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(54) **MODIFIABLE SHRINK WRAP MACHINE,  
ASSEMBLY AND RELATED METHOD**

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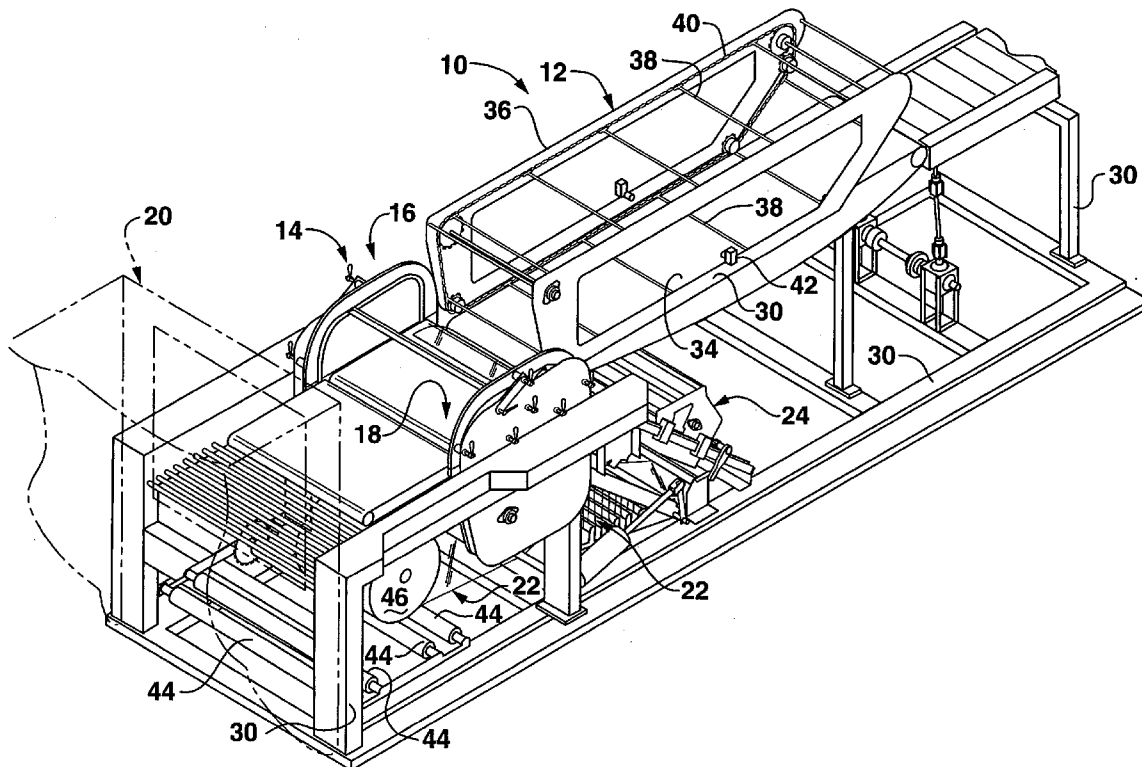
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(57) **ABSTRACT**

A machine is disclosed for shrink wrapping a load of a given size. The machine includes a supply conveyor for supplying the load to a wrapping zone, a wrap conveyor disposed in the wrapping zone, the wrap conveyor receiving the load from the supply conveyor, a film supply for supplying a film to the wrapping zone, and a wrap guide disposed in the wrapping zone. The wrap guide guides film received from the film supply in a wrap path proximate the wrap conveyor so as to place the film on the load. The wrap guide includes a removable portion defining a portion of the wrap path. The portion of the wrap path defined by the wrap guide removable portion is sized to correspond to the size of the load. A heat supply shrinks the film so as to shrink wrap the load. Related machines, assemblies and methods are also disclosed.



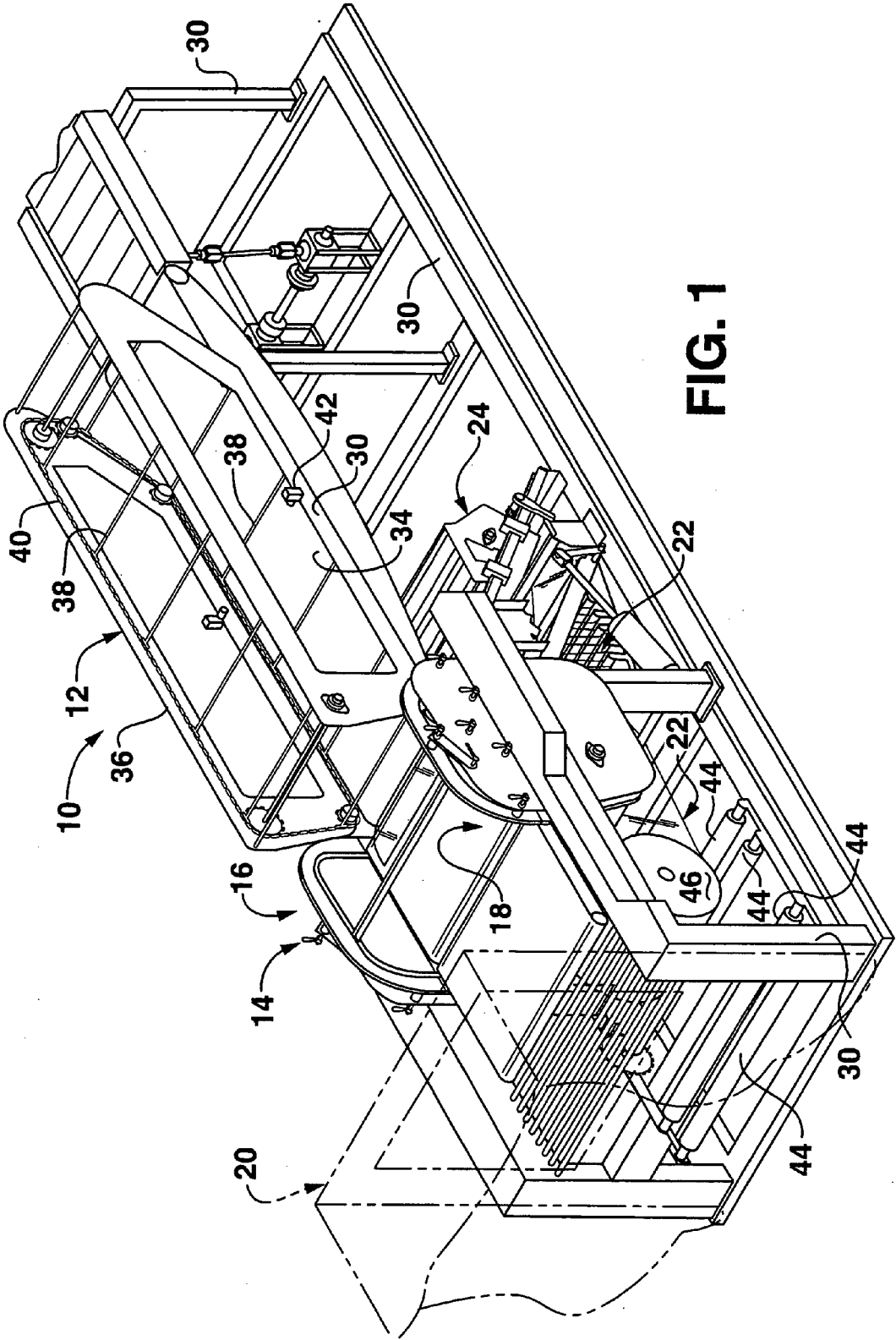


FIG. 1

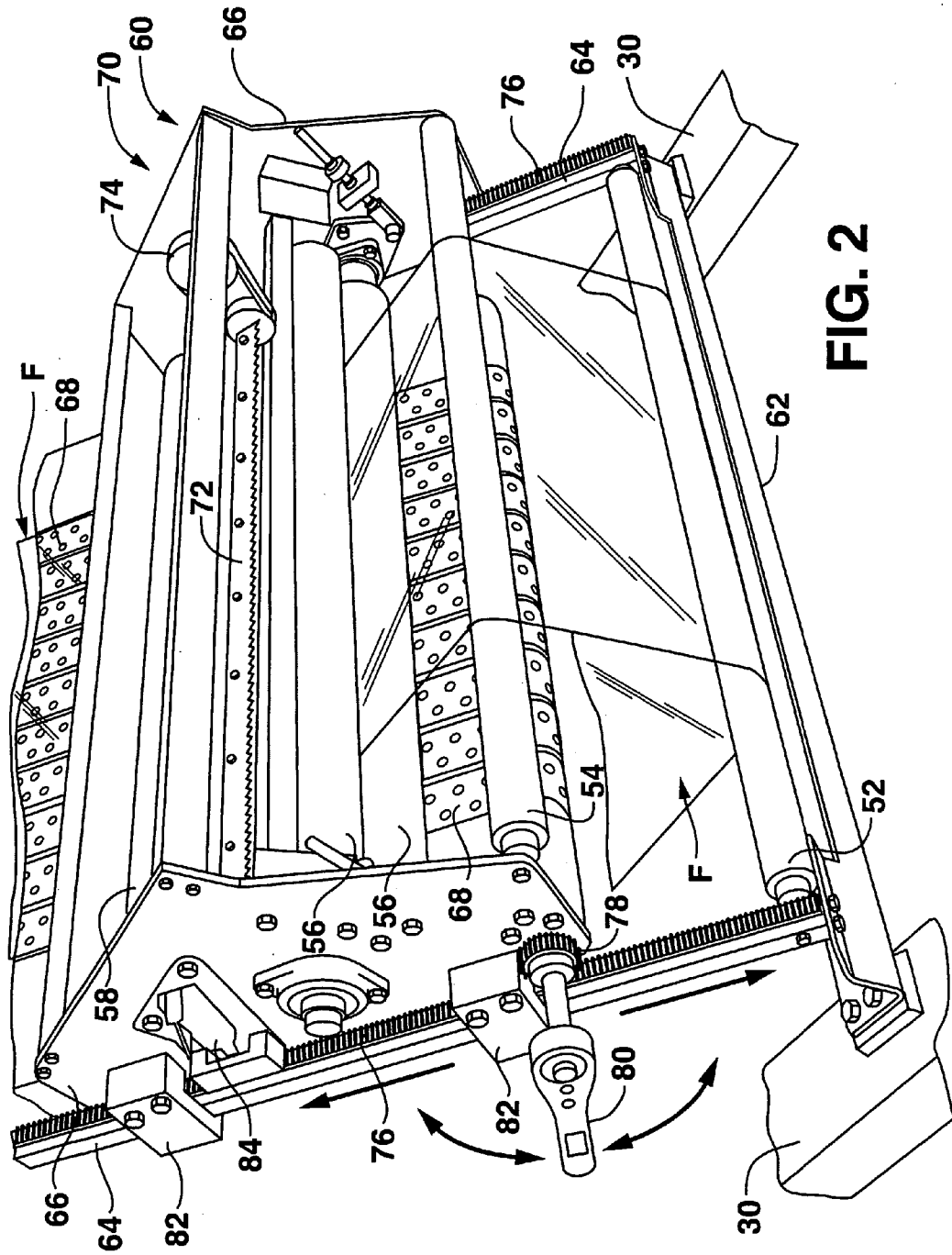
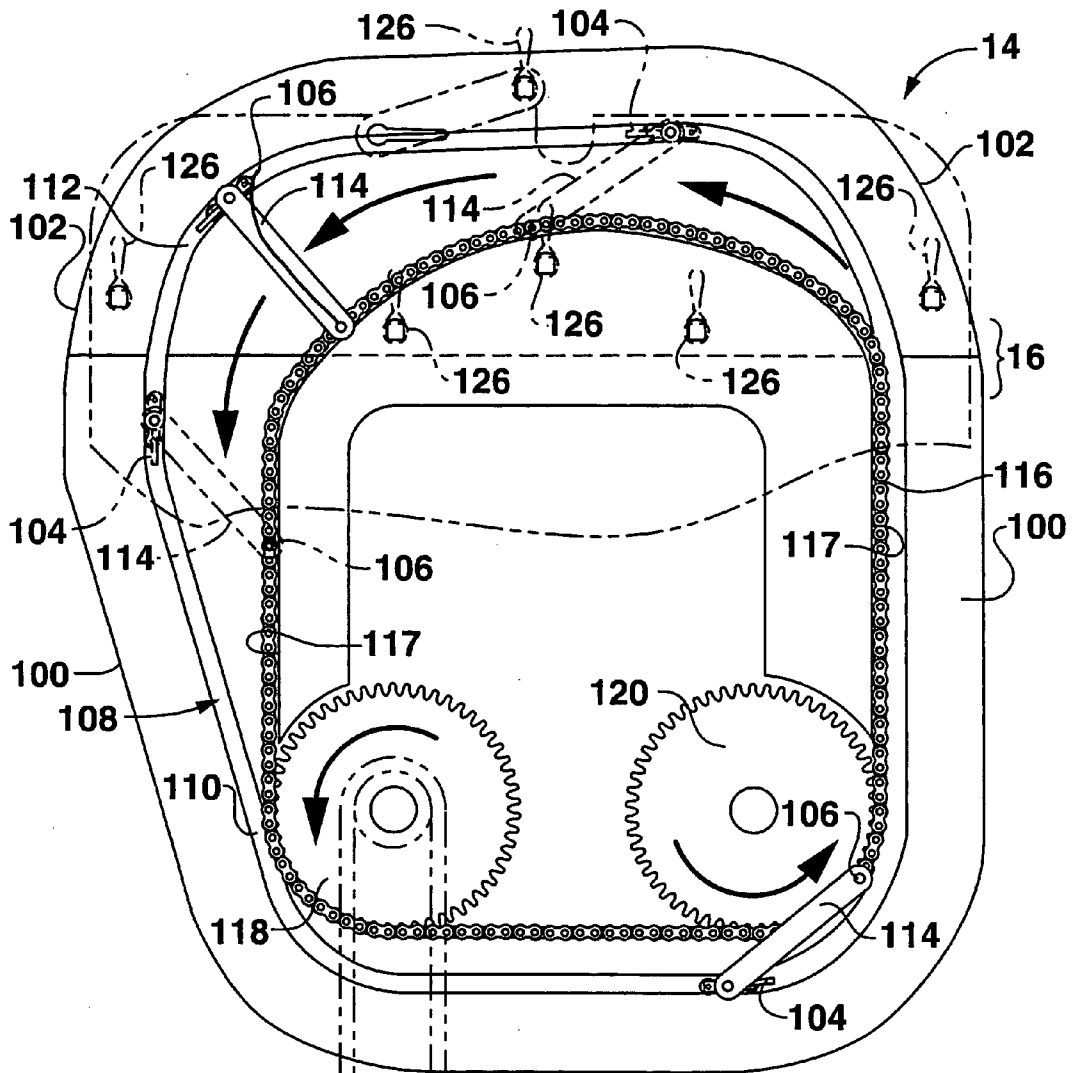
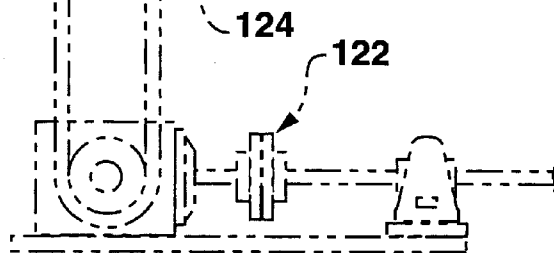


FIG. 2



**FIG. 3**



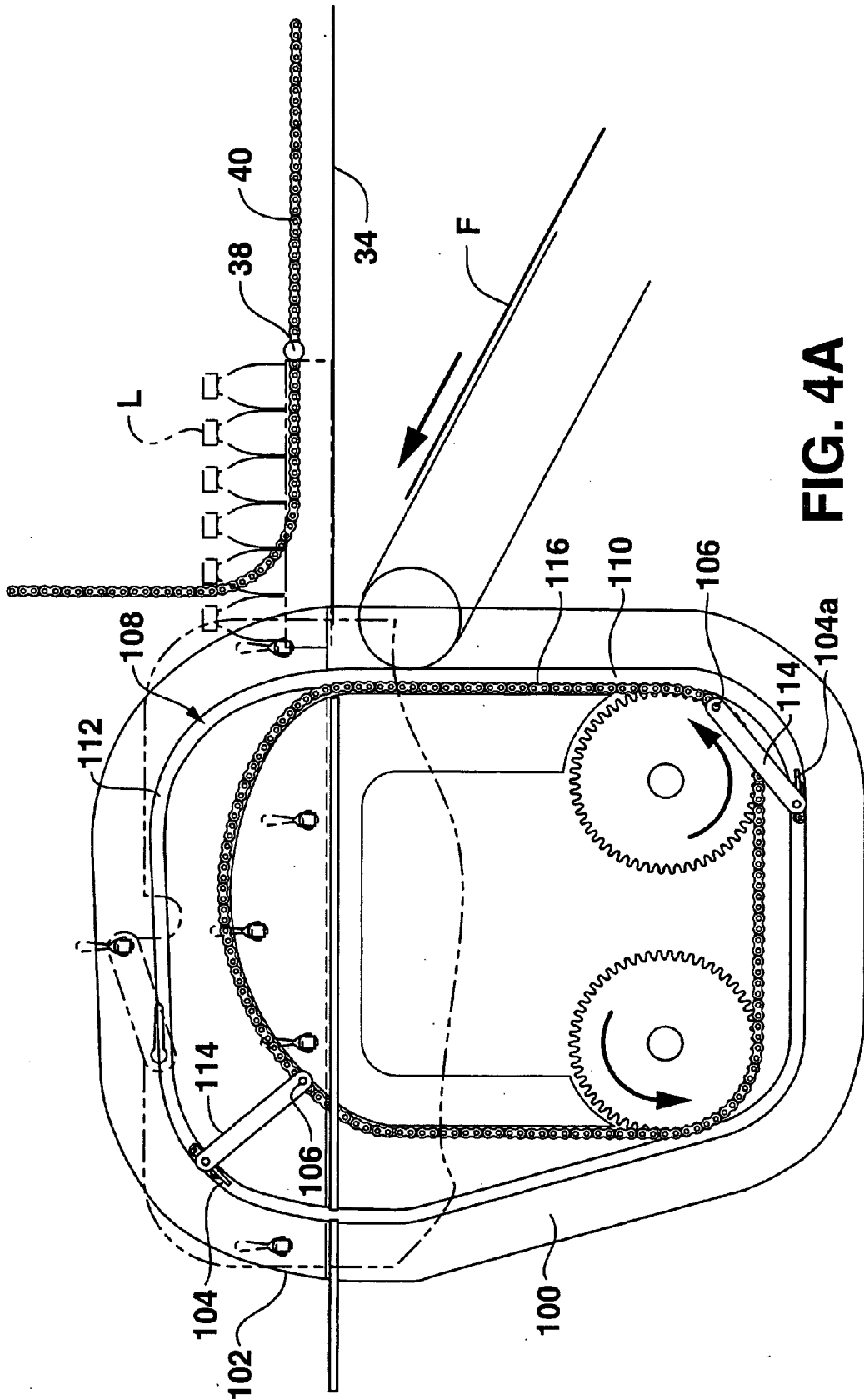


FIG. 4A

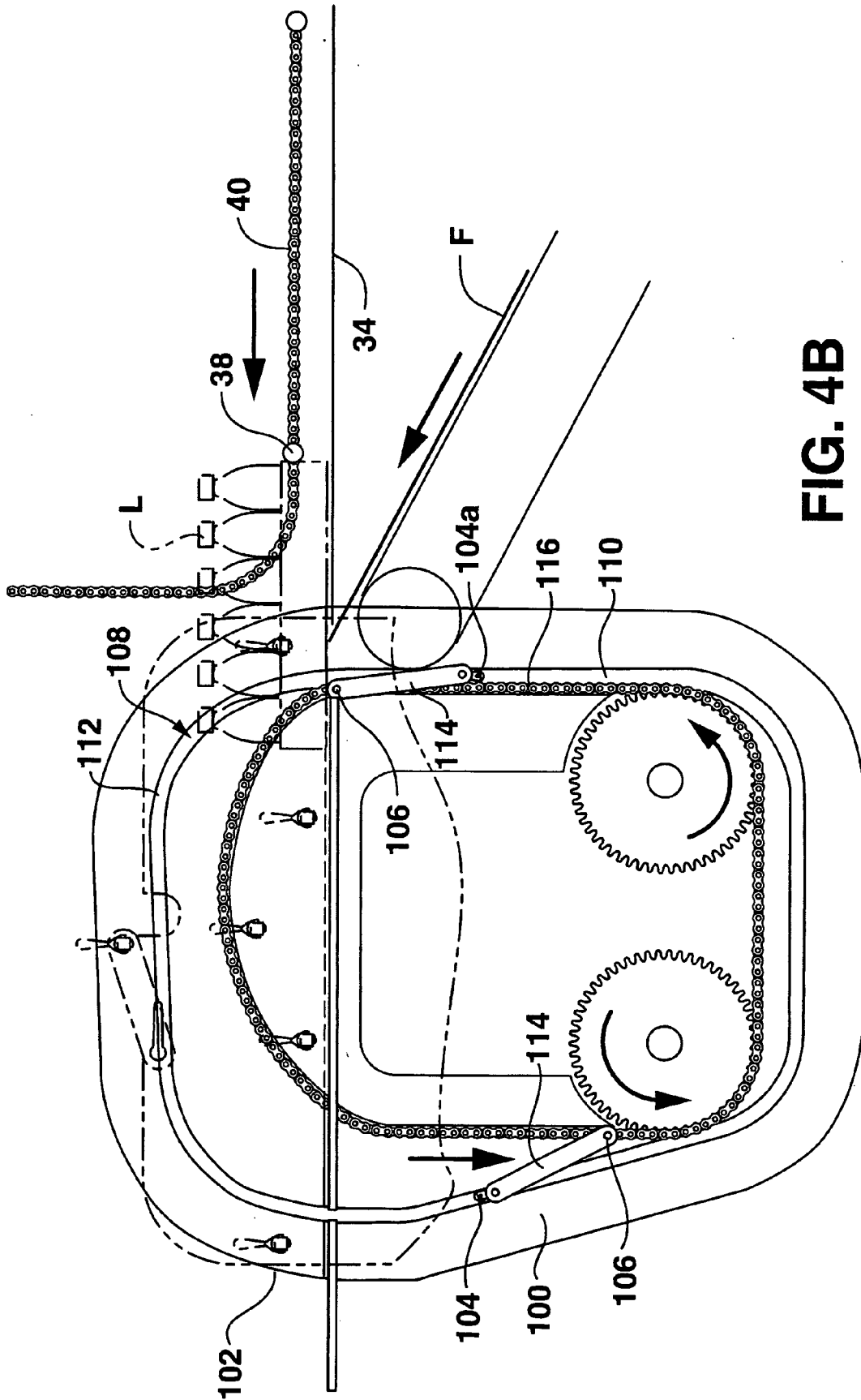


FIG. 4B

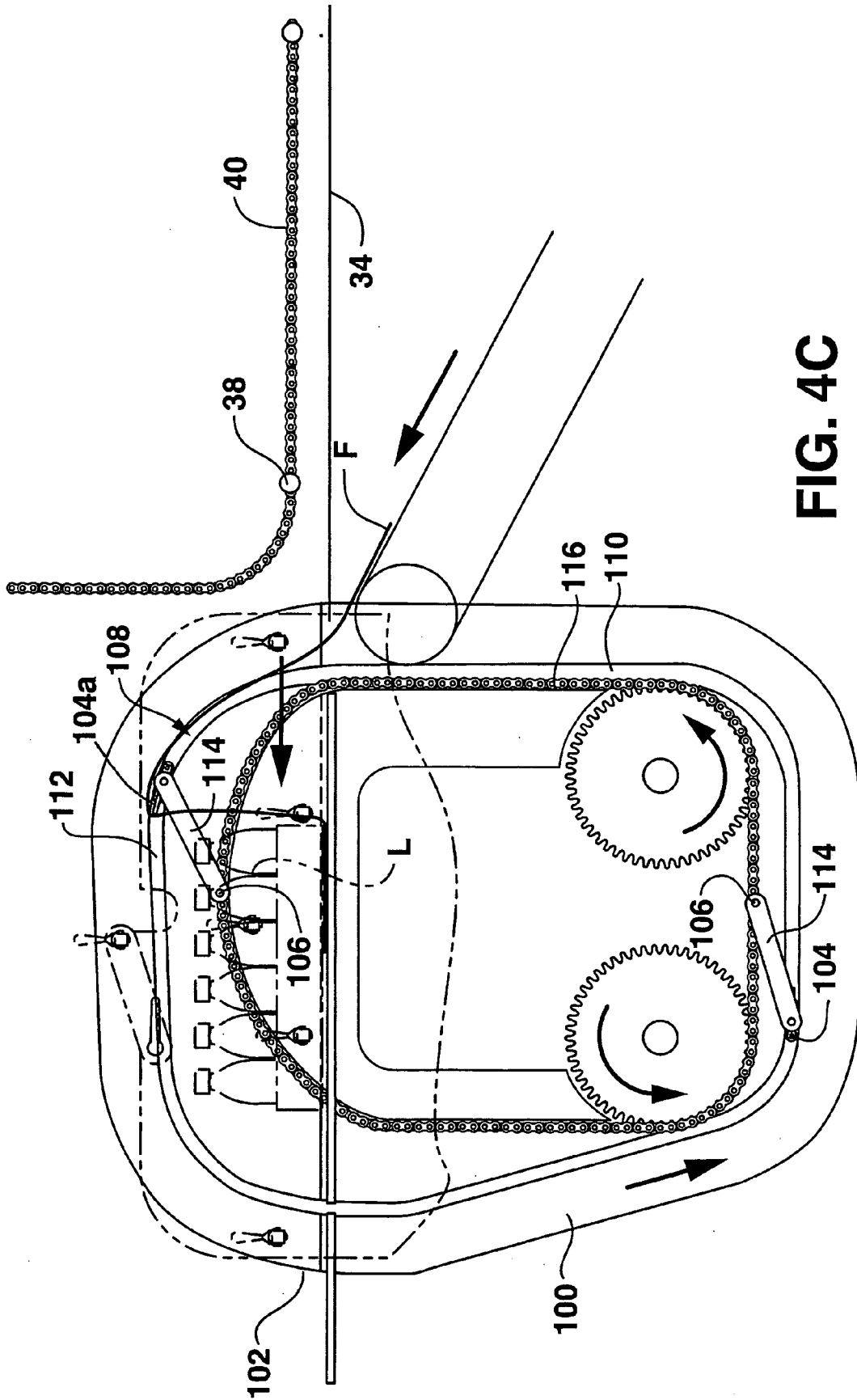


FIG. 4C

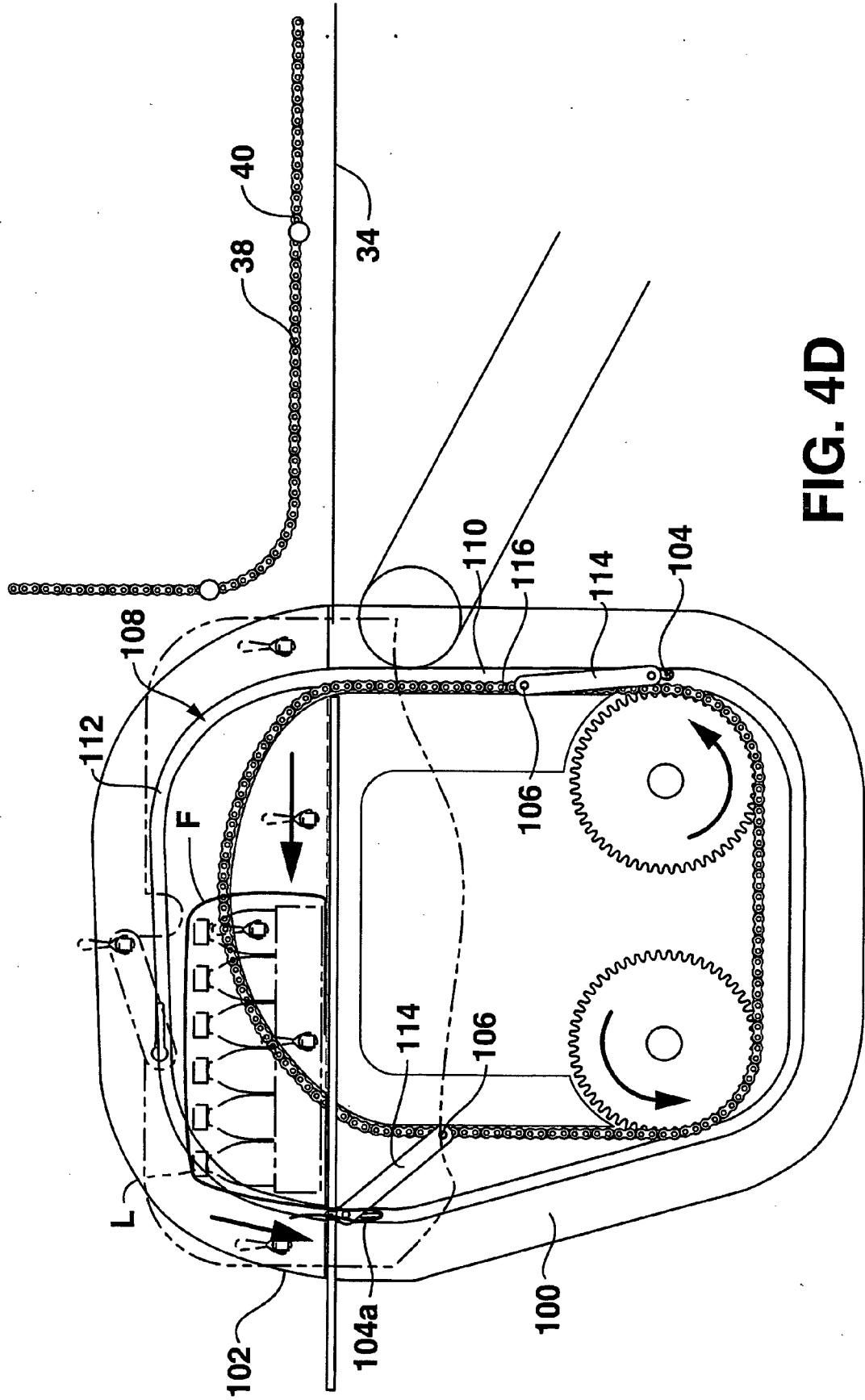
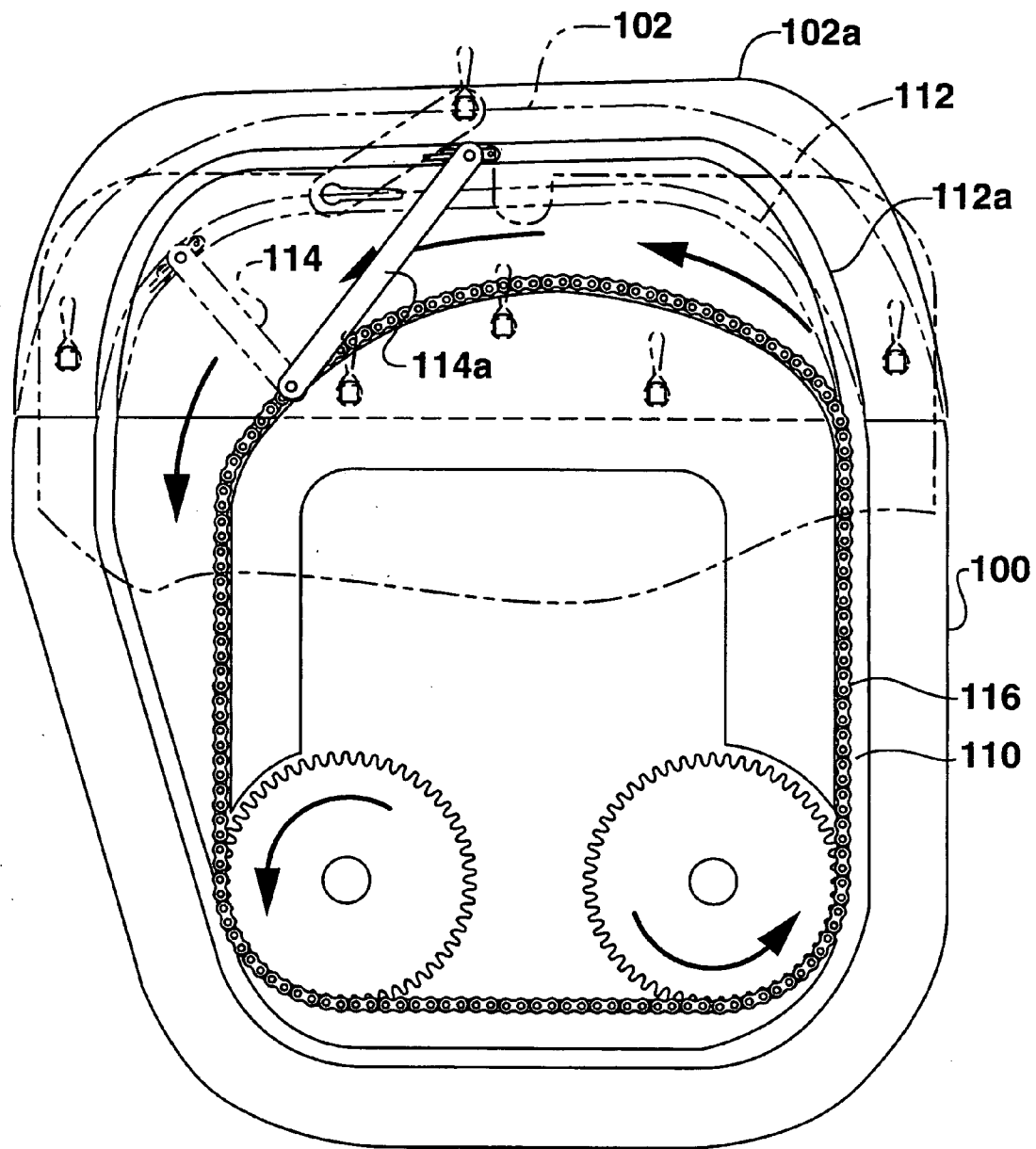
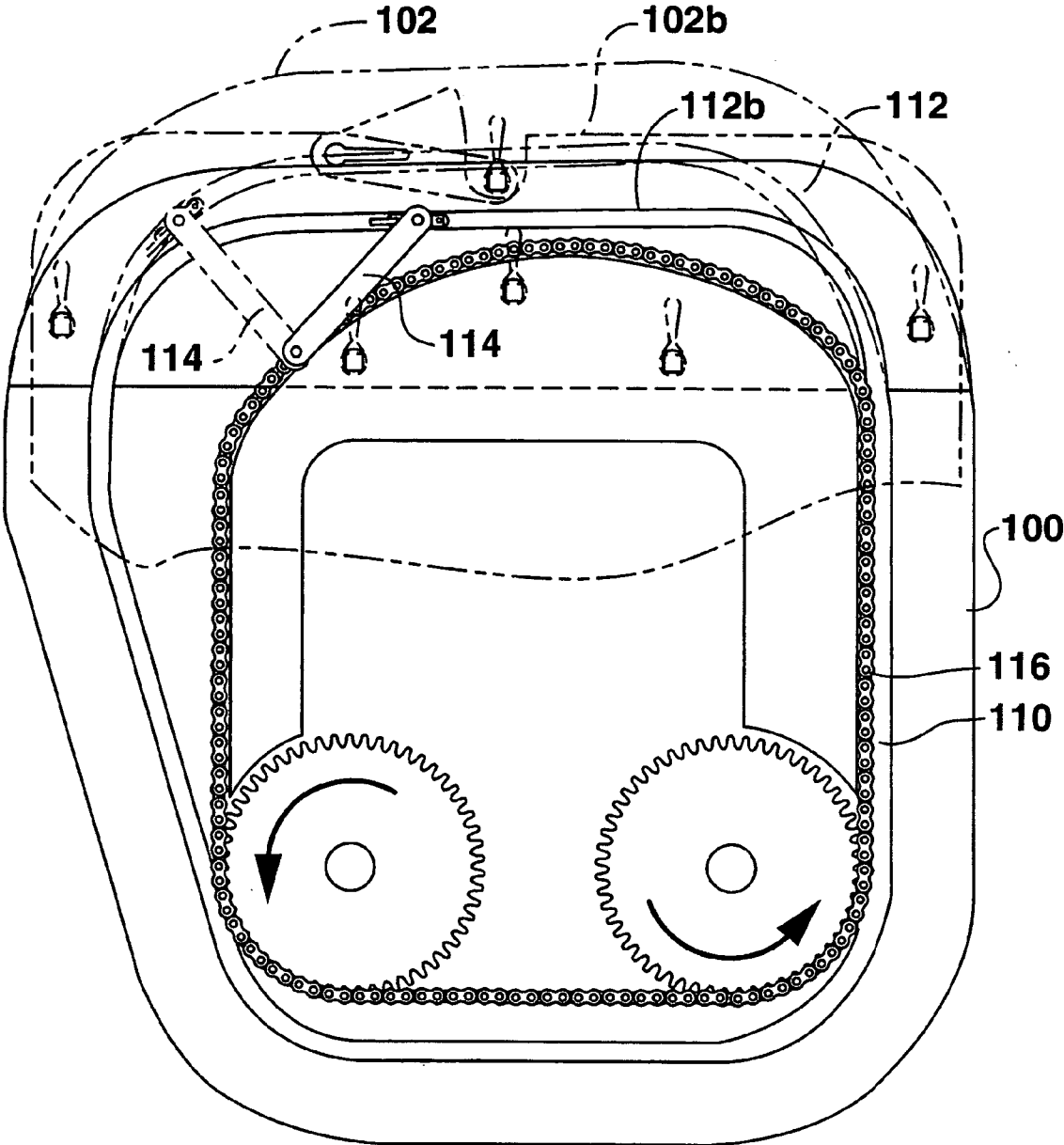


FIG. 4D

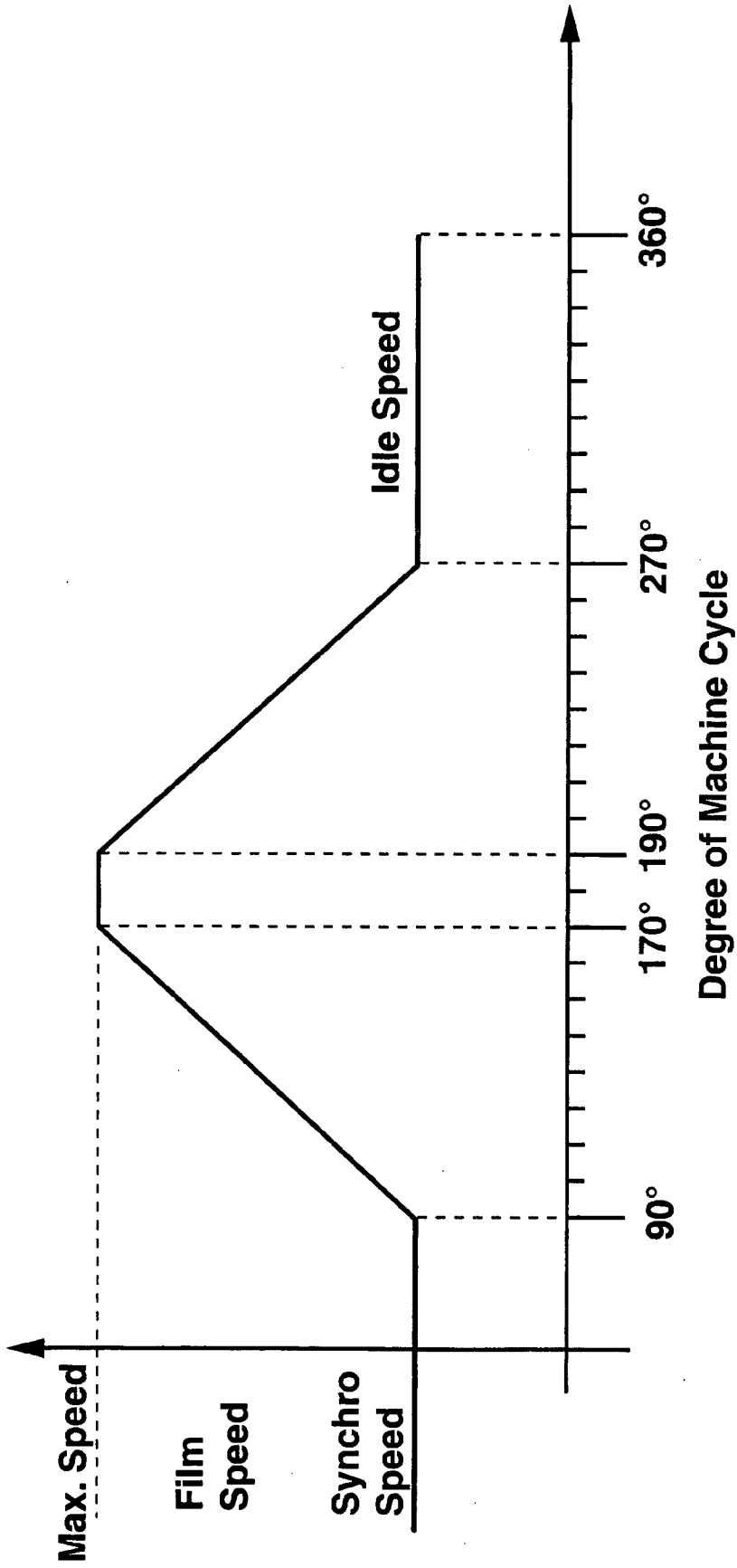




**FIG. 5A**



**FIG. 5B**



**FIG. 6**

## MODIFIABLE SHRINK WRAP MACHINE, ASSEMBLY AND RELATED METHOD

### FIELD OF THE INVENTION

[0001] The present invention relates generally to modifiable machines, assemblies, and related methods for shrink wrap packaging loads. Particularly, the present invention relates to machines, assemblies, and related methods of guiding film so as to place the film on the load utilizing a wrap guide having a removable portion sized to correspond to the size of the load.

### BACKGROUND OF THE INVENTION

[0002] In conventional shrink wrapping, a load is fed to a wrapping zone in which a shrink wrap film is placed on the load. The film is cut into pieces or sheets before or during the placement on the load. The load and film are then passed into a heating tunnel causing the film to shrink and compress against the load. Typically, the film is cut into sheets large enough to allow for some overlap between edges when placed on the load. During the heating process, the edges may therefore be sealed together forming a unitary package.

[0003] Some users of shrink wrapping machines use the machines to shrink wrap loads having different sizes, such as groups of small or large bottles, or small or large groupings of bottles. In such situations, various machine parameters have to be altered when the load size is changed. For example, the length of the sheet of film may have to be enlarged to accommodate a larger load. Also, the path of the portion of the machine that places the film on the load and/or the speed of wrapping along the path may have to be changed if the load is of a different size.

[0004] Conventional shrink wrap machines have attempted to address issues raised by shrink wrapping differently sized loads using a number of approaches. While these approaches may work in certain situations, they have been expensive in terms of complication of parts and assembly of the parts, the cost of more highly skilled laborers needed to operate the machinery, and in terms of repair and replacement of expensive worn parts. For example, conventional shrink wrapping machines have utilized adjustable wrap guides that alter the wrap path followed for wrapping a load. These guides have been complex to properly adjust and calibrate, and may require removal and replacement of a driven wrap chain. Such chain replacement can be complex and time consuming. Also, conventional shrink wrap machines have utilized complex servomotor and/or clutch arrangements to drive wrap guides at the varying speeds used during a wrap cycle. These parts are expensive to procure, maintain, and replace. Thus, it would be desirable to achieve simpler solutions than have been currently proposed for machines capable of shrink wrapping loads of different sizes.

[0005] Conventional shrink wrapping machines have also utilized servomotors and/or clutches to drive a cutting knife to cut the film to size for shrink wrapping. The placement of the cutting knife within the machine is fixed. Therefore, since the film speed during a wrap varies, often dictated by the size of the load, the film speed may or may not be at a desirable speed at the time that cutting is necessary for proper film sheet sizing. For example, the film may have to be cut at an undesirably high speed for certain load sizes.

Cutting at a high speed can produce inaccurate cuts. Alternatively, complex drive systems have been used to slow down or stop the film for cutting when the proper cut location reaches the fixed knife (see, for example, U.S. Pat. No. 6,128,888). Such systems are also unnecessarily complex and such artificial manipulation of film speed for cutting causes an uneven flow and induces wear on machine parts.

### SUMMARY OF THE INVENTION

[0006] According to some aspects of the invention, a machine is disclosed for shrink wrapping a load of a given size. The machine includes a supply conveyor for supplying the load to a wrapping zone, a wrap conveyor disposed in the wrapping zone, the wrap conveyor receiving the load from the supply conveyor, a film supply for supplying a film to the wrapping zone, and a wrap guide disposed in the wrapping zone. The wrap guide guides film received from the film supply in a wrap path proximate the wrap conveyor so as to place the film on the load. The wrap guide includes a removable portion defining a portion of the wrap path. The portion of the wrap path defined by the wrap guide removable portion is sized to correspond to the size of the load. A heat supply is provided for shrinking the film so as to shrink wrap the load. Various options and modifications are possible.

[0007] For example, the wrap guide may include two fixed guide portions and two of the removable portions, a respective one of each of the fixed guide portions and the removable portions being disposed on each side of the wrap conveyor. The removable portions may define the wrap path having a given configuration, and the machine may include alternate removable portions that define an alternate wrap path of a different configuration, the alternate removable portions configured for replacing the removable portions for wrapping an alternate load of a different size.

[0008] The wrap guide may define a track followed by a follower, the follower being pivotally connected to a wrapping bar by a linkage. The wrapping bar may be driven by the follower so as to move the film from the film supply into the wrapping zone to place the film on the load. The wrap guide may include a plurality of the followers, wrapping bars and linkages disposed around the track. The track may be not substantially congruent with the wrap path. The removable portions may define the wrap path having a given configuration, and the machine further including alternate removable portions that define an alternate wrap path of a different configuration, the alternate removable portions configured for replacing the removable portions. The track may be formed by the removable portions and the alternate removable portions may be not substantially congruent. The follower may move around the track at substantially constant speed and the wrapping bar moves around the wrap path at a varying speed.

[0009] The wrap guide may include a loop driven at constant speed for driving a wrapping bar along the wrap path at a varying speed. The wrapping bar may be connected to the loop via a pivoting linkage. The wrapping bar may be driven faster than the wrap conveyor for a portion of the travel of the wrapping bar.

[0010] According to other aspects of the invention, a machine is disclosed for selectively shrink wrapping a first

load of a first size or a second load of a second size. The machine includes a supply conveyor for supplying the first or second load to a wrapping zone, a wrap conveyor disposed in the wrapping zone, the wrap conveyor receiving the first or second load from the supply conveyor, a film supply for supplying a film to the wrapping zone, and a wrap guide disposed in the wrapping zone. The wrap guide guides film received from the film supply in a wrap path proximate the wrap conveyor so as to place the film on the first or second load. The wrap guide includes a removable portion defining a portion of the wrap path and an alternate removable portion defining an alternate portion of the wrap path. The portion of the wrap path is defined by the wrap guide removable portion and the alternate portion of the wrap path is defined by the alternate removable portion respectively being sized to correspond to the size of the first or second load. A heat supply is provided for shrinking the film so as to shrink wrap the load. Again, various options and modifications are possible.

[0011] According to other aspects of the invention, a wrapping assembly is disclosed for a machine for shrink wrapping a load of a given size. The machine includes a wrap conveyor disposed in the wrapping zone, a film supply for supplying a film to the wrapping zone, and a wrap guide disposed in the wrapping zone. The wrap guide guides film received from the film supply in a wrap path proximate the load and the wrap conveyor so as to place the film on the load. The wrap guide includes a removable portion defining a portion of the wrap path. The portion of the wrap path defined by the wrap guide removable portion is sized to correspond to the size of the load. Again, various options and modifications are possible.

[0012] According to certain other aspects of the invention, a method is disclosed for selectively shrink wrapping a first load of a first size and a second load of a second size. The method includes the steps of: (a) installing a removable portion of a wrap guide to define a wrap path, the removable portion defining a portion of the wrap path having a first configuration; (b) supplying the first load of the first size to a wrap conveyor; (c) supplying a film for wrapping the first load; (d) driving the wrap guide in the wrap path proximate the wrap conveyor so as to place the film on the first load; (e) heating the film to shrink wrap the first load; (f) replacing the removable portion with an alternate removable portion defining an alternate portion of the wrap path having a second configuration different from the first configuration; and (g) repeating steps (b) to (e) using the alternate removable portion and the second load. Various options and modifications are possible.

[0013] For example, the wrap guide may define a track followed by a follower, the follower being pivotally connected to a wrapping bar by a linkage. The wrapping bar may be driven by the follower so as to move the film from the film supply into the wrapping zone to place the film on the load. The wrap guide may include a plurality of the followers, wrapping bars and linkages disposed around the track. The track may be not substantially congruent with the wrap path. The follower may move around the track at substantially constant speed and the wrapping bar may move around the wrap path at a varying speed. The wrap guide may include a loop driven at constant speed for driving a wrapping bar along the wrap path at a varying speed.

[0014] According to other aspects of the invention, a method is disclosed for selectively shrink wrapping a load having a size. The method includes the steps of: (a) selecting a removable portion from a family of removable portions dependent on the size of the load, each removable portion having a particular configuration and defining a wrap path portion having a particular configuration; (b) installing the selected removable portion of the wrap guide to define a wrap path; (c) supplying the load to a wrap conveyor; (d) supplying a film for wrapping the first load; (e) driving the wrap guide in the wrap path proximate the wrap conveyor so as to place the film on the load; and (f) heating the film to shrink wrap the first load.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a perspective view of a shrink wrapping machine according to certain aspects of the invention.

[0016] FIG. 2 is a perspective view of a cutting assembly suitable for use in the device of FIG. 1.

[0017] FIG. 3 is a side diagrammatical view of a wrapping assembly suitable for use in the device of FIG. 1.

[0018] FIG. 4A is a side diagrammatical view of the wrapping assembly of FIG. 3 showing a first wrapping stage.

[0019] FIG. 4B is a side diagrammatical view of the wrapping assembly of FIG. 3 showing a second wrapping stage.

[0020] FIG. 4C is a side diagrammatical view of the wrapping assembly of FIG. 3 showing a third wrapping stage.

[0021] FIG. 4D is a side diagrammatical view of the wrapping assembly of FIG. 3 showing a fourth wrapping stage.

[0022] FIG. 5A is a side diagrammatical view of the wrapping assembly as in FIG. 3, showing one example of a removable portion of a wrap guide of the wrapping assembly as in FIG. 3.

[0023] FIG. 5B is a side diagrammatical view of the wrapping assembly as in FIG. 3, showing another example of a removable portion of a wrap guide of the wrapping assembly as in FIG. 3.

[0024] FIG. 6 is a diagram showing an example of possible film speed during the wrapping cycle and potential film cutting points.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] Reference will now be made in detail to embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the invention, and not meant as a limitation of the invention. For example, features illustrated or described as part of one embodiment can be used with another embodiment to yield still a third embodiment. It is intended that the present invention include these and other modifications and variations. In discussing various embodiments, like or similar reference numerals are used below with like or similar parts of various embodiments.

[0026] FIG. 1 generally shows a shrink wrapping machine 10 useful for shrink wrapping loads using conventional shrink wrapping films. Machine 10 generally includes a supply conveyor 12, a wrap zone 14, in which is disposed a wrap conveyor 16 and a wrap guide 18, and a heat supply 20. A film supply 22 supplies film to a cutting assembly 24, which supplies cut film to the wrapping zone 14. As will become apparent from the following, various aspects, combinations, and sub-combinations of features of the above elements are within the scope of the present invention. Also, it is possible to bring into practice the inventions disclosed below in numerous ways and with numerous modifications. Therefore, the specifics shown in FIG. 1 and the following figures should not be considered limiting of the invention, but only as one example of how to carry out the various inventive concepts.

[0027] FIG. 1 further shows that machine 10 is supported by a frame 30 including a number of upright and horizontal members. The various parts of machine 10 may be attached to frame 30 in conventional ways. For example, an infeed conveyor 32 may be provided to supply loads to be wrapped to machine 10. Infeed conveyor 32 may be an integral part of machine 10, or may be considered part of a separate device or conveyor, depending upon the application. Infeed conveyor 32 may supply grouped, stacked, or boxed loads, or any load to be wrapped, as desired.

[0028] Supply conveyor 12 includes a supply belt 34 and a flight bar assembly 36 for driving loads received from the infeed conveyor 32 to wrapping zone 14. Supply belt 34 may be driven or undriven, or may be replaced by rollers. Flight bar assembly 36 may include a plurality of flight bars 38 driven on chains 40 by a conventional motor drive with servo-clutches. Flight bars 38, supply belt 34 and infeed conveyor 32 may all be driven at synchronous speeds as controlled by a programmable logic controller, as desired. Sensors 42 may be provided within supply conveyor 12 to detect presence of loads being pushed by flight bars 38 for feedback loop control of various aspects of machine 10.

[0029] Film supply 22 may include rollers 44 for supporting one or more film rolls 46 for supplying film to machine 10. Rollers 44 may be driven or undriven. The film F is paid out from film roll 46 through a series of rollers 48. If desired, rollers 48 may comprise a portion of a conventional dance bar assembly used to provide more steady rotation of roll 46 while the downstream speed of film F varies due to wrapping cycle film speed changes, as is known.

[0030] FIG. 2 shows a perspective view of cutting assembly 24 according to certain aspects of the present invention. As shown, film F enters a lower portion of cutting assembly 24 threading around a first roller 52, a second roller 54, between pinch rollers 56 and past exit roller 58. Cutting assembly 24 includes a frame 60 including a base 62 and side pieces 64. Mounting plates 66 are attached to side pieces 64. Roller 52 is an idler roller mounted between side pieces 64. Rollers 54 and 58 are idler rollers mounted between mounting plates 66. At least one of pinch rollers 56 mounted between mounting plates 66 is driven. It should be understood that various different arrangements of rollers or other structures for passing film F from film supply 22 to and through cutting assembly 24 could be utilized, if desired.

[0031] A vacuum belt 68 is mounted between side pieces 64. Vacuum belt 68 may be a conventional vacuum belt used

for transmitting film in a desired direction, as is known. Vacuum belt 68 may be driven with a variable speed so as to move cut film at a desired wrapping speed. Thus, vacuum belt 68 may be driven via a variable speed servomotor, a controlled by a conventional programmable logic device. Film speeds during different portions of a wrapping cycle will be discussed in further detail below.

[0032] Cutting assembly 24 further includes a cutting mechanism 70 mounted within frame 60. As shown, cutting mechanism 70 may include a cutting blade 72 rotationally mounted within mounting plates 66. Cutting mechanism 70 may be driven by the same servomotor used to drive vacuum belt 68, and is triggered by an electronic clutch 74. It can be desirable to cause cutting blades 72 to be rotated by the servomotor and electronic clutch 74 so as to be substantially synchronized in tangential speed with the speed of film F. It is believed that such synchronization of the cutting mechanism and the film speeds creates a more accurate cut.

[0033] In some aspects of the present invention, it is desirable to selectively fix the position of the cutting mechanism within a cutting zone within cutting assembly 24. As shown in FIG. 2, rack gears 76 may be provided along side pieces 64 to mesh with pinion gears 78 attached to mounting plates 66. The rotation of handle 80 causes pinion gears 78 to rotate relative to rack gears 76, thereby positioning cutting mechanism 70 at a predetermined location along the cutting zone within cutting assembly 24. Guides 82 assist in maintaining alignment along rack gear 76. Thus, rack gears 76 may be said to comprise a track along a cutting zone, with cutting mechanism 70 being positionable along the track. If desired, a sensor 84 may be utilized to determine position along the track, such as by using an optical sensor to count teeth of rack gears 76, etc., or some equivalent.

[0034] As will be discussed in further detail below, use of handle 80 to position cutting mechanism 70 within the cutting zone between rack gears 76 can provide certain benefits in certain applications. For example, cutting mechanism 70 may be placed in a position so as to achieve a certain length of cut film, or so as to cut the film at a certain point in the wrap cycle, or at a certain film speed, or within a range of film speeds. However, it should be understood that the movable cutting mechanism 70 is not required for all aspects of the invention.

[0035] It should also be understood that other cutting mechanism location adjustment designs could be substituted for the rack and pinion arrangement shown in FIG. 2. Thus, a hydraulic, pneumatic, or electric adjustment assembly could be used. Also, other continuously or selectively (step-wise) adjustable mechanisms could be utilized, if desired. Although the cutting mechanism 70 of FIG. 2 as shown is configured to be positioned while machine 10 is not running (i.e. is only to be positioned while the machine is stopped), it would also be possible to configure cutting assembly 24 so that the location of cutting mechanism 70 would be repositionable during use of machine 10, if desired. Thus, various options and modifications are possible for the elements of cutting assembly 24 shown in FIG. 2.

[0036] FIG. 3 shows a diagram of one example of equipment useful in a wrap zone 14 according to certain aspects of the invention. More specifically, FIG. 3 shows a side view of one side of wrap guide 16 that would be disposed adjacent wrap conveyor 18 (see FIG. 1). Wrap guide 16 is

disposed in wrapping zone 14 for guiding film received from film supply 22 via cutting assembly 24 in a wrap path. Wrap guide 16 includes a fixed portion 100 and a removable portion 102. Fixed portion 100 is fixed to frame 30, and removable portion 102 is fixed to frame 30 and the fixed portion. Together, the fixed and removable portions 100 and 102 define a wrap path 108 for film being wrapped around a given load.

[0037] Wrap guide 16 further includes at least one wrapping bar 104 driven along the wrap path. Wrapping bar 104 is mounted to a follower 106 that follows a chain 116 along a track 117. Fixed portion 110 of wrap path 108 is disposed within fixed portion 100 of wrap guide 16. Removable portion 112 of wrap path 108 is disposed within removable portion 102 of wrap guide 16. Linkages 114 are connected to followers 106, and are in turn driven by chain 116. Driven gear 118 drives chain 116, and gear 120 is an idler gear. Machine main drive assembly 122 is schematically shown as connected to driven gear 118 by belt 124.

[0038] If desired, main drive assembly 122 may be utilized to drive chain 116 at a substantially constant speed. The track 117 followed by chain 116 is fixed. However, wrap path 108 may have differing shapes, depending upon the size of the load, the length of the linkages 114, etc. Thus, by designing track portion 112 accordingly, different sized loads may be wrapped without modifying main drive assembly 122 or chain 116 or its path. The profile along portion 112 of track 108 defines the path that wrap bars 104 take along the wrap path when wrapping a load with film. Quick-connect assembly devices such as clamps 126 may be utilized to readily attach and detach removable portion 102 so as to change the track portion 112 if desired. Thus, if different sized loads are to be wrapped using machine 10, a simple change out of portions 102 on either side of wrap guide 116 can accommodate the different sized loads by providing a different wrap path. By designing track portion 112 and linkage length 114 accordingly, varying wrap paths can be achieved. In such situation, chain 116 may continue to be driven at a substantially constant speed using main drive 122. Further, the orientation and/or location of chain 116 within machine 10 need not be changed, or the actual chain itself need not be changed out for different loads. Thus, it is a relatively simple matter to change the size and/or shape of load being wrapped by machine 10 by simply changing out the removable portions 102 of a first predetermined size for a second alternate removable portions of another predetermined size to provide alternate wrap paths of different configurations. However, the track 117 followed by chain 116 does not change when removable portions 102 are changed.

[0039] FIGS. 4A-4D show a portion of a wrap cycle in which cut film F is transferred from vacuum belt 68 to load L for wrapping the load. As shown therein, film F is fed so as to provide a leading edge that is captured beneath load L (between FIGS. 4B and 4C). As load L moves further to the left between FIGS. 4B and 4C the wrap bar 104 attached to linkage 114a is driven into contact with the cut film and is pulled over and around load L as it moves through wrap zone 14 along wrap conveyor 18. As shown in FIG. 4D, cut film F has been looped over top of load L. As load L moves further to the left from the position shown in 4D, the trailing edge of cut film will overlap with the leading edge beneath load L. At that point, the load will be ready for passing into

a heat supply, such as a tunnel or oven 20, as shown in FIG. 1. Chain 116 may be driven at a substantially constant speed during this wrap cycle.

[0040] The wrap path 108 generated by fixed and removable portions 100 and 102, in combination with linkage 114 causes the cut film to accelerate substantially between the positions of FIGS. 4C and 4D so that the cut film will essentially pass over and in front of the load. Film speeds will be discussed below in connection with FIG. 6.

[0041] FIGS. 5A and 5B show two alternate constructions whereby different sized wrap paths are created by providing different sized removable portions 102. In FIG. 5A, linkage 114 is replaced by linkage 114a as well as replacing removable portion 102 with removable portion 102a. Wrap path portion 112a in removable portion 102a is defined accordingly. In FIG. 5B, linkage 114 is not replaced when removable portion 102 is replaced by removable portion 102b. Accordingly a different alternate wrap path portion 112b is created. FIGS. 5A and 5B illustrate that, through a relatively simple change out of removable portions 102, with an optional change out of linkages 114, alternate wrap paths may be readily achieved, thereby allowing differently sized loads to be wrapped using the same equipment with minimal changes. Such change out can be done readily during operation requiring less down time and less technically skilled labor personnel to achieve such change out, than if the drive chain had to be changed out or its path modified.

[0042] Also, driving a wrap assembly by driving wrap bars through such a linkage attached to a substantially constant speed loop, such as chain 116, allows for a relatively simple mechanism for providing a wrap path having a wrap bar that moves at a substantially varying speed. Therefore, instead of complex servomotors and controls, a simpler and less expensive drive may be used along with a linkage and wrap path spaced from a chain track, to achieve a desired changing film speed during load wrapping.

[0043] One example of such a film speed distribution is shown in FIG. 6. More particularly, FIG. 6 shows one wrap cycle divided into 360 degrees according to the position of a wrap bar 104 on chain 116. In FIG. 6, the 0 degrees position is with the wrap bar 104 at a "3 o'clock" position around track 117, as shown in FIG. 3. As shown in FIG. 6, the speed of wrap bar 114 increases from 90 to 170 degrees. Such point corresponds to position shown, for example, in FIG. 4C where wrap bar is advancing film F from behind and over the load to be wrapped. Essentially, the wrap bar must speed up to a speed faster than the synchro speed of the load and past the load so that the leading and trailing edges may overlap. At 190 to 270 degrees the speed of wrap bar 104 slows down as the wrap bar returns for another cycle.

[0044] It should be understood that the speed profile as shown in FIG. 6 can vary a great deal according to the present invention. For example, the speed increases and decreases need not be linear, the speeds need not reach constant levels, etc. The speeds are essentially a function of the size of the guide path and the length of the linkages, as well as the speed of the load through the wrap zone. In any event, the wrap bar 104 will typically have to accelerate as it picks up a piece of cut film from behind the load, passes over top of the load, and then passes down in front of the load so as to allow for overlapping of the cut film. Thus, there is a base speed and an acceleration portion found in the

curve. Again, it should be kept in mind that multiple wrap bars may be used, so the curve could show a similar speed profile in 0 to 180 degrees, 0 to 120 degrees, 0 to 90 degrees of chain rotation, depending on the number of wrap bars attached to the chain.

[0045] If desired, it can be useful in certain applications to selectively cut the film at particular points along the speed curve. For example, it may be desired to cut the film when it is moving at a speed less than the maximum speed. It may also be useful to cut the film at a minimum speed, or somewhat proximate the minimum speed. In such case a less expensive low speed clutch may be used and synchronizing blade speed and film speed is less complicated. Thus, if desired, the position of cutting mechanism 70 within the cutting zone may be altered by using the rack and pinion gears 76 and 78 so as to locate the cutting mechanism so as to achieve cutting at a desired film speed for the desired application. Accordingly, one may therefore choose a position of cutting mechanism 70 depending upon one or more of a size of the load, a length of the film after cutting (so as to wrap the film about the load), a point in the wrap cycle in which the cutting mechanism is to cut the film, an amount of leading edge of the film to be placed beneath the load during the wrap cycle, etc. Therefore, having a cutting mechanism with an adjustable positioning device can provide certain benefits.

[0046] It is believed that programming can be created to assist in setting the optimal position of the cutting mechanism within the cutting zone based on various system parameters, such as load size, wrap path dimensions, machine speed, etc. Such optimum position could also be determined empirically through testing and experience. In any event, the optimal placement may be provided to a machine user for manual manipulation or may be automatically achieved by a drive mechanism, for example through the use of programmable logic servomotors, position sensors, etc. If desired, such positioning could be automatically achieved during operation as well based on various sensor input.

[0047] According to certain other aspects of the invention, methods of using the above shrink wrap machine components are also contemplated within the scope of the invention. For example, it is within the scope of the invention to wrap a load of a certain size using a first removable portion of a wrap guide, switching out that removable portion for an alternate removable portion of a different size defining a different wrap path, and then wrapping a load of a different size. Similarly, one may fix the cutting mechanism at a certain position, run the machine to wrap a load of a given size, and then move cutting mechanism to a different position so as to cut film so as to wrap loads of a different size. The methods may be complementary or may be employed separately, if desired. Thus, the machine and methods described above provide a flexible wrapping machine that can be utilized for different loads and for different applications, where change out and down time, if loads of different sizes are to be wrapped, is reduced.

[0048] It should be understood that various other modifications and combinations of the above embodiments are contemplated and are also within the scope of the present invention. Thus, the present invention contemplates that any and all such subject matter is included within the scope of the present invention.

What is claimed is:

1. A machine for shrink wrapping a load of a given size, the machine comprising:

a supply conveyor for supplying the load to a wrapping zone;

a wrap conveyor disposed in the wrapping zone, the wrap conveyor receiving the load from the supply conveyor;

a film supply for supplying a film to the wrapping zone;

a wrap guide disposed in the wrapping zone for guiding film received from the film supply in a wrap path proximate the wrap conveyor so as to place the film on the load, the wrap guide including a removable portion defining a portion of the wrap path, the portion of the wrap path defined by the wrap guide removable portion being sized to correspond to the size of the load; and

a heat supply for shrinking the film so as to shrink wrap the load.

2. The machine of claim 1, wherein the wrap guide includes two fixed guide portions and two of the removable portions, a respective one of each of the fixed guide portions and the removable portions being disposed on each side of the wrap conveyor.

3. The machine of claim 1, wherein the removable portions define the wrap path having a given configuration, and further including alternate removable portions that define an alternate wrap path of a different configuration, the alternate removable portions configured for replacing the removable portions for wrapping an alternate load of a different size.

4. The machine of claim 1, wherein the wrap guide defines a track followed by a follower, the follower being pivotally connected to a wrapping bar by a linkage.

5. The machine of claim 4, wherein the wrapping bar is driven by the follower so as to move the film from the film supply into the wrapping zone to place the film on the load.

6. The machine of claim 4, wherein the wrap guide includes a plurality of the followers, wrapping bars and linkages disposed around the track.

7. The machine of claim 4, wherein the track is not substantially congruent with the wrap path.

8. The machine of claim 4, wherein the removable portions define the wrap path having a given configuration, and further including alternate removable portions that define an alternate wrap path of a different configuration, the alternate removable portions configured for replacing the removable portions.

9. The machine of claim 8, wherein the track formed by the removable portions and the alternate removable portions are not substantially congruent.

10. The machine of claim 4, wherein the follower moves around the track at substantially constant speed and the wrapping bar moves around the wrap path at a varying speed.

11. The machine of claim 1, wherein the wrap guide includes a loop driven at constant speed for driving a wrapping bar along the wrap path at a varying speed.

12. The machine of claim 11, wherein the wrapping bar is connected to the loop via a pivoting linkage.

13. The machine of claim 11, wherein the wrapping bar is driven faster than the wrap conveyor for a portion of the travel of the wrapping bar.



14. A machine for selectively shrink wrapping a first load of a first size or a second load of a second size, the machine comprising:

- a supply conveyor for supplying the first or second load to a wrapping zone;
- a wrap conveyor disposed in the wrapping zone, the wrap conveyor receiving the first or second load from the supply conveyor;
- a film supply for supplying a film to the wrapping zone;
- a wrap guide disposed in the wrapping zone for guiding film received from the film supply in a wrap path proximate the wrap conveyor so as to place the film on the first or second load, the wrap guide including a removable portion defining a portion of the wrap path and an alternate removable portion defining an alternate portion of the wrap path, the portion of the wrap path defined by the wrap guide removable portion and the alternate portion of the wrap path defined by the alternate removable portion respectively being sized to correspond to the size of the first or second load; and
- a heat supply for shrinking the film so as to shrink wrap the load.

15. The machine of claim 14, wherein the wrap guide defines a track followed by a follower, the follower being pivotally connected to a wrapping bar by a linkage.

16. The machine of claim 15, wherein the wrapping bar is driven by the follower so as to move the film from the film supply into the wrapping zone to place the film on the load.

17. The machine of claim 15, wherein the wrap guide includes a plurality of the followers, wrapping bars and linkages disposed around the track.

18. The machine of claim 15, wherein the track is not substantially congruent with the wrap path.

19. The machine of claim 15, wherein the follower moves around the track at substantially constant speed and the wrapping bar moves around the wrap path at a varying speed.

20. The machine of claim 15, wherein the wrap guide includes a loop driven at constant speed for driving a wrapping bar along the wrap path at a varying speed.

21. A wrapping assembly for a machine for shrink wrapping a load of a given size, the machine comprising:

- a wrap conveyor disposed in the wrapping zone;
- a film supply for supplying a film to the wrapping zone; and
- a wrap guide disposed in the wrapping zone for guiding film received from the film supply in a wrap path proximate the load and the wrap conveyor so as to place the film on the load, the wrap guide including a removable portion defining a portion of the wrap path, the portion of the wrap path defined by the wrap guide removable portion being sized to correspond to the size of the load.

22. The assembly of claim 21, wherein the wrap guide includes two fixed guide portions and two of the removable portions, a respective one of each of the fixed guide portions and the removable portions being disposed on each side of the wrap conveyor.

23. The assembly of claim 21, wherein the removable portions define the wrap path having a given configuration,

and further including alternate removable portions that define an alternate wrap path of a different configuration, the alternate removable portions configured for replacing the removable portions for wrapping an alternate load of a different size.

24. The assembly of claim 21, wherein the wrap guide defines a track followed by a follower, the follower being pivotally connected to a wrapping bar by a linkage.

25. The assembly of claim 24, wherein the track is not substantially congruent with the wrap path.

26. The assembly of claim 24, wherein the removable portions define the wrap path having a given configuration, and further including alternate removable portions that define an alternate wrap path of a different configuration, the alternate removable portions configured for replacing the removable portions.

27. The assembly of claim 24, wherein the follower moves around the track at substantially constant speed and the wrapping bar moves around the track at a varying speed.

28. The assembly of claim 24, wherein the wrap guide includes a loop driven at constant speed for driving a wrapping bar along the wrap path at a varying speed.

29. The assembly of claim 21, further including a supply conveyor for supplying the load to the wrap conveyor.

30. The assembly of claim 21, further including a heat supply for shrinking the film so as to shrink wrap the load.

31. A method for selectively shrink wrapping a first load of a first size and a second load of a second size, the method comprising the steps of:

- (a) installing a removable portion of a wrap guide to define a wrap path, the removable portion defining a portion of the wrap path having a first configuration;
- (b) supplying the first load of the first size to a wrap conveyor;
- (c) supplying a film for wrapping the first load;
- (d) driving the wrap guide in the wrap path proximate the wrap conveyor so as to place the film on the first load;
- (e) heating the film to shrink wrap the first load;
- (f) replacing the removable portion with an alternate removable portion defining an alternate portion of the wrap path having a second configuration different from the first configuration; and
- (g) repeating steps (b) to (e) using the alternate removable portion and the second load.

32. The method of claim 31, wherein the wherein the wrap guide defines a track followed by a follower, the follower being pivotally connected to a wrapping bar by a linkage.

33. The method of claim 32, wherein the wrapping bar is driven by the follower so as to move the film from the film supply into the wrapping zone to place the film on the load.

34. The method of claim 32, wherein the wrap guide includes a plurality of the followers, wrapping bars and linkages disposed around the track.

35. The method of claim 32, wherein the track is not substantially congruent with the wrap path.

36. The method of claim 32, wherein the follower moves around the track at substantially constant speed and the wrapping bar moves around the wrap path at a varying speed.

37. The method of claim 31, wherein the wrap guide includes a loop driven at constant speed for driving a wrapping bar along the wrap path at a varying speed.

38. A method for selectively shrink wrapping a load having a size, the method comprising the steps of:

- (a) selecting a removable portion of a wrap guide from a family of removable portions dependent on the size of the load, each removable portion having a particular configuration and defining a wrap path portion having a particular configuration;

- (b) installing the selected removable portion of the wrap guide to define a wrap path;

- (c) supplying the load to a wrap conveyor;

- (d) supplying a film for wrapping the load;

- (e) driving the wrap guide in the wrap path proximate the wrap conveyor so as to place the film on the load; and

- (f) heating the film to shrink wrap the first load.

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