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(54) **Accumulation system for processing media items of various sizes and types**

(57) An accumulator system and method for collating a plurality of media items wherein the media items enter in seriatim at an media item entry point and become at least partially overlapped with each other at a media item exit point. A media item transport path connects the media item entry point and the media item exit point. A moveable member (20) is mounted along the media item transport path between the entry point and the exit point. The moveable member (20) forms part of a pocket (50) into which media items are moved to create a collation of media items. The moveable member (20) is moveable to change the size of the pocket (50). A protective mem-

ber (22) may be mounted to the moveable member (20) and positioned to protect the trailing edge of media items in the pocket (50) from the leading edge of media items to thereafter be moved into the pocket. The media item may be aligned in the collation position when moving the protective member to a media item trailing edge protective position. The transport means (38) for media items can be controlled to partially move a media item along an exit path beyond the collation position. Media items of different lengths can be formed as part of the collation at the collation position with the trailing edge of the media items aligned.

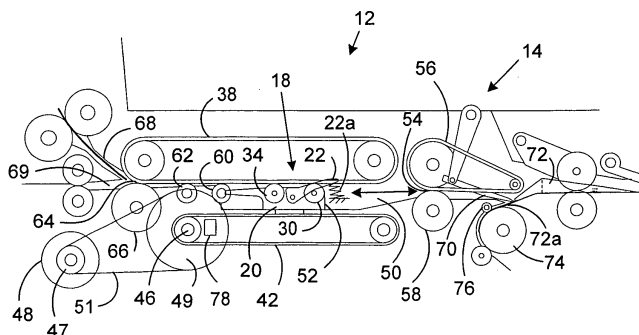


FIG. 3

Description

[0001] The present invention relates to media handling equipment, such as folder, insertion and other systems and, more particularly, to an accumulation system for processing media items of different sizes and types.

[0002] Various systems require the accumulation of media for further processing. Accumulator systems have been developed to assemble packets, often referred to as collations, for further processing. Prior accumulator systems have included fixed pitch pusher chain or belt arrangements, friction belts with a customer adjustable end stop arrangements and various other arrangements. Packets or collations of media items may be utilized in insertion systems, book binding systems and other systems.

[0003] Where the accumulator system is employed with insertion equipment, the accumulator system should, desirably, be capable of reliably handling a large variety of media that are to be processed. The media may be sheets to be folded, pre-folded and unfolded inserts, return enclosure envelopes, and the enclosure envelope into which the media item are to be inserted to build a mail piece. These media items may be of different sizes, thicknesses and types, such as glossy pamphlets, advertising brochures or very thin media. It has been particularly difficult to accumulate media of this variety whether for insertion into an envelope, other enclosure or other application. Often, when accumulating variable media items within the same collation, the collation or variation in fold types and sizes must be limited in order to prevent inter-leaving of materials as they enter the accumulator, as well as slippage and skewing of the completed collation as it exits the accumulator for insertion into an envelope, other enclosure or for a different application. Accordingly, prior accumulators have been limited in the flexibility in processing various sizes and types of media items. This limitation has involved the limited range of sizes and types of media items the accumulation equipment can handle in collations of media items of the same size. The limitation also includes where the collation involves different sizes and types of media items in a single collation.

[0004] It is an object of the present invention to provide a flexible accumulator mechanism capable of handling a wide variety of media.

[0005] It is a further object of the further invention to provide a mechanism to accumulate a variety of types of media items within the same collation, such as folded sheets of various sizes and types as well as unfolded sheets, slips, cards or booklets.

[0006] It has been discovered that a reciprocating shuttle can be employed to create a variable length accumulation pocket. It has been further discovered that the trailing edge of media items moved into the accumulator as part of a collation can be protected by a protective member, such as fingers or other structure, that shield and prevent inter-leaving with other media items thereafter

moved into the accumulator.

[0007] It has been further discovered that a shuttle mechanism can be greatly expanded in its capability by partially ingesting, moving, into a collation exit individual over-long media items. These are media items that may not fit into the accumulation pocket or have a large variation in length from other media items in the collation and are still to be part of a collation. This allows a greater variation in media items to be part of a collation of media items. It is yet been further discovered that the shuttle can act as a pusher that can de-skew and positively align media items. This can be accomplished at the collation position and also as the media items exit the accumulator mechanism as part of the complete collation. The present invention also allows the accumulation mechanism to act as a non-interrupted media transport system, when required.

[0008] An accumulator system for collating a plurality of media items, wherein the media items enter in seriatim at a media item entry point and become at least partially overlapped with each other at a media item exit point, embodying the present invention includes a media item transport path connecting the media item entry point and the media item exit point. A moveable member is mounted along the media item transport path between the entry point and the exit point. The moveable member forms part of a pocket into which media items are moved to create a collation of media items. The moveable member is adjustable to change the size of the pocket.

[0009] In accordance with a feature of the present invention a protective shield is mounted to the moveable member and positioned to protect the trail edge of media items in the pocket from the lead edge of media items to thereafter be moved into the pocket.

[0010] An accumulator system for collating a plurality of media items, wherein the media items enter in seriatim at a media item entry point and become at least partially overlapped with each other at a media item exit point, also embodying the present invention includes a media items transport belt connecting the media item entry point and the media item exit point. A moveable shuttle is mounted for reciprocating movement below the media item transport belt and between the entry point and the exit point. The moveable shuttle forms part of a pocket into which media items are moved to form a collation of media items. A member is mounted to the shuttle providing a guide surface for media items moved into the pocket and a protective shield for the trail edge of media items.

[0011] A method of forming a collation of media items embodying the present invention includes the steps of moving a media item over a protective member and into a position for collation with other media items. Moving the protective member to a position where the protective member is not in engagement with the media item. And, moving the protective member to a position where the trail edge of the media item is protected from interference with other media items to be moved into the collation position.

[0012] A feature of the present invention includes the further step of aligning the media item in the collation position when moving the protective member to the media item trail edge protective position.

[0013] A method of creating a collation of media items also embodying the present invention includes moving a first media item of a first length into a position for collation with a second shorter length media item by partially moving the first media item along a collation exit path. And, moving the second shorter length media item into the collation position such that the trailing edge of the first media item and the second media item are aligned.

[0014] In accordance with aspects of the present invention additional shorter media items a first media item may be moved into and beyond the collation position or into but not beyond the collation position, depending on the length of the additional shorter length media items.

[0015] Reference is now made to the various figures wherein like reference numerals designate similar items in the various view and in which:

[0016] Fig. 1 is a diagrammatic view of a folder inserter system employing an accumulator mechanism embodying the present invention;

[0017] Fig. 2 is an enlarged top view of the post-fold accumulator mechanism shown in Fig. 1 illustrating the shuttle mechanism, including various drive elements, home sensors and the finger elements;

[0018] Figs. 3-5 are diagrammatic views of the post-fold accumulator components with the shuttle mechanism in various positions forming different lengths of accumulation pockets;

[0019] Fig. 6 is a diagrammatic view of the post-fold accumulator components with the shuttle position for linear paper transport and showing a media item being transported through the system;

[0020] Figs. 7-21 are diagrammatic views of the post-fold accumulator with the components in various positions helpful to a full understanding of the operation of the mechanism; and,

[0021] Figs. 22 and 23 are diagrammatic representations of the post-fold accumulator showing partial ingestion of larger items by the insertion station to allow the accumulator to accommodate greater variation in length of media to be processed.

[0022] Reference is now made to the various figures and more particularly to Fig. 1. A folder inserter system 2 includes a vertical tower feed station 4 and having an envelope transport path depicted by line 6 with arrowheads. The inserter 2 includes a pre-fold accumulator station 8, a folder station 10, a post-fold accumulator station 12, an insertion station 14 and an exit area 16. Exit area 16 includes exits 15 and 17, respectively, for letters and flats. A reject area is provided at 19. Details of the paper path feed arrangement are described in U.S. Patent Application Serial No. 11/084233 filed March 18, 2005 for PAPER HANDLING SYSTEM FEED PATH ARRANGEMENT, published as US 2006/0220298.

[0023] The post-fold accumulator station 12 employs

an accumulator mechanism 18, illustrated in Figs. 2-23. The accumulator mechanism 18 includes a shuttle 20 having four spring-loaded fingers 22, 24, 26 and 28. The shuttle 20, which is a moveable member, also supports idler rollers 30, 32, 34 and 36, which cooperate with a post-fold accumulator belts 38a, 38b, and 38c for the transport of various media items. The shuttle 20 is moved or adjusted in its position by belts 40 and 42 connected via pulley shaft 46 which is driven by a servo motor 48 via pulleys 47 and 49 and belt 51. The shuttle 20 can be moved to reciprocate along in a linear path to vary the size of the accumulation pocket 50. The accumulator pocket 50 is the space between the front wall 52 of the shuttle and nip 54. Nip 54 is at the insertion station 14 and is formed by belt 56 and idler roller 58. The pocket can be of any form, size shape or orientation that will accommodate the media items to be processed in creating the collation.

[0024] The fingers 22, 24, 26 and 28 provide a protective shield for the rear edge of the mail pieces in the pocket 50 by ensuring that the next media item fed into the pocket 50, the collation position, does not crash into the trail edge of media already in pocket 50. Other protective type shield structures may be employed. The protective shield can be a continuous member rather than fingers, segment pieces and other structures that provide the protective function by preventing the next media item fed into the pocket from crashing into the trail edge of media already in pocket 50.

[0025] The post-fold accumulator mechanism 18 includes fixed idler rollers 60 and 62, which cooperate with the post-fold accumulator drive belt 38. No matter what the position of the shuttle in making a changing pocket size, a sufficient number of idler rollers always engage the post-fold accumulator transport belt 38 to securely and properly feed and transport media items of various sizes. This is because the fixed idler rollers 60 and 62 in conjunction with the idler rollers 30, 32, 34 and 36 mounted on shuttle 20 all engage associated transport belts. Media is fed into the post-fold accumulator mechanism 18 at the nip 64 formed by drive rollers 43 and 45 and the idler roller 66, which operates in conjunction with drive roller 45, and an idler roller, not shown, which operates in conjunction with drive roller 43. This arrangement ensures that the media items will be positively moved into engagement with belts 38a, 38b and 38c and the associated idler rollers for transport within the accumulator mechanism 18. The entry of media items into the post-fold accumulator station 12 can be from either of two media paths, path 68 (where a media item is shown) or path 69.

[0026] The insertion station 14 includes the belt 56 and idler roller 58, which drive media items and/or collations past the throat opening of finger 70 and into an envelope 72. The envelope flap 72a is captured between a drive roller 74 and an idler roller 76. The insertion mechanism is described in the above-identified U.S. Patent Publication No. US 2006/0220298.

[0027] Reference is now made to Fig. 4, which shows the post-fold accumulator components of Fig. 3 with the shuttle 20 position with a minimum pocket 50 size (50a). Fig. 5 shows the shuttle 20 position with a maximum pocket 50 size (50b). A home sensor 78 detects the position of the shuttle 20. The home sensor 78 flags when the shuttle is at the home position. As illustrated in Figs. 4 and 5, because the shuttle moves under servo control of the motor 48, the pocket 50 size can automatically be adjusted for all sizes of media items programmed into the system. Fig. 4 shows a small pocket 50 size (50a) due to the position of shuttle 20, for example, where 80 millimeters (mm) inserts may be accumulated. Fig. 5 shows a large pocket 50 size (50b) due to the position of shuttle 20 where, for example, 165 inserts may be accumulated. Common size media items normally employed in various countries can be programmed for automatic servo control of motor 48. This may include media that can vary, approximately 80-165mm in length. However, the particular size of the pocket 50 and the particular media items that can be accommodated are a matter of design choice. Because of the shuttle operation, depending on the machine design, media of various lengths can be accommodated by creating larger or smaller pockets.

[0028] Reference is now made to Fig. 6, which shows the shuttle 20 is in an intermediate position. The shuttle 20 is positioned in an optimum location for a particular length media item to have linear transport of such media items through the system and into the insertion system 14. With the shuttle so positioned, the post-fold accumulator acts as a linear transport path, such as for the insertion of unfolded sheets into flats-type envelopes.

[0029] Reference is now made to Figs. 7-21, which show the operation of the post fold accumulator mechanism in the normal mode of operation. As shown in Fig. 7, media items may enter the post-fold accumulator station 12 upstream from nip 64 either as folded sheets or as unfolded inserts. The media item 80 is moved through the post-fold accumulator mechanism 18 by belts 38a, 38b and 38c and associated idler rollers and onto the shuttle 20. As the media item 80 travels into the post-fold accumulator, the shuttle fingers 22, 24, 26 and 28, are deflected downward, as is shown with finger 22. The media item 80 travels over the fingers and into the post-fold accumulator pocket 50, as is shown in Fig. 10. The shuttle 20 thereafter retracts toward the left, as is shown in Fig. 11. When the shuttle 20 is fully retracted, as is shown in Fig. 12, the fingers (including finger 22) release from the trail edge of the media item 80. The media items are driven fully into the pocket by the forward motion of the belts 38a, 38b and 38c. As is shown in Fig. 13, the fingers, including finger 22, rise up under action of the springs associated with each finger 22, 24, 26 and 28. Only spring 22a associated with finger 22 is shown; however, fingers 24, 26 and 28 also each have a similar spring arrangement. Spring 22a, for clarity in the various other figures, is illustrated only in Fig. 3.

[0030] The fingers 22, 24, 26 and 28 rise up and over-

lap the trail edge of the media item 80. As is shown in Fig. 14, the shuttle 20 moves to the right and the shuttle wall 58 pushes the media item 80 leading edge against nip 54 at the insertion station 14. The media 80 is thus registered against the nip 54 and positioned for further processing by the insertion station 14 when the entire collation is ready to be processed. As is shown in Fig. 15, another media item 82 enters the post-fold accumulator mechanism 18 via path 69 and the fingers of the shuttle 20 shield the trail edge of the first media item 80. This prevents the leading edge of the second media item 82 from crashing into the trail edge of the first media item 80. This is shown in Fig. 16. As is shown in Fig. 17, the shuttle 20 retracts, allowing the second media item 82 to enter the pocket and the fingers 22, 24, 26 and 28 to return above the trail edge of the two media items 80 and 82, which are both now in the pocket 50. The shuttle 20 returns to the right, registering the second media item 82 against the nip 54 of the insertion station 14 by the pushing action of the front wall 52 and urging action of the belts 38. Thus, with the shuttle returned to the right registering position, as shown in Fig. 18, both media items 80 and 82 are registered against the nip 54 of the insertion station 14. The procedure repeats multiple times until an entire collation 83 is accumulated in the pocket 50 and registered against the insertion nip 54, as shown in Fig. 19.

[0031] After the accumulation is complete, the insertion belt 56 is tuned on and the shuttle continues to move to the right, as shown in Fig. 20, assisting the collation 83 further into nip 54 and thus into the insertion station 14, as shown in Fig. 20. The insertion belt 56 drives the collation into the open envelope 72, as shown in Fig. 21, and the post fold accumulator 12 is now ready to accumulate the next collation or to function as the media item transport that was described in connection with Fig. 6.

[0032] Reference is now made to Figs. 22 and 23. In order to accommodate a larger variation in the size of media items, the insertion station 14 can be controlled to partially ingest the such that the resulting media item lengths will all be equalized. This results in the trailing edge of the longer media items line up with the trailing edges of shorter media items that are part of the same collation. Additionally, this technique can also be employed where one or more larger media items in a collation will not fit into the pocket 50 because of the length of such media items. Whether for the purpose of aligning trailing edges and/or because of not fitting into the pocket, in such operation, the largest media items are fed first into the pocket 50 and thereafter moved, ingested, into the insertion station 12. This involves moving a media item, such as media item 90, partially out of the pocket 50, the collation position, along the collation exit path. For example, a plurality of media items, longest media items followed by shorter media items, could be moved along the collation exit path beyond the pocket 50. Each of the plurality of media items would be positioned such that the trailing edge of the item in the pocket 50 is located

where the trailing edge of the media item will align with any other media items in of the plurality of media items and also with the trailing edge of any other media items in the collation that will fit within the pocket.

[0033] In this arrangement different shorter length media items moved into the pocket 50 after the longer length media items. When all the media items are brought into and/or partially ingested beyond the pocket 50, the location of the trailing edges of all of the media items in the collation are located such that they can be protected by the fingers 22, 24, 26 and 28. It should be recognized that the fingers 22, 24, 26 and 28 are of a length to accommodate certain variation in the length of various media items to be part of the collation without employing partial movement of media items out of the pocket and into the collation exit transport path. For example, the fingers 22, 24, 26 and 28, may be designed to accommodate a variation of media item length of up to 12 mm.

[0034] Because the shuttle 20 moves under servo control of the motor 48, the pocket 50 size can be automatically adjusted for all common size media and also over-size materials by employing the partial ingestion process. The initial movement or ingestion of the largest media is such that subsequent movement or ingestion of the shorter but still too large media items will have the media items properly situated so that the fingers 22, 24, 26 and 28 will engage and protect the trailing edge of these media items. As is shown in Fig. 22, in order to build collations of shorter media items on top of longer ones, the longer media items 90, once accumulated, are partially driven into the insertion nip 54, thereby allowing for the creation of a smaller pocket 50 size correctly sized for the shorter media items such as media item 92. As is shown in Fig. 23, the shorter media items are then accumulated on top of the longer media items in a manner similar to that described in connection with Figs. 7-21. Such an arrangement is ideal for an application, such as a collation that consists of half-folded sheets with a No. 9 return envelope. These media can have variations in up to several inches in length and still be formed into a collation by the accumulator mechanism 18.

[0035] The term media and media items are intended to be a broad term encompassing various items that may be accumulated by an accumulator mechanism. The terms are intended include items such as different types of mail pieces such as letter mail, postcards and flats. The USPS considers mail pieces to be flats when the mail piece exceeds at least one of the dimensional regulations of letter-sized mail (e.g. over 11.5 inches long, over 6 inches tall, or over ¼ inch thick) but does not exceed 15 inches by 11.5 by ¾ inch thick. Flats include such mail as pamphlets, annual reports and the like. Other examples of media items include sheets of paper, checks, compact discs, DVD discs, books, packages of greeting cards, and any other items that can be accumulated by an accumulator mechanism. The term belt is also intended to be a broad term encompassing segmented belt drive systems and single and plural belt drive

systems as well as other type drive systems that function similar to a belt drive system.

[0036] It should be recognized that many modifications can be made to the present system. Many different drive arrangements can be employed for moving media items into, within and out of the post fold accumulator station. Any suitable design can be used such as those involving belts, rollers, pushers, lead screws, rack and pinions. Additionally, although the accumulator mechanism 18 is illustrated as a post-fold accumulator station in an inserter system, the accumulator mechanism may be employed in other systems and applications where media items are to be accumulated. Moreover, the pocket, the shuttle, and the guide and protective member can be of any suitable design that provides the various functions of these components. For example, the fingers could be constructed as flexible spring steel or mylar fingers or spring loaded plastic fingers. The shuttle could be various arrangements of sheet metal or plastic parts driven into the desired adjustment by a lead screw or belt or other drive mechanism.

Claims

1. An accumulator system for collating a plurality of media items wherein the media items enter in seriatim at an media item entry point and become at least partially overlapped with each other at a media item exit point, comprising:
 - a media item transport path connecting said media item entry point and said media item exit point;
 - a moveable member (20) mounted along said media item transport path between said entry point and said exit point, said moveable member forming part of a pocket (50) into which media items are moved to create a collation of media items; and,
 - said moveable member (20) moveable to change the size of said pocket (50).
2. An accumulator system for collating a plurality of media items as defined in Claim 1, wherein said moveable member (20) is movable to push media items in said pocket into said media item exit point.
3. An accumulator system for collating a plurality of media items as defined in Claim 1 or 2 further comprising a protective shield (22,24,26,28) mounted to said moveable member (20) and positionable to protect the trail edge of media items in said pocket from the lead edge of media items to thereafter be moved into said pocket.
4. An accumulator system for collating a plurality of media items as defined in Claim 3 further comprising

means connected to said protective shield (22,24,26,28) for urging said shield to rise above the top surface of said moveable member (20) adjacent said trail edge of media items in said pocket.

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11. An accumulator system for collating a plurality of media items wherein the media items enter in seriatim at an media item entry point and become at least partially overlapped with each other at a media item exit point, comprising:

a media item transport belt (38) connecting said media item entry point and said media item exit point;
a moveable shuttle (20) mounted for reciprocating movement below said media item transport belt (38) and between said entry point and said exit point, said moveable shuttle forming part of a pocket (50) into which media items are moved to create a collation of media items; and,
a member mounted to said shuttle providing a guide surface for each media item being moved and a protective shield (22,24,26,28) for the trail edge of each media item after being moved into said pocket (50).

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6. An accumulator system for collating a plurality of media items as defined in Claim 5, wherein said moveable shuttle (20) is moveable to change the size of said pocket such that media items of various sizes can be collated.

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7. An accumulator system for collating a plurality of media items as defined in Claim 5 or 6, wherein said shuttle (20) is controllable to be stopped from movement at a position for non-collation transport of media items though said collation exit path.

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8. A method of creating a collation of media items, comprising the steps of:

moving a media item over a protective member and into a position for collation with other media items;
moving said protective member to a position where said protective member is not in engagement with said media item; and,
moving said protective member to a position where the trail edge of said media item is protected from interference with other media items to be moved into said collation position.

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9. A method of creating a collation of media items as defined in Claim 8 further comprising the step of aligning said media item in said collation position when moving said protective member to said media item trail edge protective position.

10. A method of creating a collation of media items as defined in Claim 9, wherein said step of aligning includes urging said media item against a media item stop.

11. A method of creating a collation of media items as defined in Claim 8, 9 or 10 comprising the further step of selectively controlling a transport means to partially move said media item along a collation exit path such that said media item and other media items of different lengths from said media item can be formed as part of said collation at said collation position.

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12. A method of creating a collation of media items as defined in any one of Claims 8 to 11 comprising the further step of positioning said media item and other media items of different lengths from said media item with the trail edge of said media item and said other media items aligned.

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13. A method of creating a collation of media items as defined in any one of Claims 8 to 12, wherein said protective member is mounted on a moveable member controlled for reciprocating movement.

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14. A method of creating a collation of media items as defined in Claim 13, wherein said position for collation is a pocket where each media item in said collation is positioned as said collation is being formed.

15. A method of creating a collation of media items, comprising the steps of:

moving a first media item of a first length into a position for collation with a second shorter length media items by partially moving said first media item along a collation exit path; and,
moving said second shorter length media item into said collation position such that the trailing edge of said first media item and said second media item are aligned.

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16. A method of creating a collation of media items as defined in Claim 15, wherein moving said second shorter length media item includes partially moving said second media item along said collation exit path.

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17. A method of creating a collation of media items as defined in Claim 15 or 16 comprising the further step of moving a third media item of shorter length than said second media item into but not beyond said collation position such that the trailing edge of said first media item, said second media item and said third media are aligned.

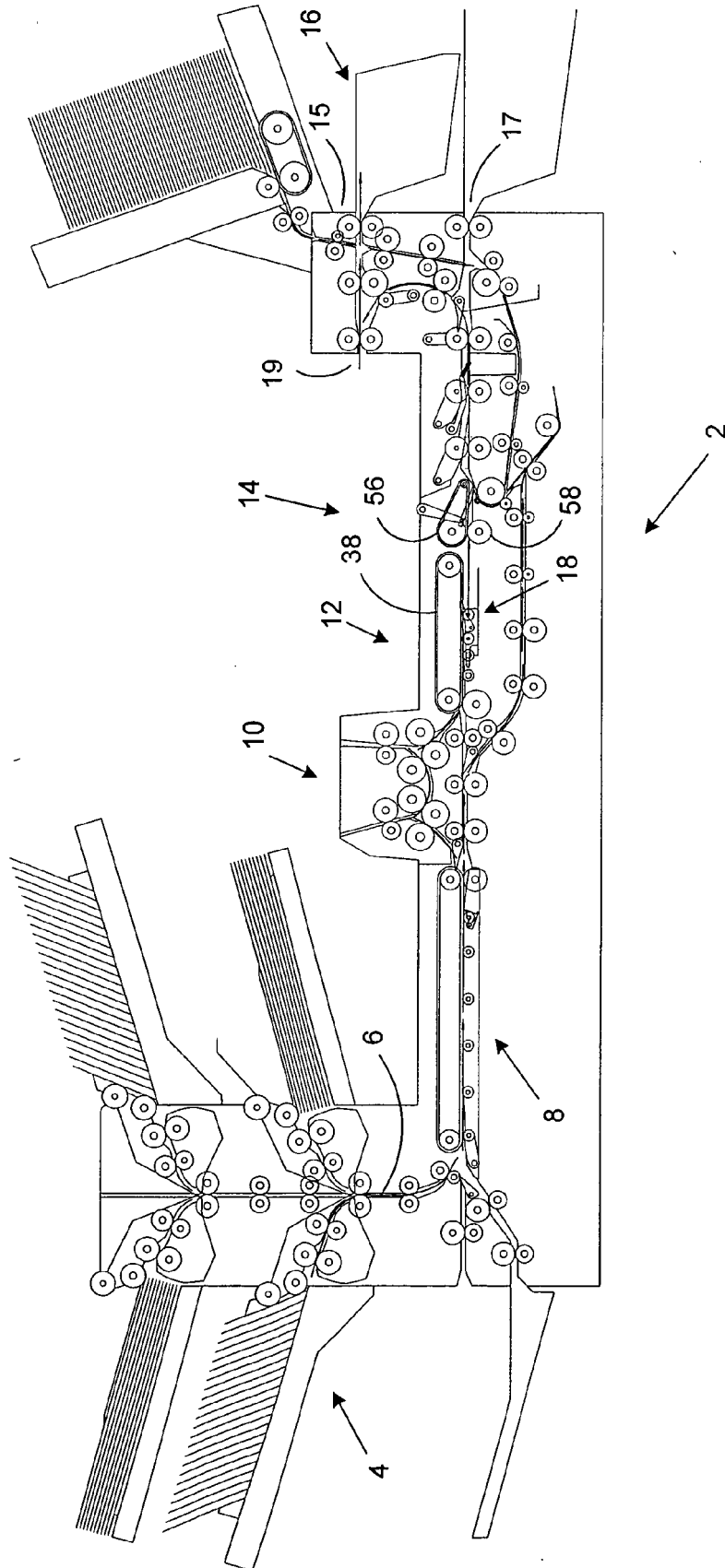


Fig. 1

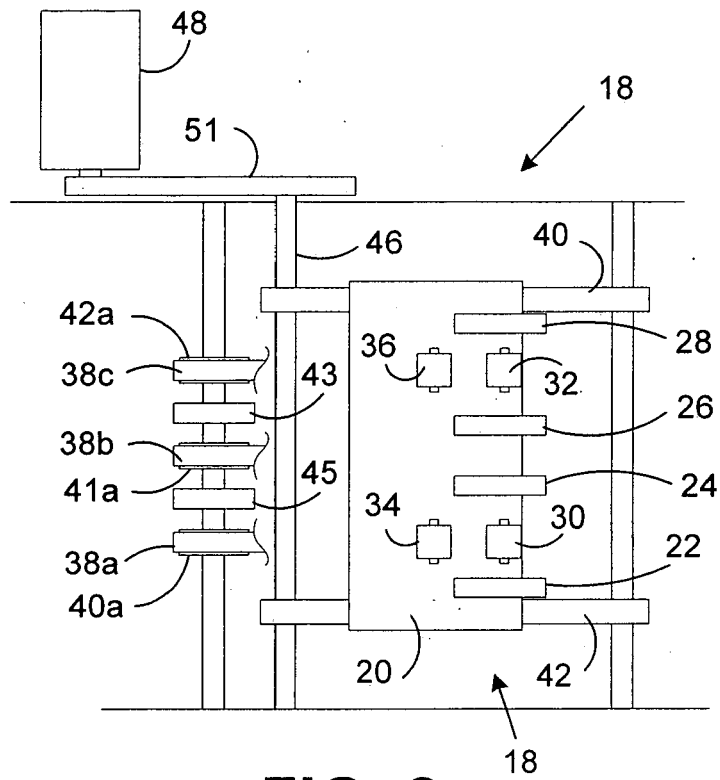


FIG. 2

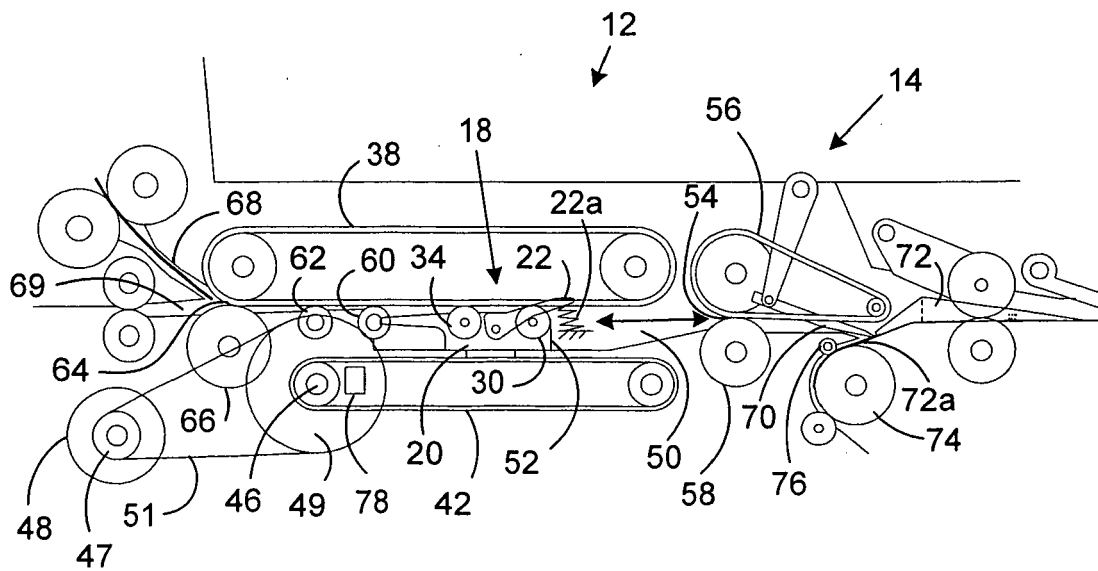
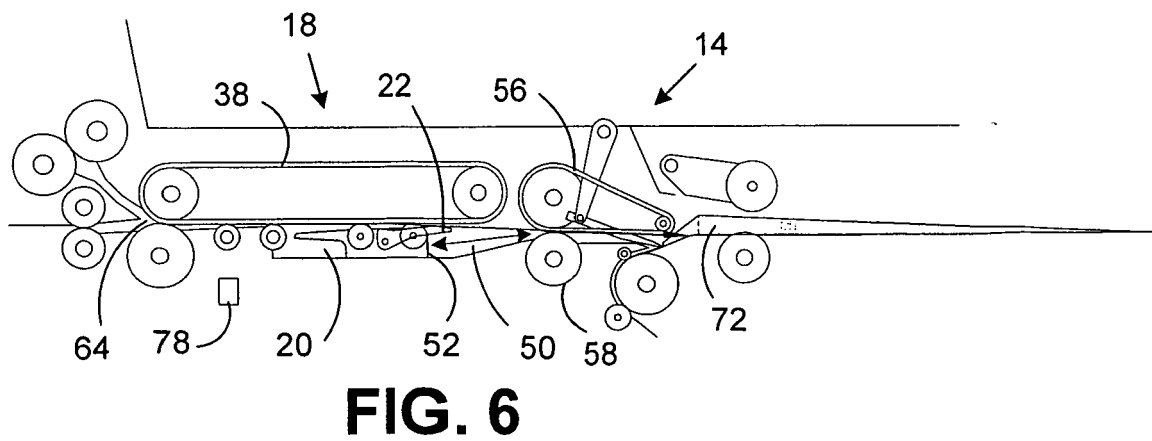
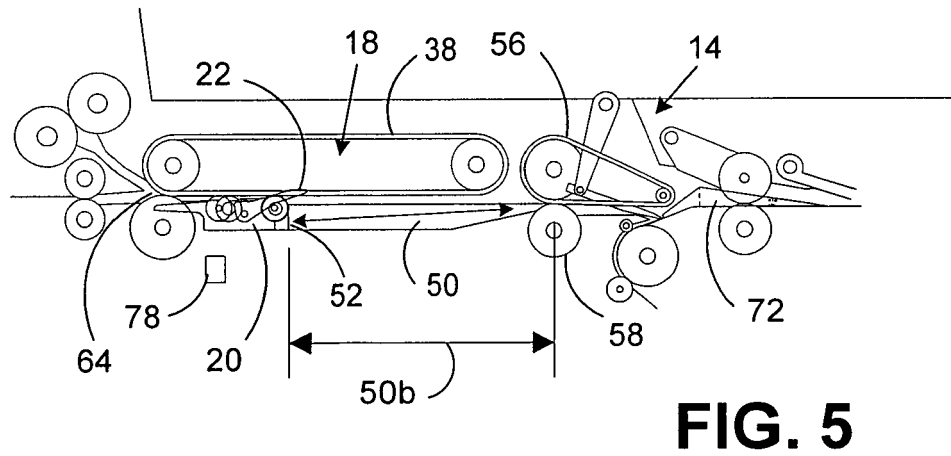
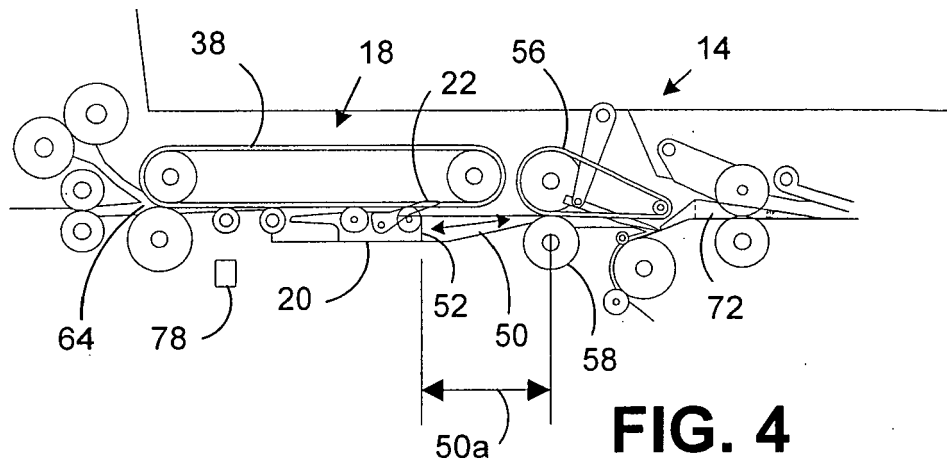


FIG. 3



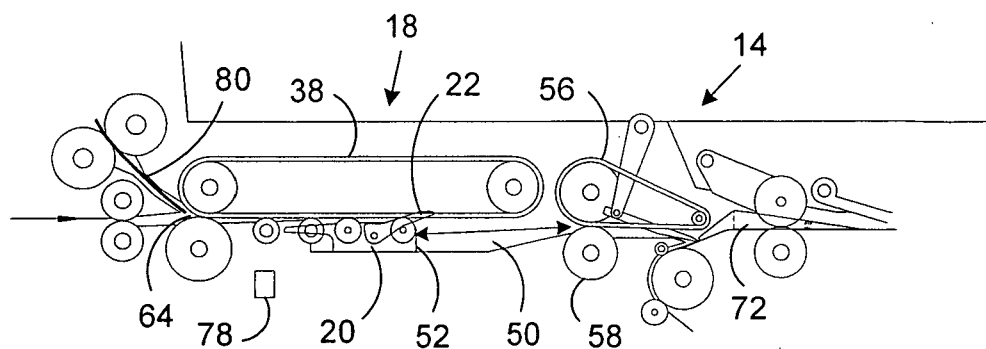


FIG. 7

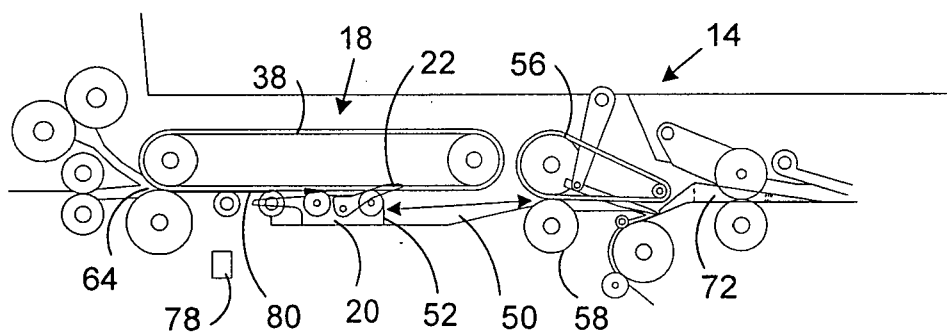


FIG. 8

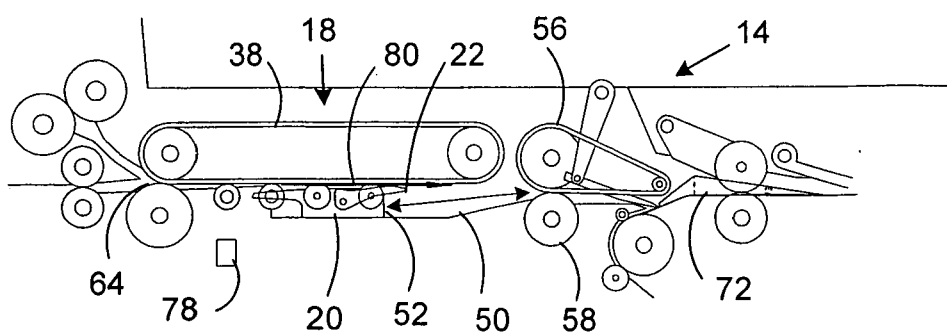


FIG. 9

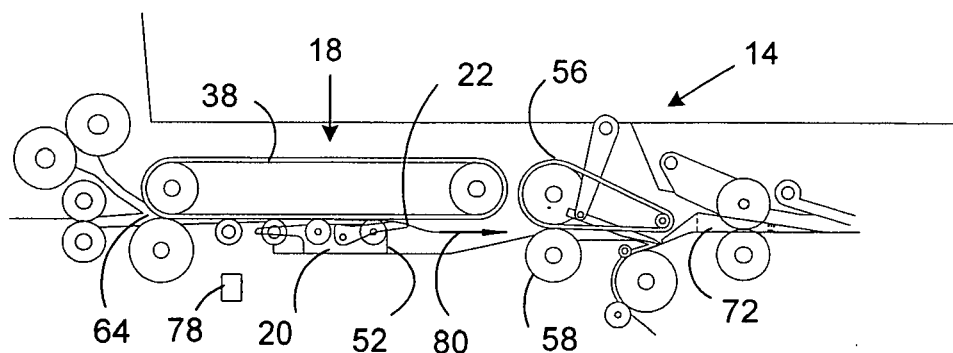


FIG. 10

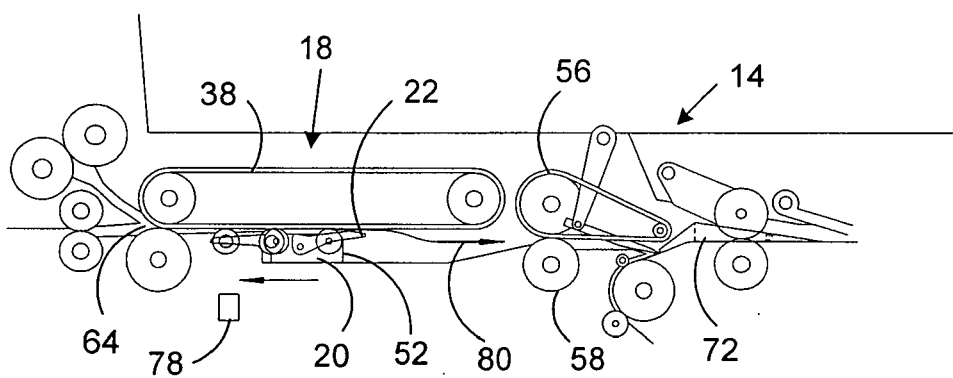


FIG. 11

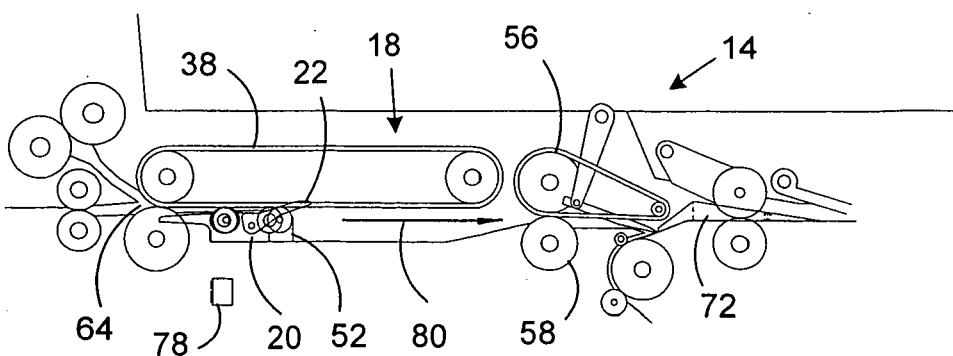


FIG. 12

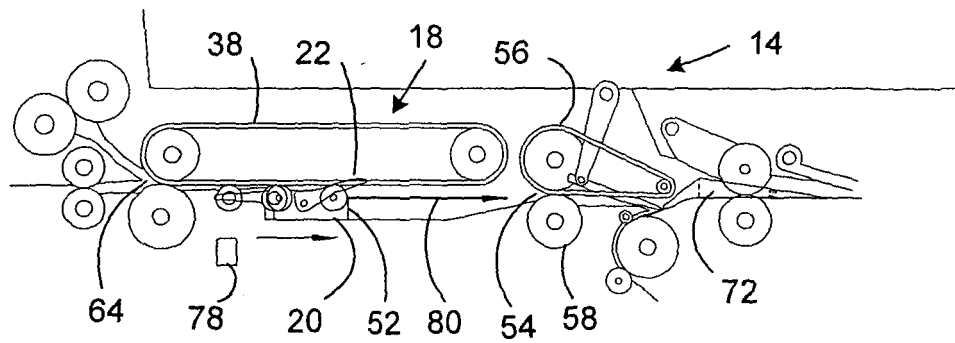


FIG. 13

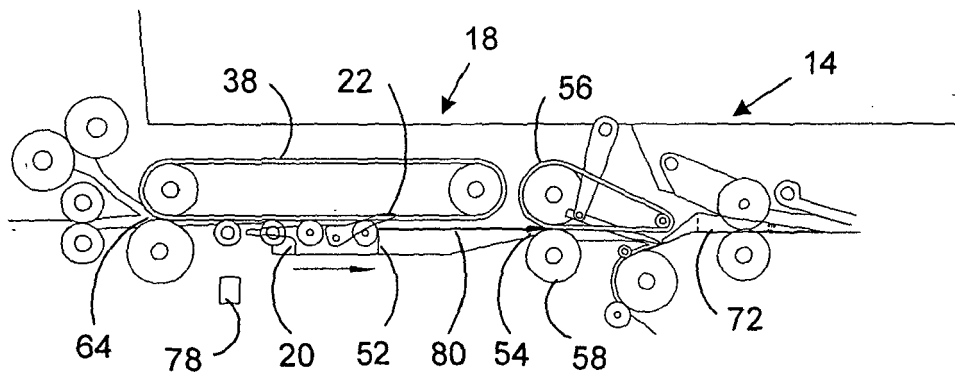


FIG. 14

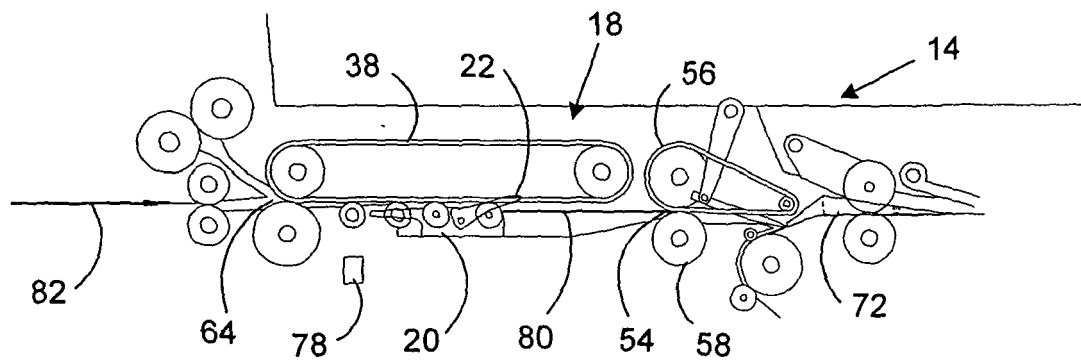


FIG. 15

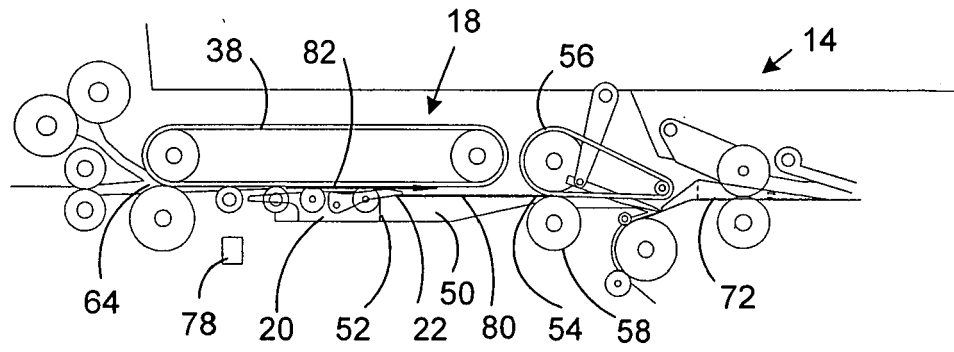


FIG. 16

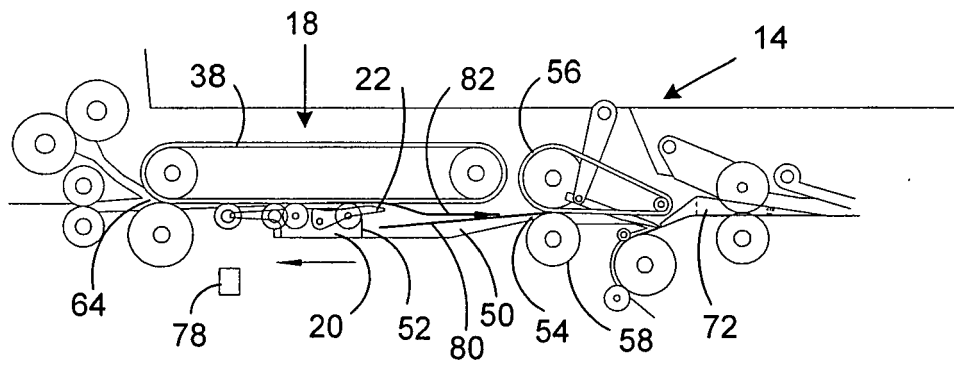


FIG. 17

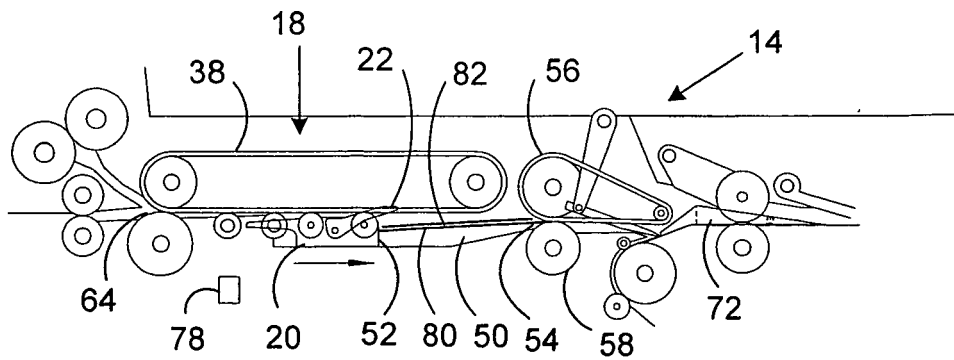


FIG. 18

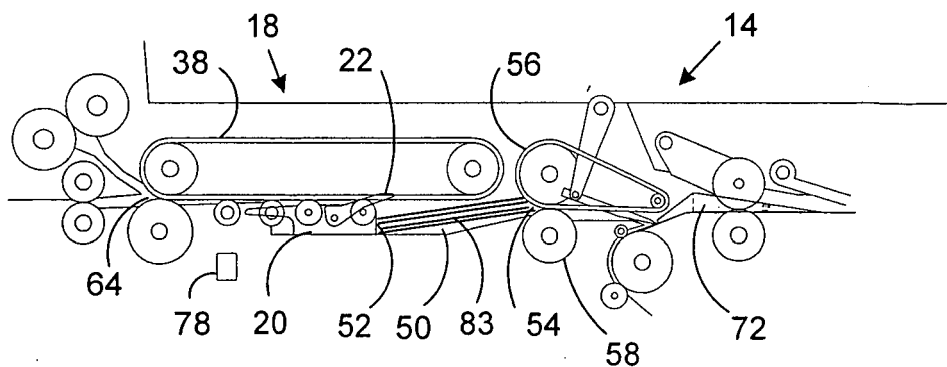


FIG. 19

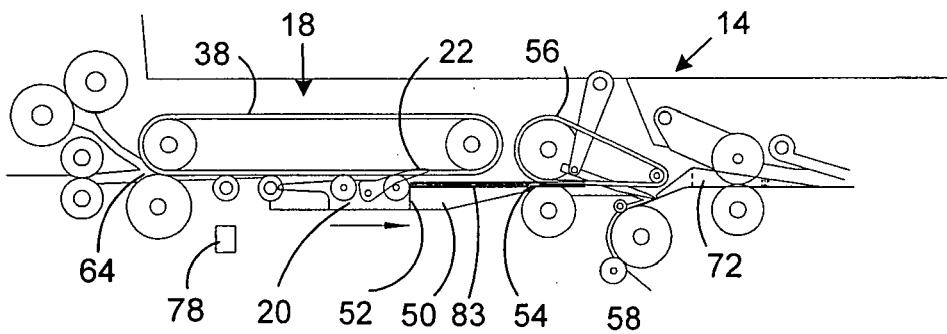


FIG. 20

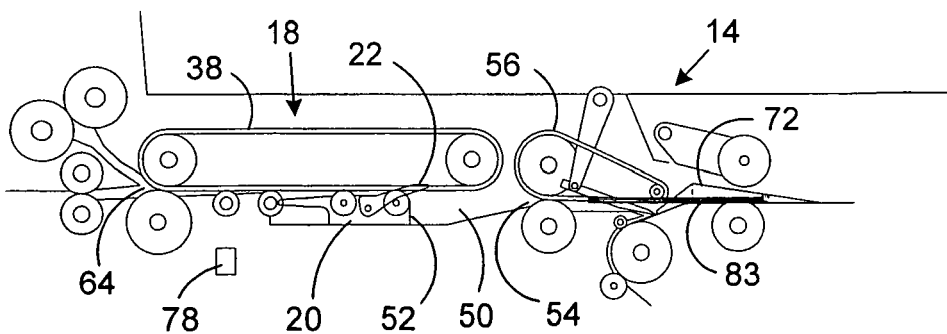


FIG. 21

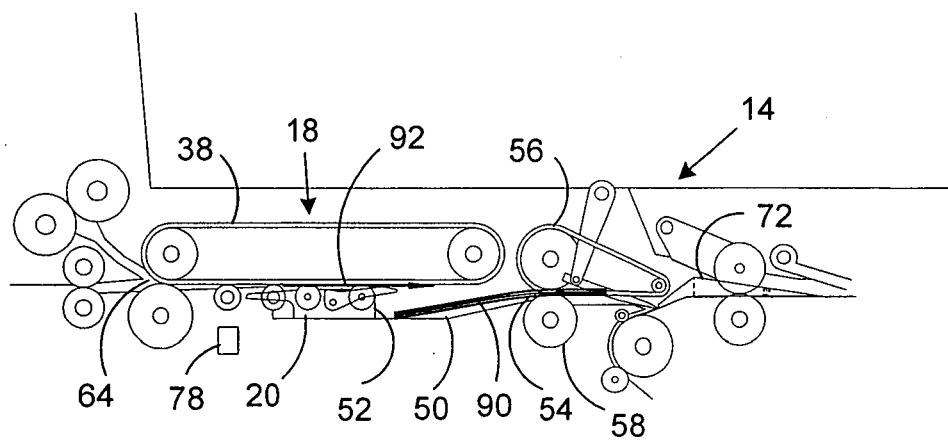


FIG. 22

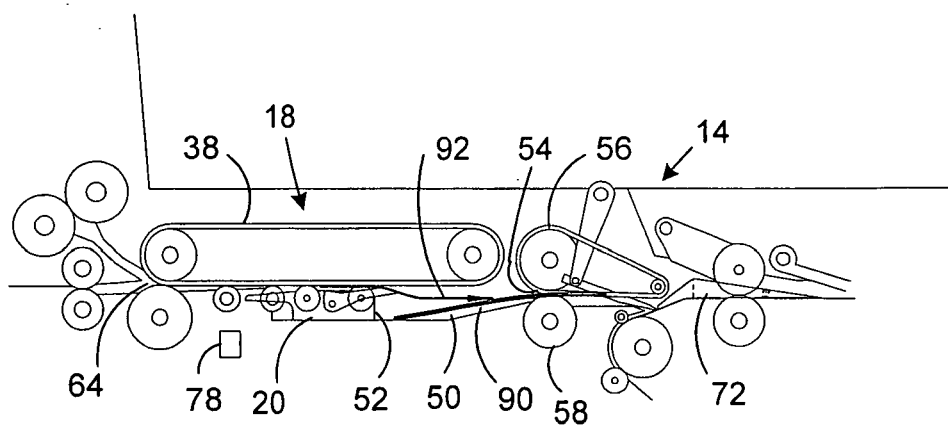


FIG. 23

REFERENCES CITED IN THE DESCRIPTION

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