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(54) **BOOKLET FEEDER SYSTEMS AND METHODS**

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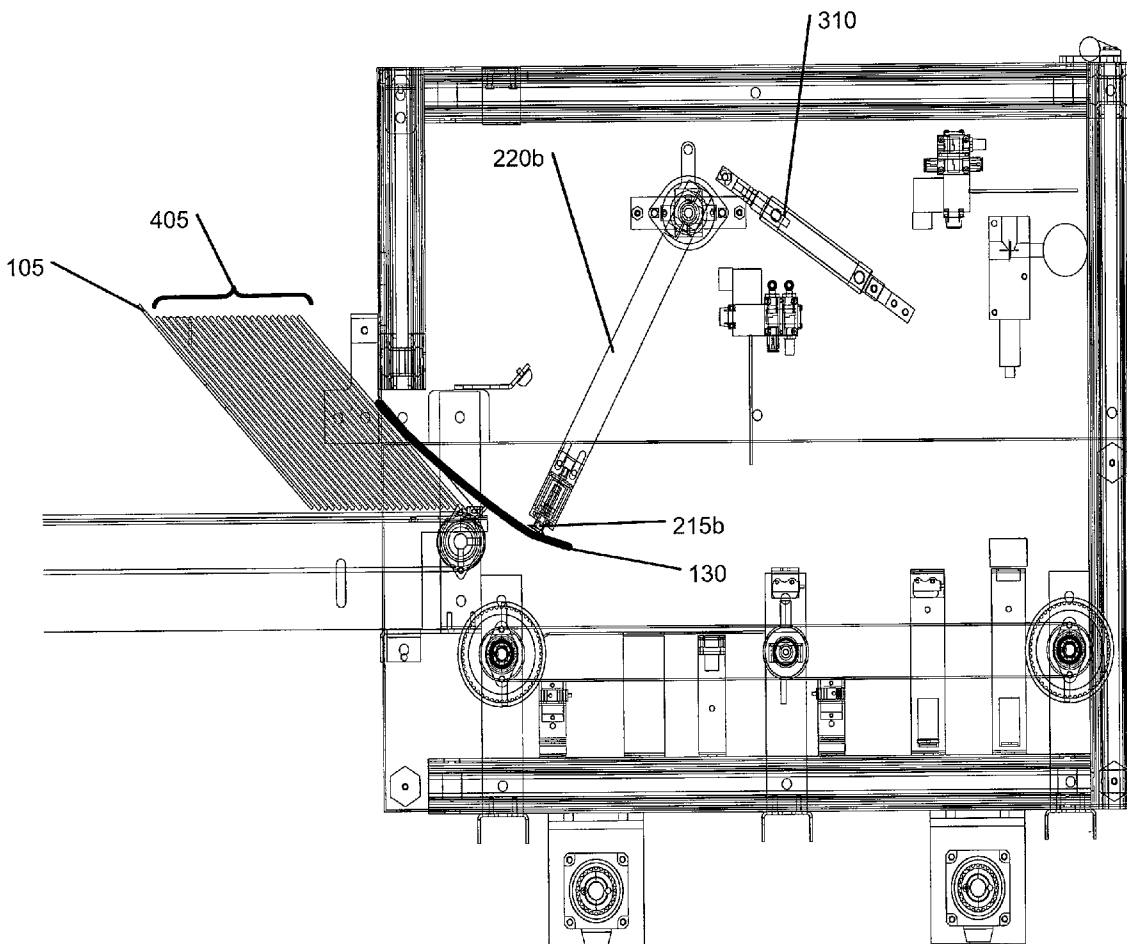
(57) **ABSTRACT**

The present subject matter relates to systems and methods for advancing booklets from a group of booklets are provided. In particular, a booklet feeder can include a conveying path for supporting a group of booklets with each booklet comprising a stack of bound sheet articles, and a grip remover configured for engaging booklets in a seriatim manner in the conveying path. The grip remover can be movable to remove an engaged booklet from the conveying path and advance the removed booklet to an exit path.

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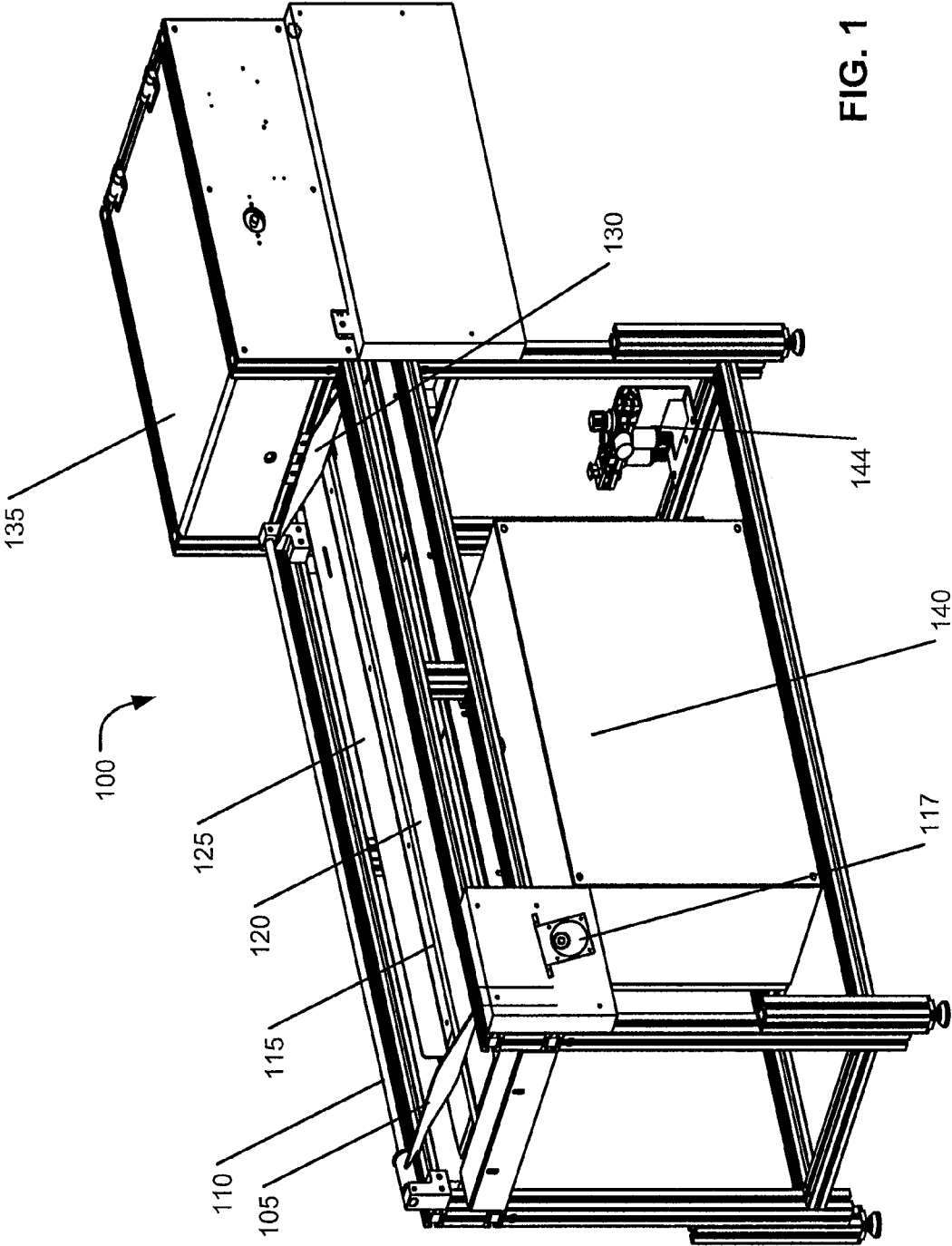


FIG. 1

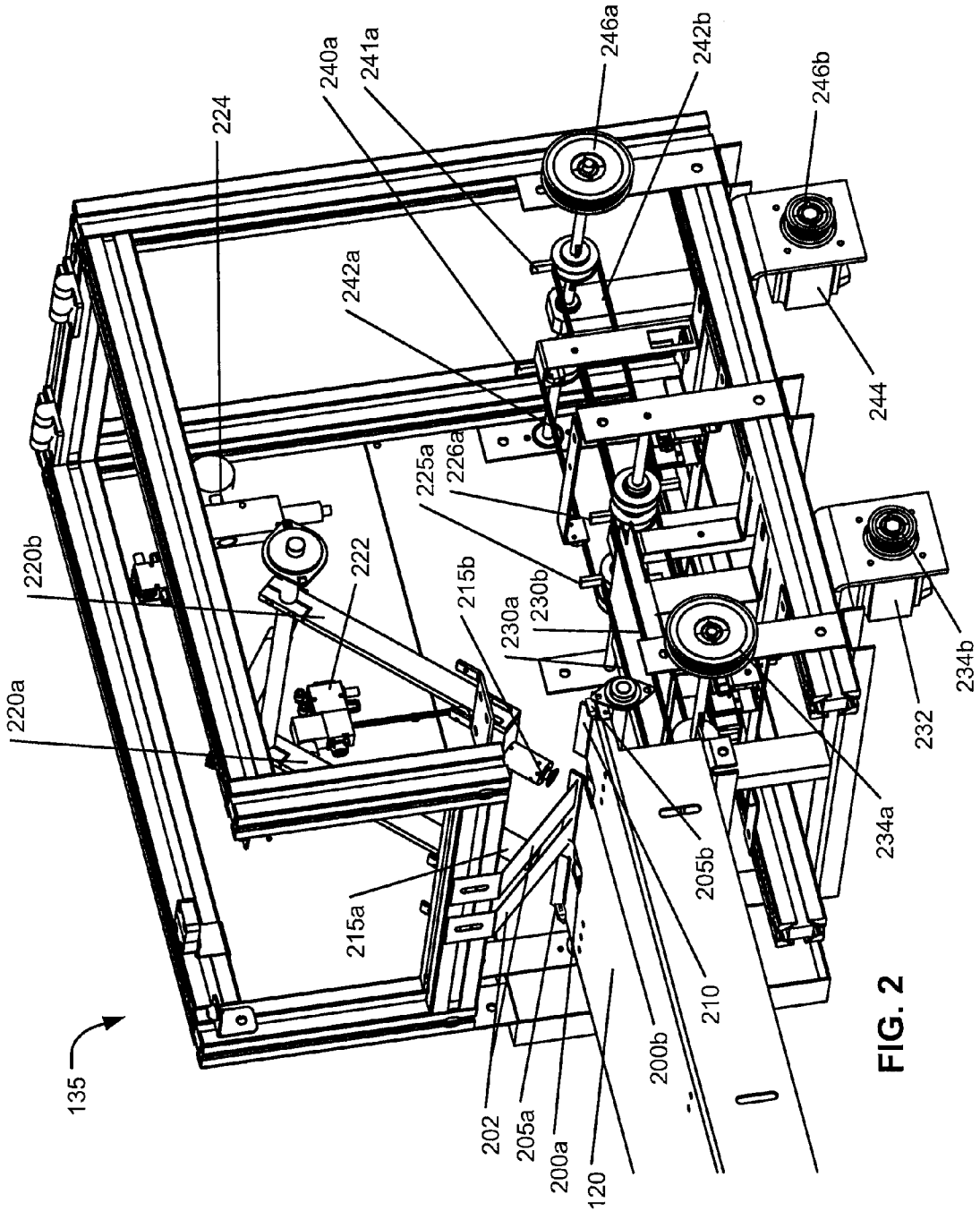


FIG. 2

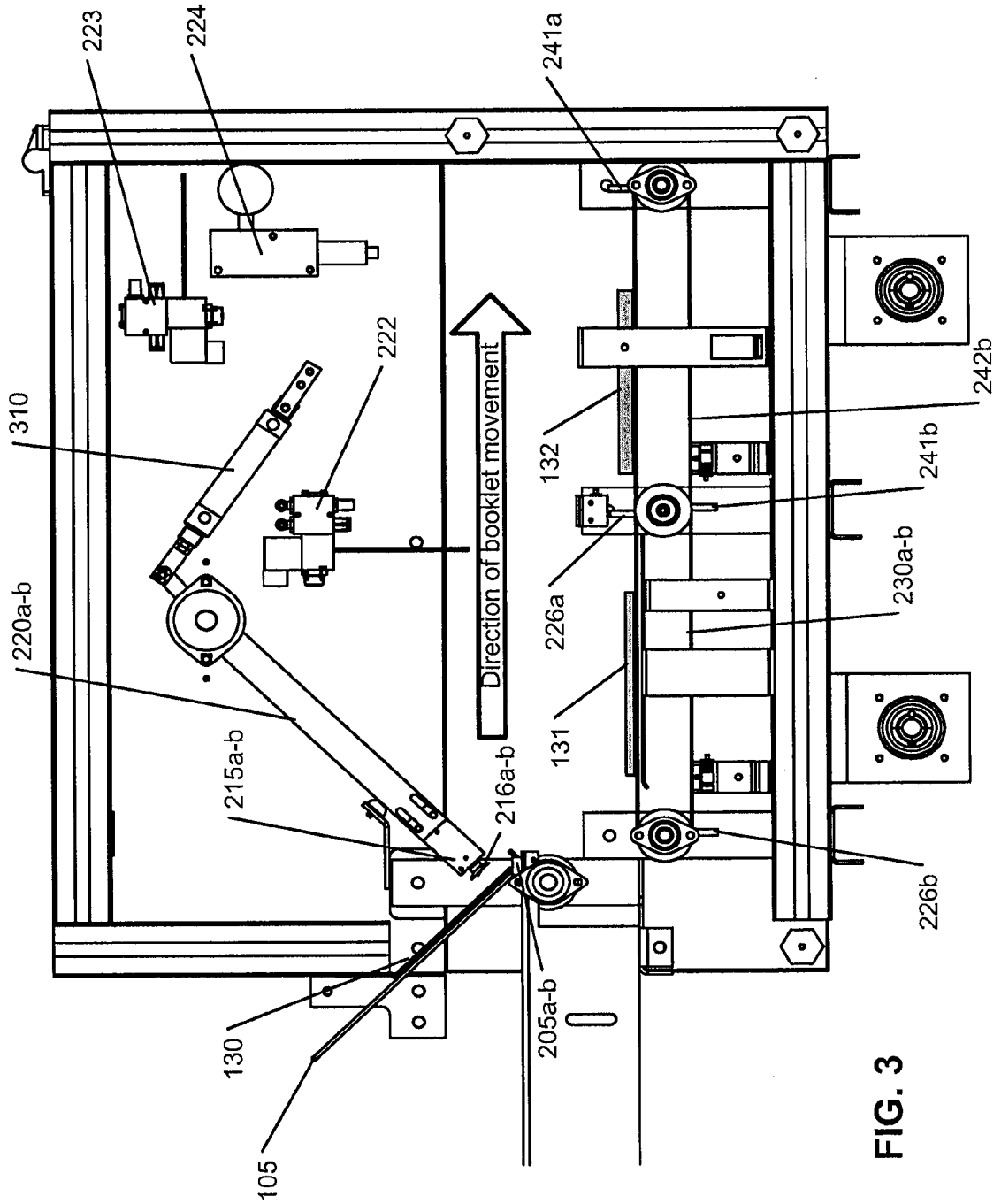


FIG. 3

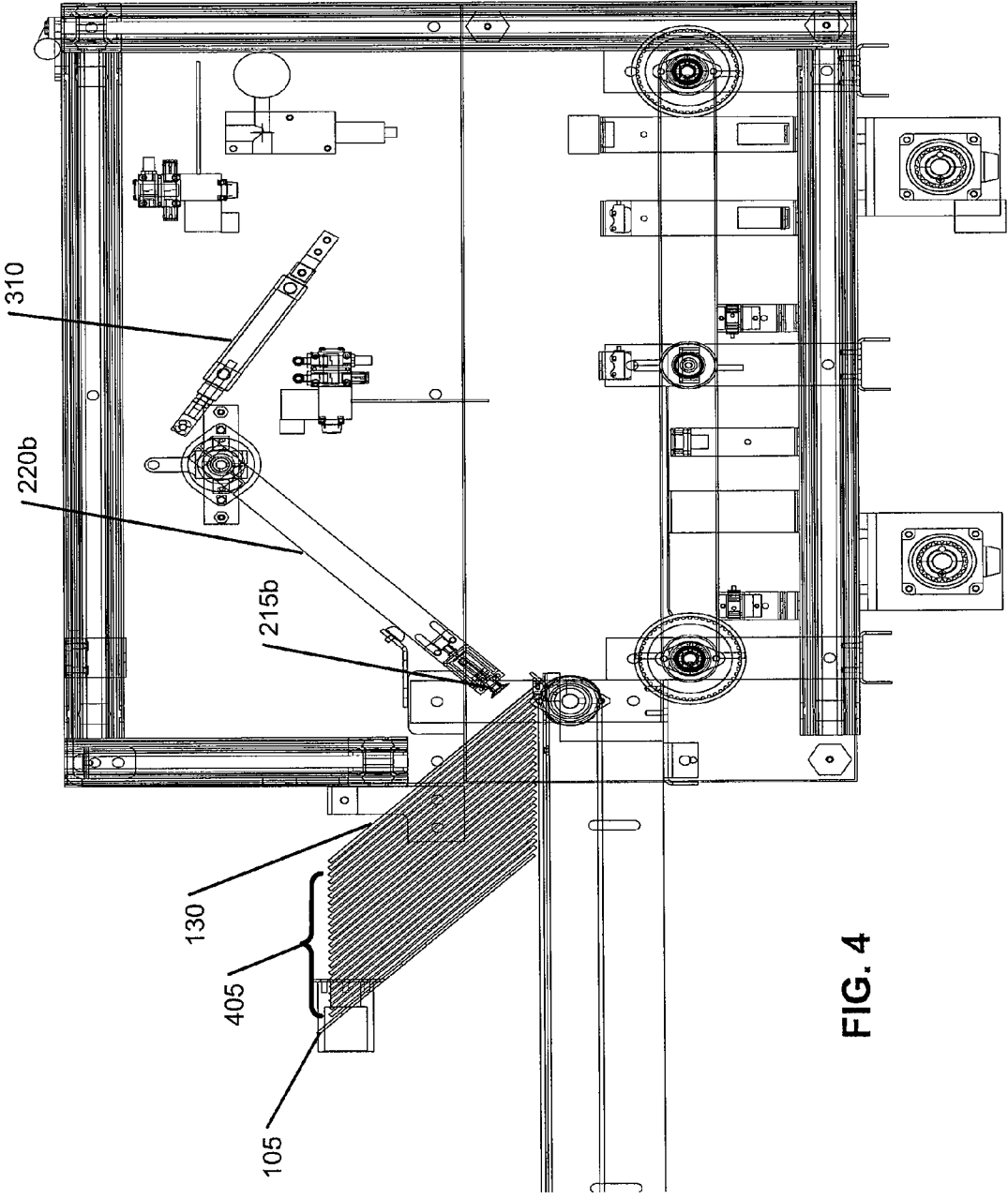


FIG. 4

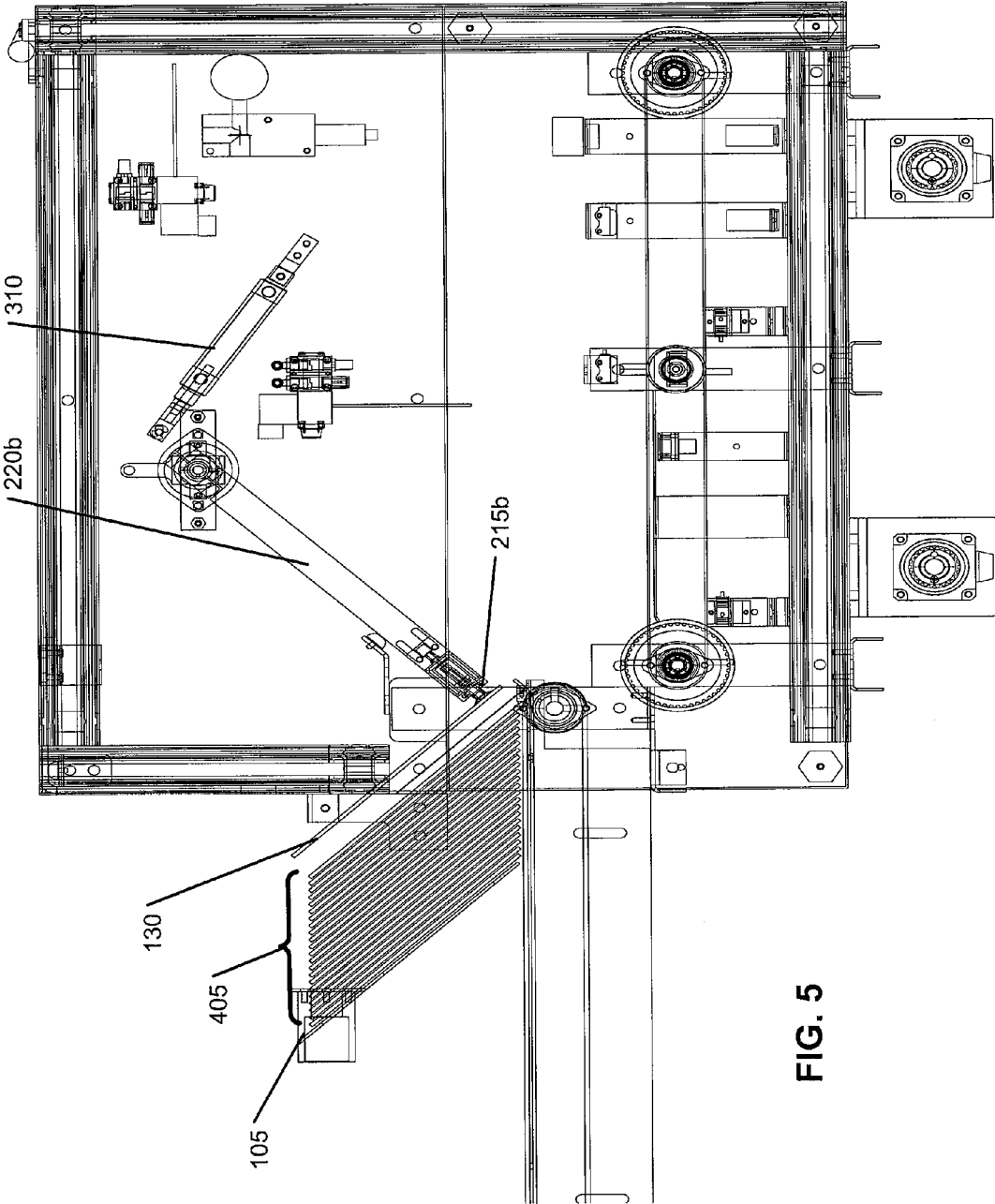


FIG. 5

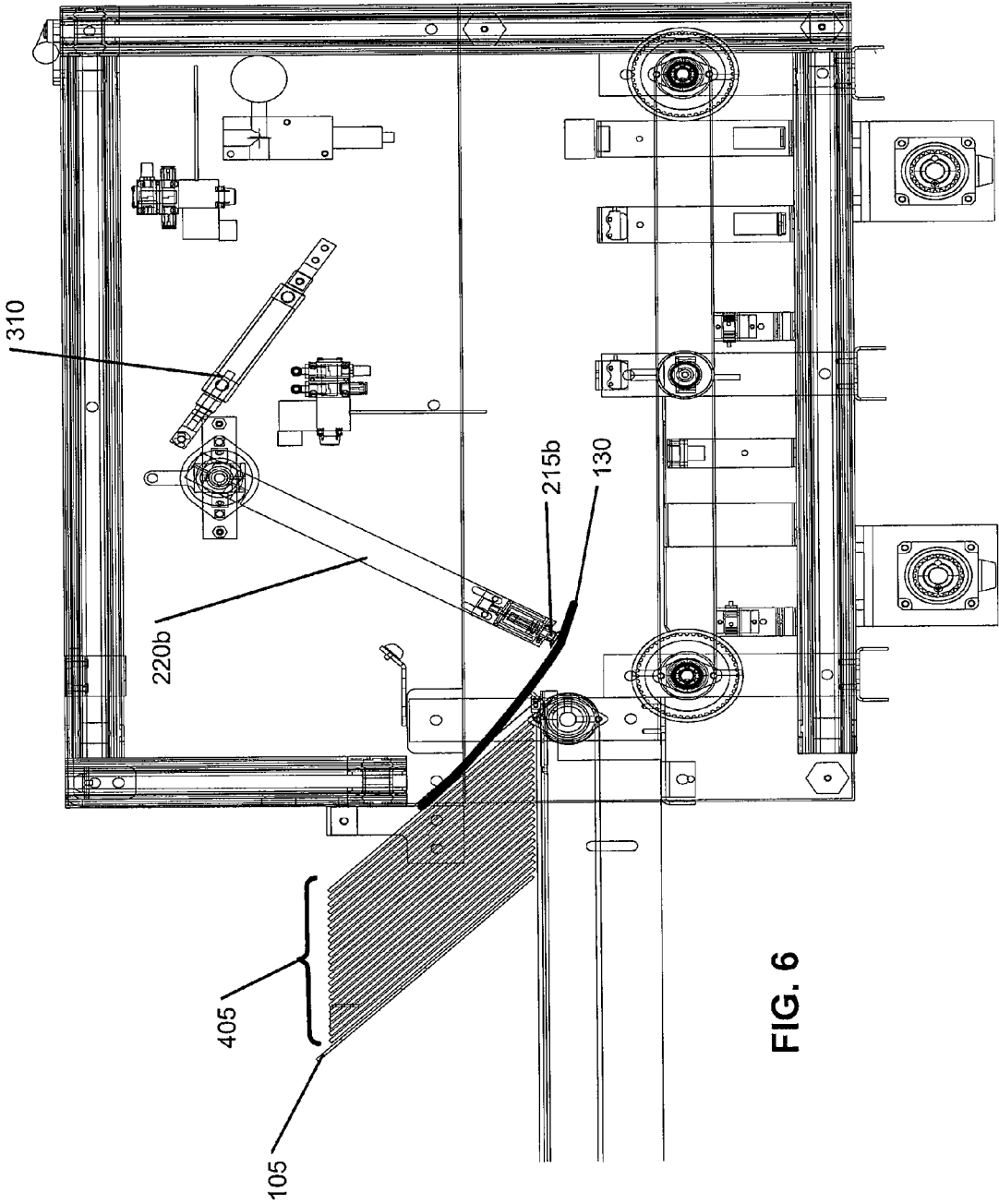


FIG. 6

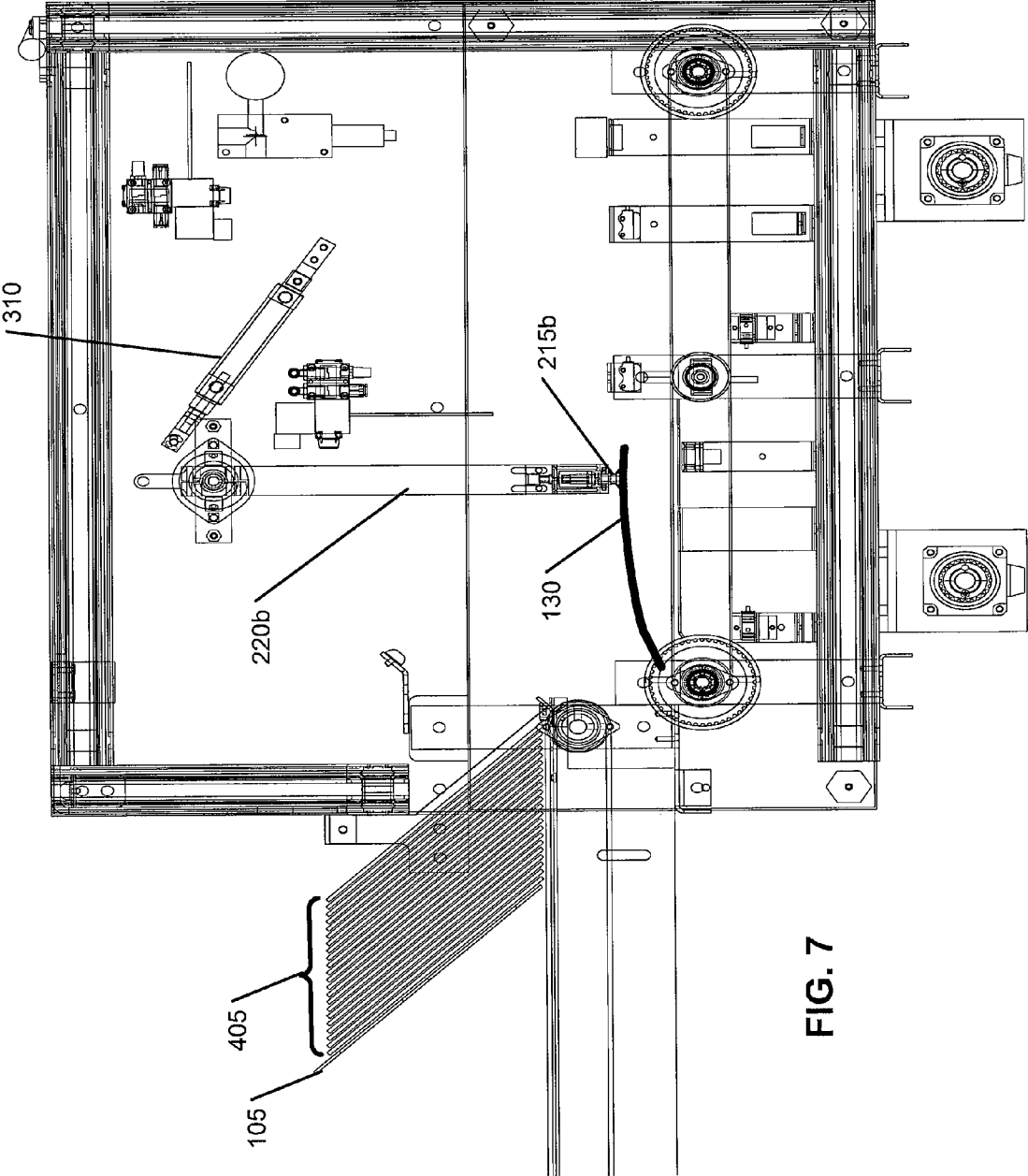


FIG. 7



**BOOKLET FEEDER SYSTEMS AND METHODS**

**TECHNICAL FIELD**

[0001] The subject matter disclosed herein relates generally to systems and methods for document handling and processing technologies. More particularly, the subject matter disclosed herein relates to booklet feeder systems and methods for processing or advancing booklets that can be of varying thicknesses.

**BACKGROUND**

[0002] Machines for feeding documents seriatim from a stack can be useful in a wide variety of document processing applications, such as printing, separating, collating, folding, scoring, and inserting machines, to name a few. A number of options are available for feeding documents in this manner, including friction rollers, reciprocating friction pusher feeders, grippers, and clamps-type devices, and including top-feeding or bottom-feeding systems. When booklets of multiple pages are to be advanced or fed, however, the thicknesses of the booklets can limit the options available.

[0003] In particular, currently-used systems for feeding booklets, such as friction feeders, generally require all of the booklets to be fed to have the same booklet thicknesses (i.e., the same page count and page thicknesses). If the booklets are too thick, they may not fit through the feeder assembly. If the booklets are too thin, they may not be taken up by the feeder assembly. As a result, the required uniformity prevents many choices of customization in the variety of booklets that can be processed in the same stack. Accordingly, current booklet feeders are ill-suited to provide a wide range of options for document processing.

**SUMMARY**

[0004] In accordance with this disclosure, systems and methods for advancing booklets from a group of booklets are provided. In one aspect, a booklet feeder is provided having a conveying path for supporting a group of booklets with each booklet comprising a stack of bound sheet articles, and a grip remover is provided and configured for engaging booklets in a seriatim manner in the conveying path. The grip remover can be movable to remove an engaged booklet from the conveying path and advance the removed booklet to an exit path.

[0005] In another aspect, the booklet feeder can be provided with a conveying path for supporting a group of booklets having non-uniform booklet thicknesses, at least one vacuum picker assembly configured for engaging booklets in a seriatim manner in the conveying path, and a controller connected to the at least one vacuum picker assembly for controlling the movement of an engaged booklet from the conveying path to the exit path. The conveying path can itself comprise a supply conveyor for advancing the group toward an end of the conveying path. The at least one vacuum picker assembly can be movable to remove an engaged booklet from the conveying path and advance the removed booklet to an exit path.

[0006] In yet other aspects, methods for advancing booklets from a group of booklets are provided. The methods can include supporting one or more booklets in a conveying path, engaging one of the booklets in the conveying path using a

grip remover, removing the engaged booklet from the conveying path, and advancing the removed booklet to an exit path.

[0007] Some of the aspects of the subject matter disclosed herein having been stated hereinabove, and which are achieved in whole or in part by the presently disclosed subject matter, other aspects will become evident as the description proceeds when taken in connection with the accompanying drawings as best described hereinbelow.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0008] The features and advantages of the present subject matter will be more readily understood from the following detailed description which should be read in conjunction with the accompanying drawings that are given merely by way of explanatory and non-limiting example, and in which:

[0009] FIG. 1 is a perspective view of a booklet feeder according to an aspect of the presently disclosed subject matter;

[0010] FIG. 2 is a perspective view of a booklet feeder according to an aspect of the presently disclosed subject matter with the interior components exposed;

[0011] FIG. 3 is an elevated side view of an interior of a booklet feeder according to an aspect of the presently disclosed subject matter; and

[0012] FIGS. 4 through 7 are side views of an interior of a booklet feeder in sequential steps of operation according to an aspect of the presently disclosed subject matter.

**DETAILED DESCRIPTION**

[0013] Reference will now be made in detail to presently preferred aspects of the present subject matter, one or more examples of which are shown in the 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.

[0014] The present subject matter provides systems and methods for advancing booklets from a group of booklets. As will be appreciated by those of skill in the art, references to a "booklet" can be understood to mean, as an example and without limitation, a stack of bound sheet articles or the like. Further, the term "bound" should be understood to mean, as an example and without limitation, anything that suitably holds or maintains a stacked group of sheet articles together. In particular, such systems and methods can be used in document processing systems such as, for example, mail inserting systems, mail sorting systems, and any other suitable sheet processing systems. In one aspect, the present subject matter provides a booklet feeder, generally designated 100, for advancing booklets such as booklet 130 from a group of booklets. Booklet feeder 100 can include a conveying path, generally designated 120, for supporting a group of booklets (only a single booklet 130 is illustrated in FIG. 1 to show the underlying features of conveying path 120). For instance, conveying path 120 can comprise a supply conveyor 115 for advancing the group toward an end of conveying path 120.

[0015] In particular, as is illustrated in FIG. 1, supply conveyor 115 can be a continuous belt conveyor that is driven by a supply conveyor drive motor 117 over a set of supply conveyor pulleys 200a and 200b (see, e.g., FIG. 2). In this configuration, supply conveyor 115 can advance booklets such as

booklet **130** toward an end of conveying path **120**, which can be in communication with a feeder assembly, generally designated **135**. Conveying path **120** can also include booklet side guides **125** for keeping the group of booklets aligned as they are advanced. In addition, conveying path **120** can also include a paddle assembly **105** movable with supply conveyor **115** for guiding the advancement of the booklets such as booklet **130**. Paddle assembly **105** can be angled relative to conveying path **120** for supporting the group of booklets at an angle (e.g., about a 45° angle). Paddle assembly **105** can be guided along conveying path **120** by paddle slide guides **110**.

[0016] Referring now to FIG. 2, when a first booklet **130** in the group reaches an end of conveying path **120**, one or more sensors **205a** and **205b** can signal supply conveyor **115** to stop moving. In addition, an advancement barrier can be provided for preventing the inadvertent advancement of the group. Examples of an advancement barrier can include a raised lip **210** on the end of conveying path **120** (e.g., about ½ inch high) and/or a flexible hold-back **202** (e.g., a spring steel hold-back), both of which are shown in FIG. 2.

[0017] Booklet feeder **100** can further include one or more booklet removers, such as grip removers **215a** and **215b** that can be contained within feeder assembly **135**. These grip removers **215a** and **215b** can be configured for engaging booklets such as booklet **130** in a seriatim manner in conveying path **120**. Further, grip removers **215a** and **215b** can be movable to remove an engaged booklet **130** from conveying path **120** and advance the removed booklet **130** to an exit path, which is generally designated **230** in the Figures. Grip removers **215a** and **215b** can be movable to lift the engaged booklet **130** past the advancement barrier (e.g., under flexible hold-back **202** and/or over raised lip **210**). For instance, grip removers **215a** and **215b** can be configured to raise booklet **130** away from the group of booklets and over raised lip **210** (e.g., raise the bottom of booklet **130** about 1.25 inches)

[0018] In one aspect, grip removers **215a** and **215b** can comprise vacuum picker assemblies, which can be carried on pivotable swing arms **220a** and **220b**, respectively. Suction can be provided by a vacuum generator **224** (e.g., a vacuum pump or pressurized air source), the operation of which can be regulated by a first vacuum control valve **222** and fed from an air preparation system **144** (see FIG. 1). In such a system, grip removers **215a** and **215b** are moved near booklet **130** and suction is created (i.e., vacuum generator **224** is enabled). Booklet **130** is controllably engaged by grip removers **215a** and **215b** such that booklet **130** can be moved with the movement of grip removers **215a** and **215b**. When booklet **130** is moved to a desirable location, the suction is removed, and booklet **130** can be disengaged from grip removers **215a** and **215b**.

[0019] Regardless of the specific design of grip removers **215a** and **215b**, however, grip removers **215a** and **215b** can be configured for engaging booklets regardless of the booklet thicknesses. As a result, grip removers **215a** and **215b** can advance booklets such as booklets **130** having any of a variety of booklet thicknesses (e.g., number of pages from 2 pages to about 100 pages or more) from conveying path **120** to exit path **230**. Further, because grip removers **215a** and **215b** need not be specifically designed for a particular booklet thickness, booklet feeder **100** can be used to advance groups of booklets having non-uniform booklet thicknesses (e.g., varying page counts and varying paper weights within the same stack) without requiring adjustments to booklet feeder **100**. For example, as is shown in FIG. 3, a relatively thin booklet **130a**

and a relatively thick booklet **130b** can be advanced in a continuous manner. Such flexibility can provide advantages over current booklet feeders, which, as noted above, are generally configured for a specific booklet thickness and would need to be adjusted before feeding a booklet having a different thickness. This design thus allows for personalization opportunities and possibly partnering with other print vendors.

[0020] As noted above, booklet **130** can then be moved toward exit path **230**. This movement can be accomplished by pivoting lever arms **220a** and **220b** from a first position in which grip removers **215a** and **215b** are near the end of conveying path **120** to a second position above exit path **230**. Specifically, lever arms **220a** and **220b** in the first position can be oriented at an angle relative to conveying path **120** to match the angle of booklet **130** (e.g., about 45 degrees). The pivoting of lever arms **220a** and **220b** can be caused by the operation of a swing arm actuator **310** (e.g., an air cylinder), which can be regulated by a second vacuum control valve **223**.

[0021] Exit path **230** can be an output conveyor, for instance having conveyor sections **232a**, **232b**, **242a**, and **242b**, for advancing the removed booklet **130** away from grip removers **215a** and **215b**. In particular, exit path **230** can comprise a first output conveyor stage composed of first output conveyor sections **232a** and **232b** and a second output conveyor stage composed of second output conveyor sections **242a** and **242b**. First output conveyor sections **232a** and **232b** can be driven by a first drive motor **234** (e.g., a stepper motor) connected through first drive pulleys **236a** and **236b**. Second conveyor sections **242a** and **242b** can be independently driven by a second drive motor **244** (e.g., another stepper motor) through second drive pulleys **246a** and **246b**. In this arrangement, the first output conveyor stage can be adapted for advancing the removed booklet **130** to the second output conveyor stage. In addition, the first output conveyor stage can further include first booklet pusher lugs **225a** and **226a** associated with first output conveyor sections **232a** and **232b**, respectively, for assisting the advancement of booklet **130** from the first output conveyor stage to the second output conveyor stage. In addition, first booklet pusher lugs **225a** and **226a** can be complemented by additional booklet pusher lugs connected to opposite ends of first output conveyor sections **232a** and **232b**, respectively (see first booklet pusher lug **226b** complementary to first booklet pusher lug **226a** in FIG. 3). Similarly, the second output conveyor stage can include second booklet pusher lugs **240a** and **241a** associated with second output conveyor sections **242a** and **242b**, respectively, for assisting the advancement of booklet **130** out of feeder assembly **135** for downstream processing. (Again, additional second booklet pusher lugs, such as second booklet pusher lug **241b** shown in FIG. 3 can also be provided.)

[0022] A controller, such as the computer controller generally designated **140** in FIG. 1, can be provided to coordinate the advancement of booklet **130** along conveying path **120**, the engagement of booklet **130** by grip removers **215a** and **215b** (e.g., vacuum picker assemblies), the movement of grip removers **215a** and **215b** to move engaged booklet **130** from conveying path **120** to exit path **230**, and the advancement of booklet **130** along exit path **230**.

[0023] With a configuration such as is described above, booklet feeder **100** can operate as shown in FIGS. 4 through 7. A group of booklets **405**, which can have non-uniform booklet thicknesses, can be supported on conveying path **120**. As noted above, group **405** can be supported on conveying

path 120 at an angle relative to conveying path 120 (e.g., about a 45° angle). Group 405 can be advanced along supply conveyor 115 toward grip remover 215b, but advancement can be stopped when a first booklet 130 in group 405 reaches an end of supply conveyor 115. It is noted that although grip remover 215a is not shown in this drawing, it is to be understood that both grip removers 215a and 215b can be positioned identically to operate cooperatively together.

[0024] As is shown in FIG. 4, swing arm 220b can be positioned such that grip remover 215b is near a first booklet 130 of group 405. Specifically, as indicated above, swing arm 220b can be positioned at an angle (e.g., about 45 degrees) such that grip remover 215b is angled complementarily to the angle of booklet 130. Referring to FIG. 5, booklets 405 can thus be engaged in a seriatim manner in conveying path 120 using grip remover 215b, for example by actuating the vacuum picker assembly serving as grip remover 215b. Referring to FIGS. 6 and 7, engaged booklet 130 can be removed from conveying path 120 and advanced toward exit path 230. As noted above, booklet 130 can be advanced from conveying path 120 to exit path 230 by the movement of grip remover 215b. Specifically, swing arm 220b on which grip remover 215b is carried can be pivoted from a first position (see, e.g., FIG. 5) in which grip remover 215b is near the end of conveying path 120 to a second position (see, e.g., FIG. 7) above exit path 230. Furthermore, it is noted again that although grip remover 215a and swing arm 220a are not shown, these elements can operate in the same manner as is described with regard to grip remover 215b and swing arm 220b. Once booklet 130 is moved above exit path 230, booklet 130 can be received on an output conveyor, such as a conveyor having sections 232a, 232b, 242a, and 242b illustrated in the Figures (Only sections 232b and 242b are shown in FIGS. 3-7). Specifically, moving booklet 130 to the output conveyor can comprise moving booklet 130 to a first output conveyor stage (first output conveyor sections 232a and 232b), and advancing booklet 130 from the first output conveyor stage to a second output conveyor stage (second output conveyor sections 242a and 242b).

[0025] Accordingly, the methods and systems disclosed hereinabove provide the capability to feed booklets with different page counts and different paper weights within the same stack. This capability creates a more flexible system for document processing that can allow for greater levels of personalization and customization and can thus be incorporated into a wide variety of applications.

[0026] The present subject matter can be embodied in other forms without departure from the spirit and essential characteristics thereof. The embodiments described therefore are to be considered in all respects as illustrative and not restrictive. Although the present subject matter has been described in terms of certain preferred embodiments, other embodiments that are apparent to those of ordinary skill in the art are also within the scope of the present subject matter.

What is claimed is:

1. A booklet feeder for advancing booklets from a group of booklets, the booklet feeder comprising:

a conveying path for supporting a group of booklets with each booklet comprising a stack of bound sheet articles; and

a grip remover configured for engaging booklets in a seriatim manner in the conveying path, the grip remover

being movable to remove an engaged booklet from the conveying path and advance the removed booklet to an exit path.

2. The booklet feeder of claim 1, wherein the conveying path comprises a supply conveyor for advancing the group toward the grip remover.

3. The booklet feeder of claim 2, wherein the supply conveyor comprises a paddle assembly movable with the supply conveyor, the paddle assembly being angled relative to the conveying path for supporting the group of booklets at about an angle.

4. The booklet feeder of claim 2, wherein the supply conveyor comprises an advancement barrier for stopping the advancement of the group when a first booklet in the group reaches an end of the supply conveyor; and

wherein the grip remover is movable to lift the engaged booklet past the advancement barrier.

5. The booklet feeder of claim 1, wherein the grip remover comprises at least one vacuum picker assembly.

6. The booklet feeder of claim 5, wherein the vacuum picker assembly is carried on a pivotable swing arm.

7. The booklet feeder of claim 1, wherein the grip remover is configured for engaging booklets of different booklet thicknesses.

8. The booklet feeder of claim 1, wherein the exit path comprises an output conveyor for advancing the removed booklet away from the grip remover.

9. The booklet feeder of claim 8, wherein the output conveyor comprises a first output conveyor stage and a second output conveyor stage, the first output conveyor stage being adapted for advancing the removed booklet to the second output conveyor stage.

10. The booklet feeder of claim 1, further comprising a controller connected to the grip remover for controlling the movement of an engaged booklet from the conveying path to the exit path.

11. A booklet feeder for advancing booklets from a group of booklets, the booklet feeder comprising:

a conveying path for supporting a group of booklets having non-uniform booklet thicknesses, the conveying path comprising a supply conveyor for advancing the group toward an end of the conveying path;

at least one vacuum picker assembly configured for engaging booklets in a seriatim manner in the conveying path, the at least one vacuum picker assembly being movable to remove an engaged booklet from the conveying path and advance the removed booklet to an exit path; and

a controller connected to the at least one vacuum picker assembly for controlling the movement of an engaged booklet from the conveying path to the exit path.

12. A method for advancing one or more booklets, the method comprising:

supporting one or more booklets in a conveying path;

engaging one of the booklets in the conveying path using a grip remover;

removing the engaged booklet from the conveying path; and

advancing the removed booklet to an exit path.

13. The method of claim 12, comprising supporting a group of booklets having non-uniform booklet thicknesses in the conveying path.

14. The method of claim 12, comprising supporting the group at an angle relative to the conveying path.

15. The method of claim 12, comprising advancing the group along a supply conveyor toward the grip remover.

**16.** The method of claim **15**, wherein advancing the group along a supply conveyor comprises stopping advancement when a first booklet in the group reaches an end of the supply conveyor.

**17.** The method of claim **12**, wherein engaging booklets comprises actuating a vacuum picker assembly.

**18.** The method of claim **17**, wherein advancing the removed booklet to an exit path comprises pivoting a swing arm on which the vacuum picker assembly is carried.

**19.** The method of claim **12**, wherein advancing the removed booklet to an exit path comprises moving the booklet to an output conveyor.

**20.** The method of claim **19**, wherein moving the booklet to an output conveyor comprises moving the booklet to a first output conveyor stage and advancing the booklet from the first output conveyor stage to a second output conveyor stage.

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