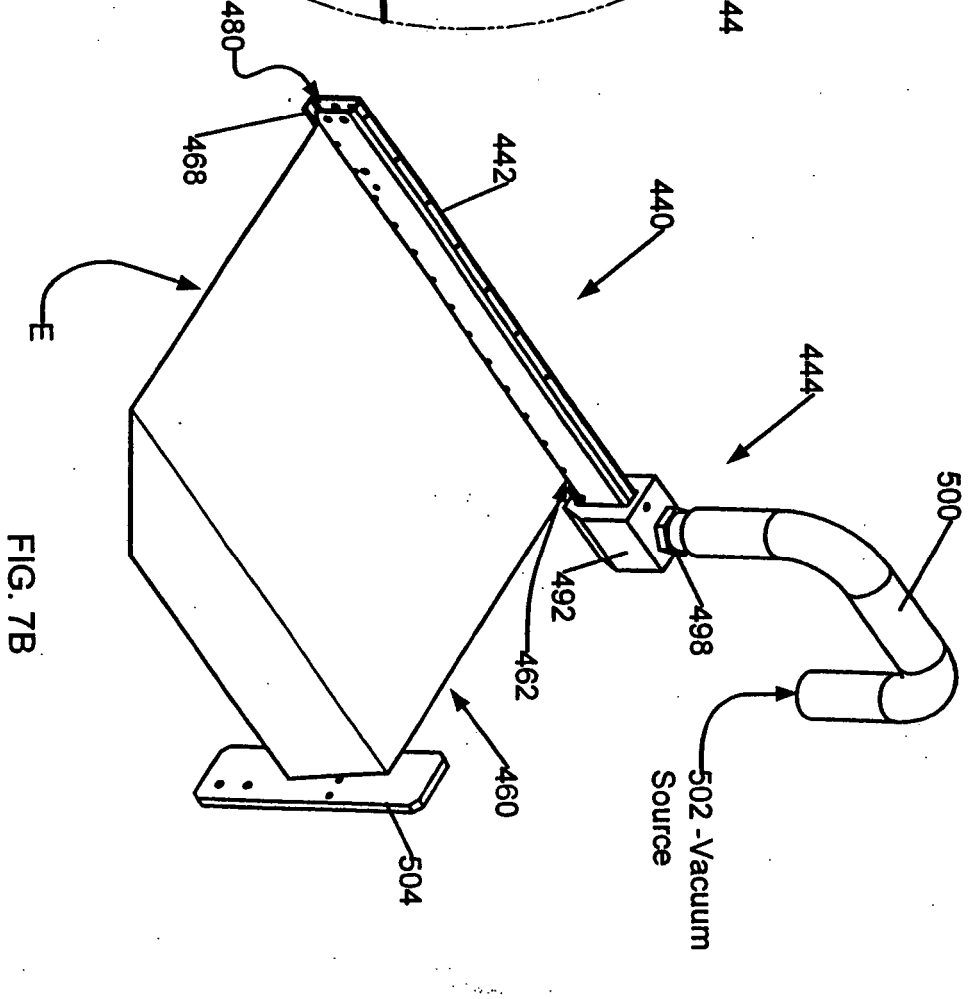
474
475
488
R
462
480
472
E
444

FIG. 7A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442
440
444
E
500
492
498
462
460
504
502 -Vacuum Source

FIG. 7B

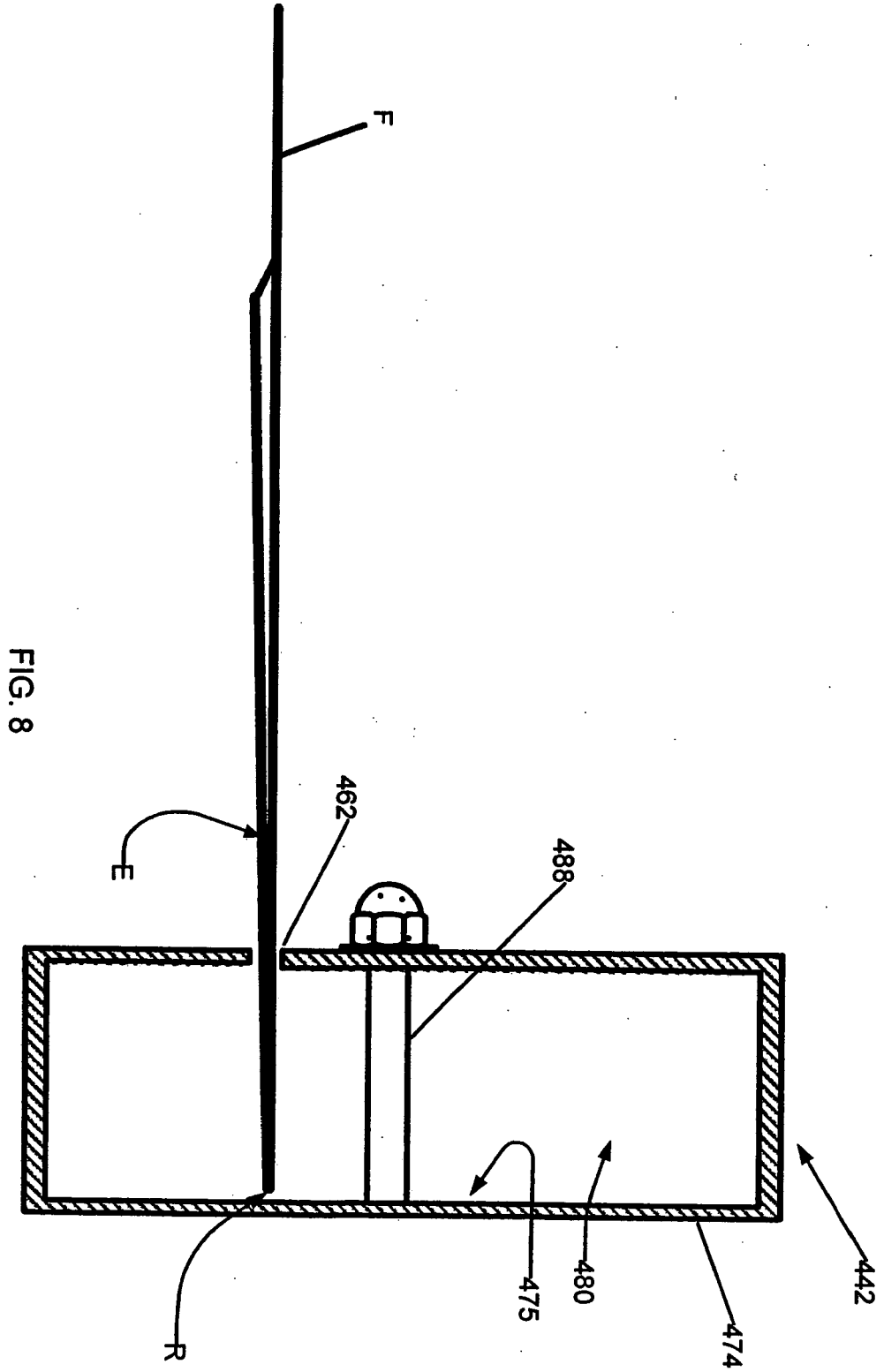


FIG. 8

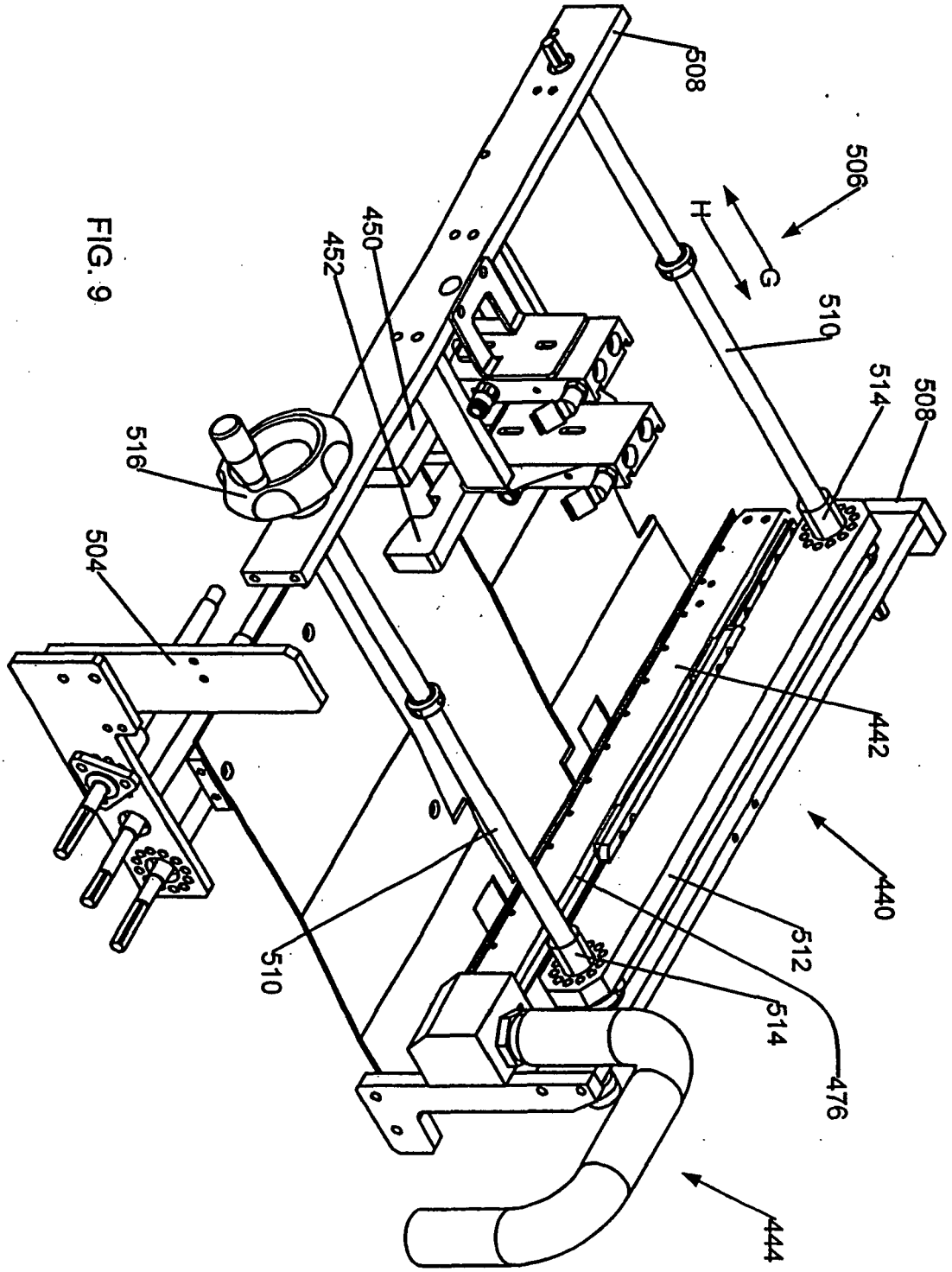
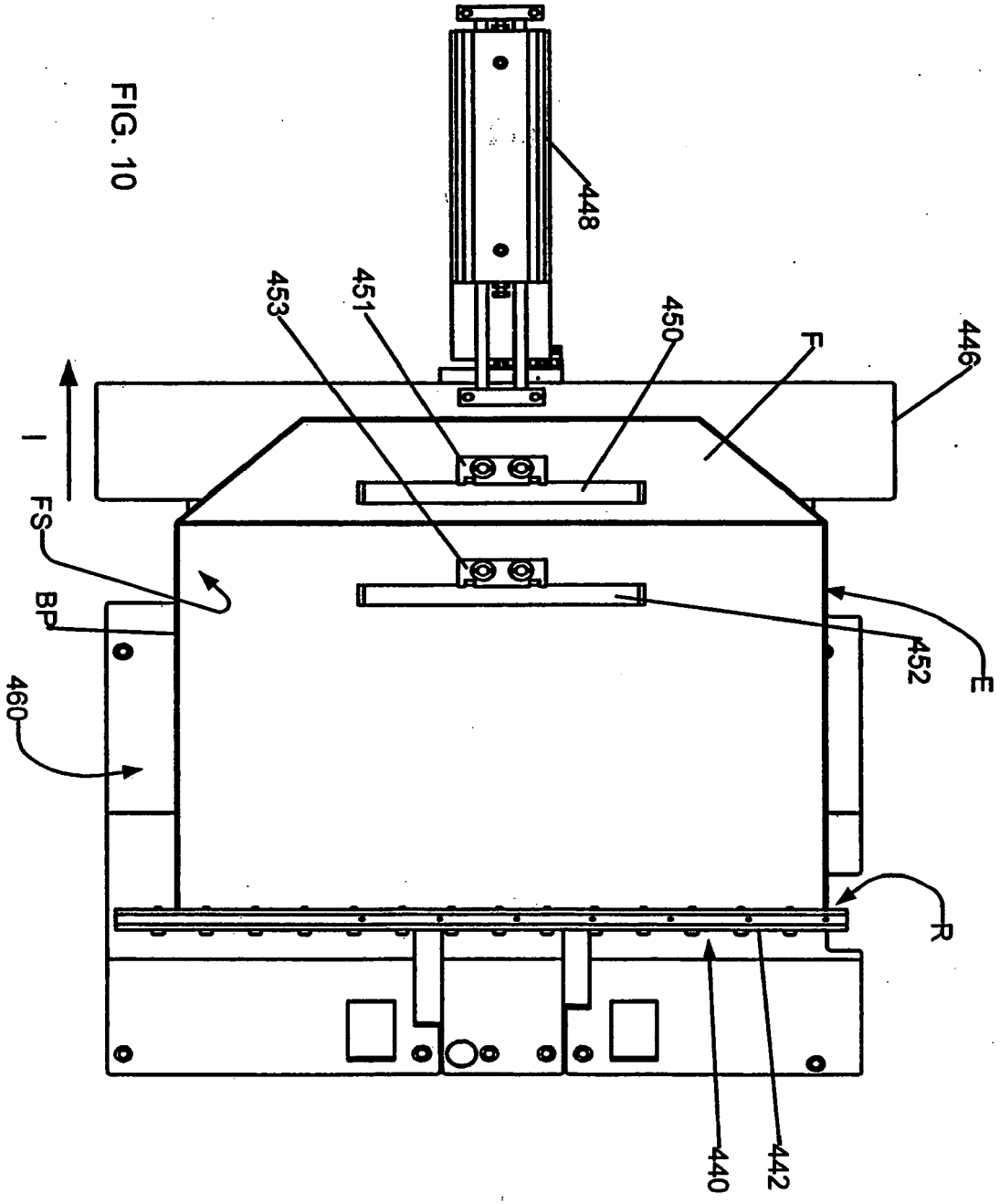

508
506
H
G
450
452
510
514
508
516
504
442
440
512
510
514
476
444

FIG. 9

FIG. 10



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