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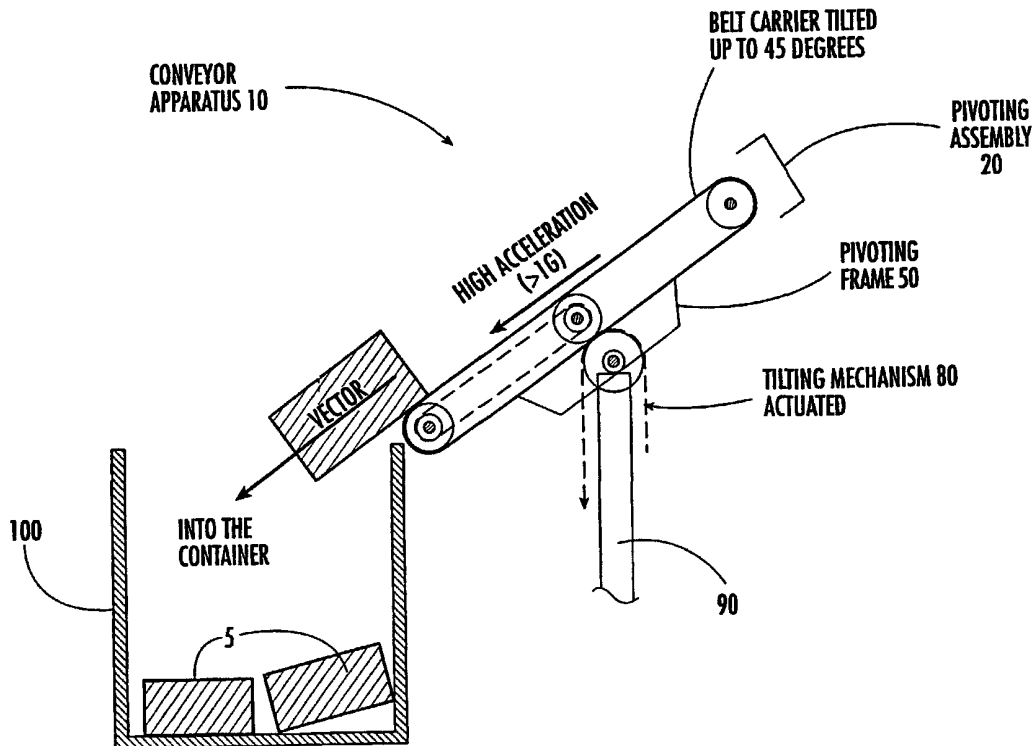
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- (71) Applicant: **UNITED PARCEL SERVICE OF AMERICA, INC.** [US/US]; 55 Glenlake Parkway, N.E., Atlanta, GA 30328 (US). For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: HIGH SPEED PARCEL SORTER



(57) Abstract: A conveyor system particularly configured for discrete parcels, which combines tilting tray concepts with "cross-belt" or powered conveyor concepts, which allows for the acceleration of parcels above one gravity force "G". In one configuration, two levels can be used, the upper for larger packages, and the lower for lower packages.



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HIGH SPEED PARCEL SORTER

Technical Field

The present invention generally relates to conveyor systems, and particularly relates to conveyor systems which allow for selective discharge therefrom.

Background of the Invention

5 Due to the high cost of automated sorting equipment, such equipment must be very productive and efficient for its use to be profitable to its owner.

 The sortation of small parcels demands a particularly high productivity level in order to be lucrative to the shipper. One reason is that small packages by virtue of their low weight and low volume command a relatively low shipping fee, yet they
10 must be individually sorted like any other parcel in order to get to their destination. Therefore the transportation company that actually does the sorting needs to make sure that the automated sorting machines it uses are considerably more efficient than those handling large parcels, which command higher shipping fees.

 However, most known systems currently in existence either use cross belt
15 sorters or gravity in order to discharge small packages. Neither of these methods allow for a very fast discharge speed, hence the resulting low relative productivity.

Kofoed, U.S. Patent No. 5,690,209, issued November 25, 1997 discloses the use of a sorting conveyor having powered transverse conveyors. However, the transverse conveyors do not tilt. In the case of such "cross belt" sorters, speeding up
20 of the cross belt runs against the forces of inertia which either causes the packages to slip or tumble on the belt itself. So in all these cases the acceleration cannot exceed $1G$, if one is to maintain its parcel under control and avoid missorting. Therefore the travel speed of the whole system is forced to be relatively low.

 U.S. Patent No. 5,433,311, entitled "Dual Level Tilting Tray Package Sorting
25 Apparatus" discloses the use of multiple "tilting trays", which when tilted, allow

packages to slide therefrom into appropriate chutes. In the case of such a tilt tray sorter, parcels are discharged due to the forces of gravity which are resisted by the forces of inertia as well as friction. The result is a relatively low discharge rate, a relatively low travel speed and a relatively low productivity.

5 Therefore there is a need in the art to provide a method and apparatus for sorting both large and small packages with improved efficiency and with minimum machine costs.

Summary of the Invention

10 The present invention overcomes deficiencies in the prior art by providing a conveyor system which combines the advantages of powered conveyor sorting mechanisms with the advantages of "tilting tray" conveying systems to provide an apparatus which can sort both large and small packages with improved efficiency.

15 Generally described, the present invention is directed towards a conveying apparatus for conveying articles, the apparatus comprising a stationary frame defining a path and at least one conveying module for movement along the path, each module itself comprising a conveying module frame member configured for translational movement along the path, a pivoting conveying subassembly pivotably attached relative to the conveying module frame member, the pivoting conveying subassembly including a selectively powered conveyor for selectively discharging an article
20 thereon, and a tilting mechanism for tilting the pivoting conveying subassembly and the powered conveyor relative to the conveying module frame member, such that the pivoting conveying subassembly, including the powered conveyor, can be in a tilted position at the same time the powered conveyor is powered, thus causing the article atop the powered conveyor to be discharged both by gravity and conveyor force.

25 Therefore it is an object of the present invention to provide an improved conveyor apparatus and method of using same.

 It is a further object of the present invention to provide an improved conveyor apparatus which provides improved discharge features.

30 It is a further object of the present invention to provide an improved conveyor apparatus which is effective in its discharge.

It is a further object of the present invention to provide an improved conveyor apparatus which is accurate in its discharge.

It is a further object of the present invention to provide an improved conveyor apparatus which is simple in operation.

5 It is a further object of the present invention to provide an improved conveyor apparatus which is simple in construction.

It is a further object of the present invention to provide an improved conveyor apparatus which is efficient in operation.

10 It is a further object of the present invention to provide an improved conveyor apparatus which can accommodate a variety of parcels.

It is a further object of the present invention to provide an improved conveyor apparatus which can accommodate a variety of parcel weights and sizes.

It is a further object of the present invention to provide an improved conveyor apparatus which can discharge to different levels.

15 Other objects, features, and advantages of the present invention will become apparent upon reading the following detailed description of the preferred embodiment of the invention when taken in conjunction with the drawing and the appended claims.

Brief Description of the Drawings

20 Fig. 1 is an illustrative front elevational view of a conveying module of a conveyor apparatus according to the present invention, used to transport an article such as a parcel (a.k.a. a "package") 5. The conveying module 11 is configured to move along with other similar modules along a path or track provided by a stationary endless rail 97.

25 Fig. 2 is a front elevational illustrative view showing the configuration 10 of Fig. 1 with the pivoting frame 50 of the pivoting assembly 20 tilted from the neutral orientation of Fig. 1 to a tilted orientation. The parcel 5 shown atop the pivoting assembly 20 is shown being discharged into a parcel-accepting container 100.

30 Fig. 3 shows a top plan view of a portion of the conveying apparatus 10 according to the present invention, illustrating a total of four (4) conveying modules 11, one of which is tilted towards a destination chute 100, having just discharged a parcel 5 therein. Vectors **D** (discharge) **T** (travel) and **V** (resulting vector) are

likewise shown. The stationary endless rail **97** supports the modules **11** as they travel in a direction towards the bottom of the page.

Fig. 4 shows optional additions to the conveying apparatus, being upper withdrawal belt conveyors **300, 400**, which provides an "upper level" of discharge beyond the lower level of discharge provided into chutes **100, 200**. Such a configuration can be used with a method according to the present invention for sorting large parcels **5L** separately from small parcels **5S**.

Fig. 5 shows an overall conveyor configuration **10**, which includes an endless path conveying path **10P** having a plurality of discharge stations **13** on both sides of the path **10P**. Multiple input stations **14** are also shown, which can include conventional measuring devices to measure the weight and dimensional properties of the parcels as known in the art.

Fig. 6 shows an alternative belt configuration which includes optional pushing lugs **25A, 25B** which are attached atop the powered conveyor belt **20**.

Fig. 7 shows a general control diagram, which illustrates a controller **1000** which accepts package information (e.g. package size, weight, and destination) illustrated via block **1100**. Based on such information, the controller controls the drive belt (illustrated via block **1200**) and also the operation of the titling mechanism, generally referenced via block **1300**.

Detailed Description of the Preferred Embodiment

Reference is now made to the drawings, in which like numerals indicate like elements throughout the several views.

General Discussion

Reference is first made to Figs. 1 and 2. The machine consists of a tilting mechanism that is also equipped with a powered conveyor belt, instead of a gravity tray (a tray which allows the parcels to slide off solely under the influence of gravity).

The resulting apparatus is a sorting machine capable of very high sorting speed and therefore high productivity while providing package acceleration capable of exceeding 1G, while keeping the parcel in control with a minimum of slipping or tumbling.

It should be understood that the term "tilting" and "pivoting" are used interchangeably in this description.

More Detailed Discussion

5 For background purposes, reference is first made to U.S. Patent No. 5,433,311, entitled "Dual Level Tilting Tray Package Sorting Apparatus" hereby incorporated by reference. This '311 Patent discloses the use of multiple "tilting trays", which when tilted, allow packages to slide therefrom into appropriate chutes.

10 The present invention could be thought of modifying the apparatus shown in the '311 Patent to include tilting powered transverse conveyors, instead of the tilting smooth trays used in the '311 Patent.

Reference is now particularly made to Figs. 1 and 2. The machine consists of a tilt mechanism that is also equipped with a powered conveyor belt instead of a gravity tray. The resulting apparatus is a sorting machine capable of very high sorting speed and therefore high productivity while providing package acceleration capable of exceeding 1G, while keeping the parcel in control with a minimum of slipping or tumbling.

The Overall Environment

20 Fig. 1 is an front elevational illustrative view of a conveying module of a conveyor apparatus according to the present invention, used to transport a parcel (a. k. a. a "package") **5**. The conveying module **11** is configured to move along with other similar modules along a path or track provided by a stationary endless rail **97**.

25 Fig. 2 is an front elevational illustrative view showing the configuration **10** of Fig. 1 with the pivoting frame **50** of the pivoting assembly **20** tilted from the neutral orientation of Fig. 1 to a tilted orientation. The parcel **5** shown atop the pivoting assembly **20** is shown being discharged into a parcel-accepting container **100**.

30 Fig. 3 shows a top plan view of a portion of the conveying apparatus **10** according to the present invention, illustrating a total of four (4) conveying modules **11**, one of which is tilted towards a destination chute **100**, having just discharged a parcel **5** therein. Vectors **D** (discharge) **T** (travel) and **V** (resulting vector) are

likewise shown. The stationary endless rail **97** supports the modules **11** as they travel in a direction towards the bottom of the page.

Fig. 4 shows optional additions to the conveying apparatus, being upper withdrawal belt conveyors **300, 400**, which provides an "upper level" of discharge beyond the lower level of discharge provided into chutes **100, 200**. Such a configuration can be used with a method according to the present invention for sorting large parcels separately from small parcels.

Fig. 5 shows an overall conveyor configuration **10**, which includes an endless path conveying path **10P** having a plurality of discharge stations **13** on both sides of the path **10P**. Multiple input stations **14** are also shown, which can include conventional measuring devices to measure the weight and dimensional properties of the parcels as known in the art.

Fig. 6 shows an alternative belt configuration which includes optional lugs **25A, 25B** which are attached atop the powered conveyor belt **20**.

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The Individual Elements

Referring now generally to Figs. 1-3, the discharge apparatus **10** includes a plurality of conveying modules **11** which are configured to move along a path or track provided by a stationary endless rail **97** being part of a stationary frame member structure.

Each conveying module **11** includes the following:

- a pivoting conveying subassembly **20**,
- a tilting mechanism **80**,
- a conveying module frame member **90** including a conveyor frame carriage **95**.

25 ----

Each pivoting conveying subassembly **20** itself includes:

- a conveyor belt **25**,
- a drive pulley **30**,
- a high torque motor **35**,
- a drive timing chain **37**,
- an idler pulley **40**,

30

a pivoting assembly frame **50**.

The conveying module **11** discharges parcels (a.k.a. packages) or other items into containers such as **100** shown in Fig. 2.

5 ----

The Pivoting Conveying Subassembly **20**

The pivoting subassembly **20** includes the conveyor belt **25**, drive pulley **30**, high torque motor **35**, drive timing chain **37**, idler pulley **40**, and the pivoting assembly frame **50**.

10 The conveyor belt **25** is endless and has a roughened surface selected as needed as known in the art.

The drive pulley **30** and the idler pulley **40** are rotatably mounted relative to the pivoting assembly frame **50**, and provide support for the endless conveyor belt **25**.

15 The high torque motor **35** is configured to drive the drive pulley **30** (and thus the conveyor belt **25**) through the drive timing chain **37**.

The pivoting assembly frame **50** is pivotally mounted relative to a corresponding conveyor frame member module.

20 Each conveying module frame member **90** of each module **11** of the conveyor apparatus **10** includes a conveyor frame carriage **95**, which is configured to roll or otherwise move relative to an endless stationary rail **97**, such as shown in U. S. Patent No. 5,433,311.

Operation

25 In operation, the module (a.k.a. "cell") carrying the parcel can travel horizontally at relatively high speeds, from 350 to 500 feet per minute in the direction of transport.

30 Just before it reaches its destination container, the pivoting conveying subassembly **20** begins to tilt and shortly thereafter the belt begins to accelerate. The particular timing can be varied as known in the art. In one embodiment of use, the belt should preferably not reach its 1G acceleration until the tray is at least tilted at an angle of 30 degrees so as to inhibit the parcel from either slipping or tumbling.

As noted above, the belt **25** is designed with a rough top surface to give extra grip on the parcel during discharge. The tilt is sufficient to prevent tumbling. The total acceleration may now exceed 1G without loss of control of the parcel.

The other features of this machine with respect to induction, traction, and control are the same as that of a simple cross belt sorter or a simple tilt tray. Hence they are not described here.

Fig. 7 shows a general control diagram, which illustrates a controller **1000** which accepts package information (e.g. package size, weight, and destination) illustrated via block **1100**. Based on such information, the controller controls the drive belt (illustrated via block **1200**) and also the operation of the tilting mechanism, generally referenced via block **1300**.

Alternate Configurations

As may be understood, optional or alternate configurations may be provided.

15 ----

Lugs

Fig. 6 shows an optional pair of lugs **25A**, **25B** which are attached atop the powered conveyor belt to provide additional pushing capabilities. As may be understood, the lugs **25A**, **25B** provide positive engaging members which engage the sides of the parcels, thus not relying on friction.

Four Way Tilting Cross Belt Sorter

Generally speaking most crossbelt sorters are designed to sort in two opposing directions or in some instances two extra outlet paths may be added by using a vertical gate type splitter on each side.

Fig. 4 shows optional additions to the conveying apparatus to provide an optional conveying apparatus **10**, including upper withdrawal conveyors **300**, **400**, providing an "upper level" of discharge beyond the lower level of discharge provided into chutes **100**, **200**, thus providing includes upper and lower levels of destination.

The method used with the alternate configuration of Fig. 4 makes it feasible to sort small as well as large parcels with equal effectiveness simultaneously, thus making it possible for an operator to use a single machine instead of two.

Since large and heavy packages do not do well when subject to gravity it is much better to keep such packages under control at all times by sorting them by means of powered belted conveyors. Large packages when subject to gravity tend to accelerate too much or tend to roll or tumble due to their high center of gravity. In addition because of the above they tend to cause damage to themselves, to other packages as well as to the transportation equipment.

This is not the case with small and light packages. Small parcels maintain low acceleration and cause no damage when they roll or tumble, to themselves or the equipment handling them.

Under the system of Fig. 4 when a large, tall and heavy package is placed onto the system, appropriate controls will be used which will cause the larger packages to only be discharged on the "upper" part of the system. In such an instance the cross belt carrier remains horizontal. The package may be discharged left or right as the case may be departing on its destination. This in itself may be considered as one "mode" of the optional apparatus 10'. Determination of size and weight is done by weighing/dimensioning machines such as already available on the market.

When the package meets the low size and weight criteria programmed into the dimensional weighing machine, the resulting small parcel will always be discharged onto the "lower" level of the optional apparatus 10', by means of the tilting cross belt sorter into a receiving chute. The tilting may be done either left or right depending on the destination of the parcel. The entire "lower" level can be equipped with chutes and in effect can be treated like a second machine for small parcels only.

Under such a "dual level" configuration an apparatus for accommodating large and small packages is provided, thus requiring a much lower capital expenditure than if two separate machines are used.

Advantages

It may be understood that under the tilted condition of Fig. 2 it should be very unlikely that the package will tilt and roll uphill. In addition its discharge vector V will be directly oriented towards the receiving bin. There is less danger that the parcel will overshoot its destination bag as it often happens in a cross belt sorter trajectory

inherent in those machines. Here the small parcel is actually "shot" into its bag rather than simply dragged into it.

As a result of such precise discharge, the whole system can now move at a much higher speed, allowing for a commensurate increase in productivity.

5 ----

Conclusion

Therefore it may be seen that the present invention overcomes deficiencies in the prior art by providing the power of a cross belt sorter with the forces of gravity of a tilt tray and arriving a at sorting machine capable of very high sorting speed and therefore high productivity while exceeding the acceleration over 1G, all while keeping the parcel in control at all times without slipping or tumbling.

While this invention has been described in specific detail with reference to the disclosed embodiments, it will be understood that many variations and modifications may be effected within the spirit and scope of the invention as described in the appended claims.

15

THAT WHICH IS CLAIMED:

1. A conveying apparatus for conveying articles, said apparatus comprising:

5 A) a stationary frame defining a path; and

B) at least one conveying module for movement along said path, each module itself comprising:

1) a conveying module frame member configured for translational movement along said path;

10 2) a pivoting conveying subassembly pivotably attached relative to said conveying module frame member, said pivoting conveying subassembly including a selectively powered conveyor for selectively discharging an article thereon; and

15 3) a tilting mechanism for tilting said pivoting conveying subassembly and said powered conveyor relative to said conveying module frame member,

such that said pivoting conveying subassembly, including said powered conveyor, can be in a tilted position at the same time said powered conveyor is powered, thus causing said article atop said powered conveyor to be discharged both
20 by gravity and conveyor force.

2. The conveying apparatus as claimed in Claim 1, wherein said tilting mechanism is configured to be tilted before said powered conveyor selectively powers said powered conveyor.

25 3. The conveying apparatus as claimed in Claim 1, wherein said tilting mechanism is configured to be tilted at approximately the same time said powered conveyor selectively powers said powered conveyor.

30 4. The conveying apparatus as claimed in Claim 1, wherein said tilting mechanism is configured to be tilted after said powered conveyor selectively powers said powered conveyor but before said article is discharged from said conveyor.

5. The conveying apparatus as claimed in Claim 1, wherein said stationary frame includes an endless stationary guide rail.

5 6. The conveying apparatus as claimed in Claim 1, wherein said powered conveyor includes a powered conveyor belt defining an article supporting surface, and wherein said powered conveyor further includes at least one lug extending upwardly from said article supporting surface, for contacting and discharging said articles.

10 7. A conveying apparatus for conveying articles, said apparatus comprising:

A) a stationary frame defining a path; and

B) at least one conveying module for movement along said path, each module itself comprising:

15 1) a conveying module frame member configured for translational movement along said path;

2) a pivoting conveying subassembly pivotably attached relative to said conveying module frame member, said pivoting conveying subassembly including a selectively powered conveyor for discharging an article thereon and a powered conveyor belt motor for selectively
20 powering said powered conveyor, said powered conveyor having an upwardly-directed lug thereon; and

3) a tilting mechanism for tilting said pivoting conveying subassembly and said powered conveyor relative to said conveying module frame member,
25

such that said pivoting conveying subassembly, including said powered conveyor, can be in a tilted position at the same time said powered conveyor is selectively powered, thus causing said article atop said selectively powered conveyor to be discharged both by gravity and force exhibited by said lug.

8. A conveying apparatus for conveying articles, said apparatus comprising:

A) a stationary frame defining a path; and

5 B) at least one conveying module for movement along said path, each module itself comprising:

1) a conveying module frame member configured for translational movement along said path;

10 2) a pivoting conveying subassembly pivotably attached relative to said conveying module frame member, said pivoting conveying subassembly including a selectively powered conveyor belt for discharging an article thereon and a selectively powered conveyor belt motor for powering said powered conveyor belt; and

15 3) a tilting mechanism for tilting said pivoting conveying subassembly and said powered conveyor belt relative to said conveying module frame member,

such that said pivoting conveying subassembly, including said powered conveyor belt, can be in a tilted position at the same time said powered conveyor belt is selectively powered, thus causing said article atop said powered conveyor belt to be
20 discharged both by gravity and belt force.

9. The conveying apparatus as claimed in Claim 8, wherein said pivoting conveying subassembly is configured to be tilted before said powered conveyor selectively powers said powered conveyor belt.

25

10. The conveying apparatus as claimed in Claim 8, wherein said pivoting conveying subassembly is configured to be tilted at approximately the same time said powered conveyor selectively powers said powered conveyor belt.

11. The conveying apparatus as claimed in Claim 8, wherein said pivoting conveying subassembly is configured to be tilted after said powered conveyor selectively powers said powered conveyor but before said article is discharged from said belt.

12. The conveying apparatus as claimed in Claim 8, wherein said stationary frame includes an endless stationary guide rail.

13. The conveying apparatus as claimed in Claim 8, wherein said powered conveyor belt defines an article supporting surface, and wherein said powered conveyor belt further includes at least one lug extending upwardly from said article supporting surface, for contacting and discharging said articles.

14. A conveying apparatus for conveying articles, said apparatus comprising:

A) a stationary frame defining a path; and

B) at least one conveying module for movement along said path, each module itself comprising:

1) a conveying module frame member configured for translational movement along said path;

2) a pivoting conveying subassembly pivotably attached relative to said conveying module frame member, said pivoting conveying subassembly including a selectively powered conveyor belt for discharging an article thereon and a selectively powered conveyor belt motor for selectively powering said powered conveyor belt, said powered conveyor belt having an upwardly-directed lug thereon; and

3) a tilting mechanism for tilting said pivoting conveying subassembly and said powered conveyor belt relative to said conveying module frame member,

such that said pivoting conveying subassembly, including said powered conveyor belt, can be in a tilted position at the same time said powered conveyor belt

is selectively powered, thus causing said article atop said powered conveyor belt to be discharged both by gravity and force exhibited by said lug.

15. A method of conveying articles, said method comprising the steps of:

5 A) providing a stationary frame defining a path;
B) providing at least one conveying module for movement along said path,
each module itself comprising:

- 1) a conveying module frame member configured for translational movement along said path;
- 10 2) a pivoting conveying subassembly pivotably attached relative to said conveying module frame member, said pivoting conveying subassembly including a selectively powered conveyor for selectively discharging an article thereon; and
- 15 3) a tilting mechanism for tilting said pivoting conveying subassembly and said powered conveyor belt relative to said conveying module frame member; and

C) discharging said articles from said powered conveyor by tilting said pivoting conveying subassembly while said powered conveyor is powered, thus causing said article atop said powered conveyor to be discharged both by gravity and
20 conveyor force.

16. The conveying apparatus as claimed in Claim 8, wherein in step B said powered conveyor is provided as a powered conveyor belt.

25 17. The conveying apparatus as claimed in Claim 8, wherein in step C, said pivoting conveying subassembly is tilted before said powered conveyor selectively powers said powered conveyor belt.

30 18. The conveying apparatus as claimed in Claim 8, wherein said pivoting conveying subassembly is configured to be tilted at approximately the same time said powered conveyor selectively powers said powered conveyor belt.

19. The conveying apparatus as claimed in Claim 8, wherein said pivoting conveying subassembly is configured to be tilted after said powered conveyor selectively powers said powered conveyor but before said article is discharged from said belt.

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20. The conveying apparatus as claimed in Claim 8, further comprising the step of distinguishing between heavier and lighter articles in electing whether to tilt said pivoting conveying subassembly during discharge.

10

21. The conveying apparatus as claimed in Claim 8, further comprising the step of distinguishing between larger and smaller articles in electing whether to tilt said pivoting conveying subassembly during discharge.

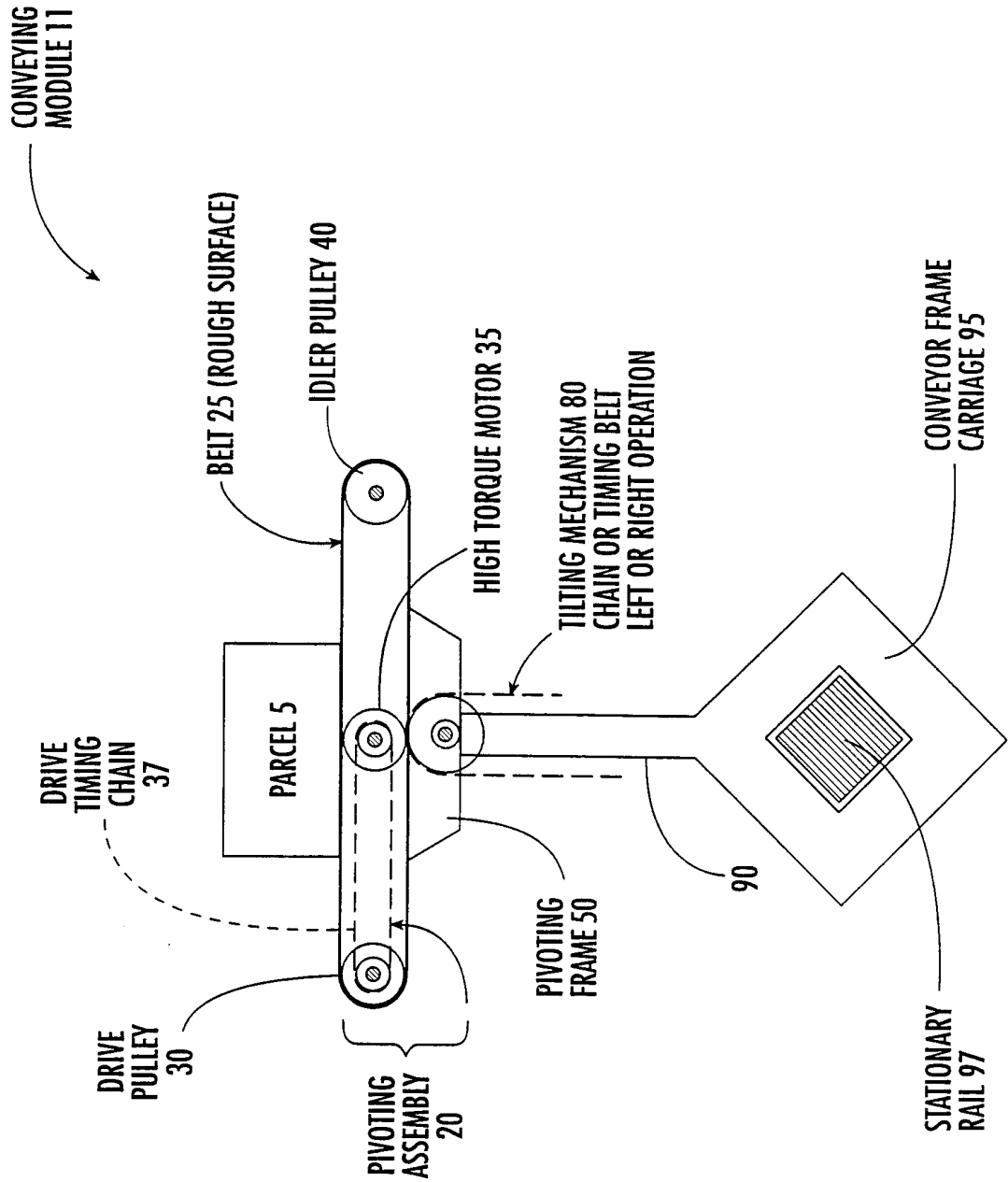
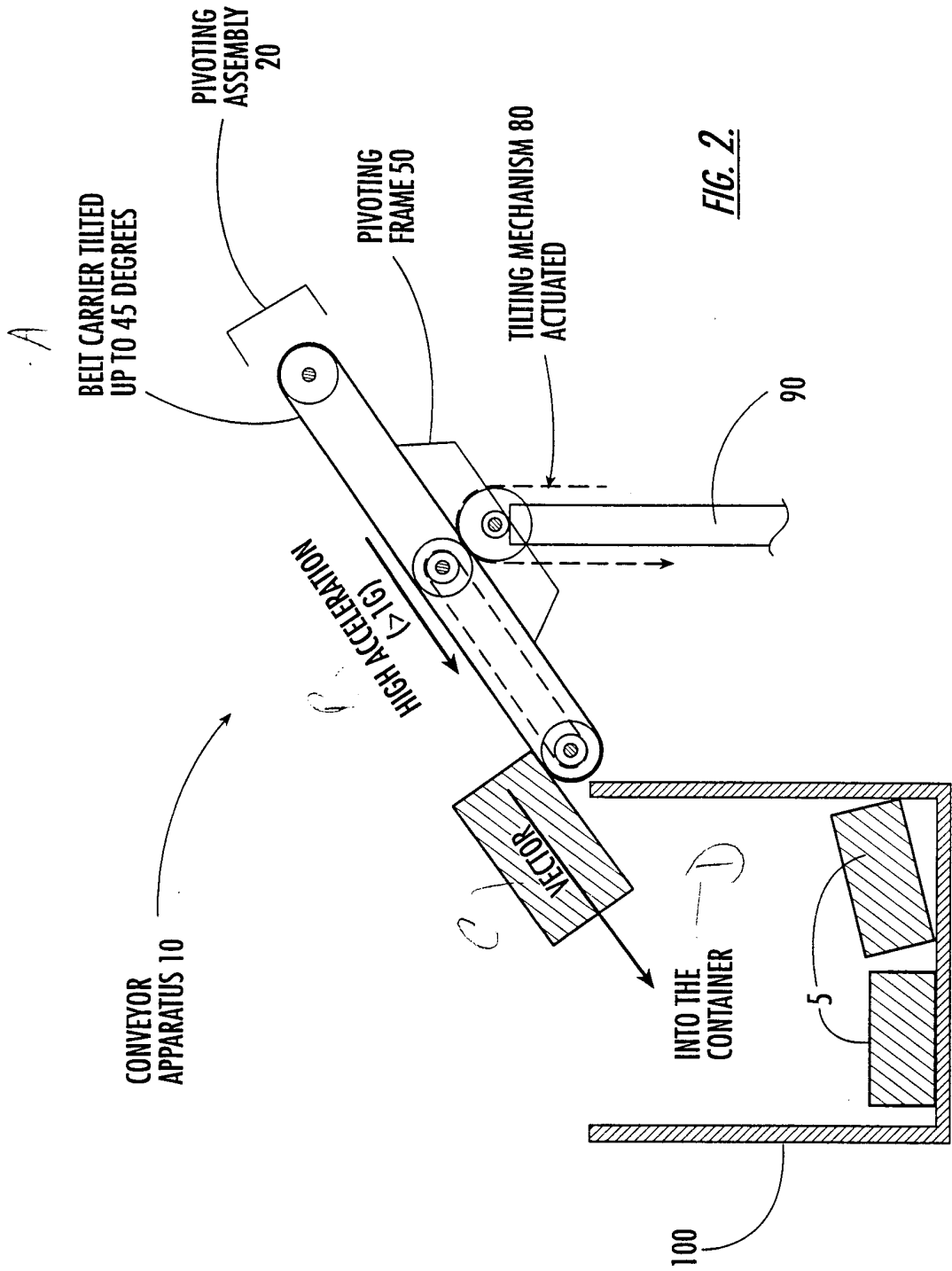
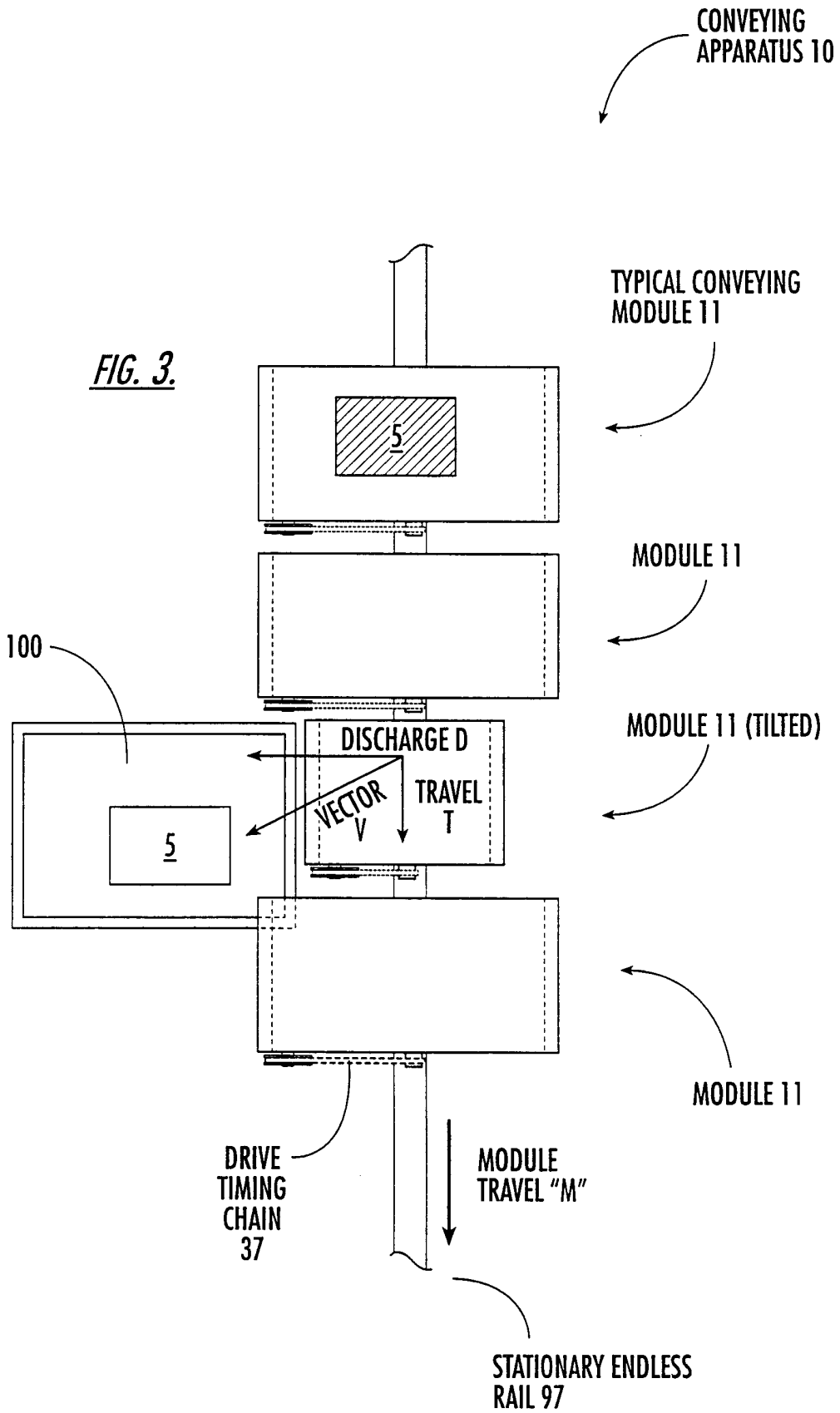


FIG. 1.





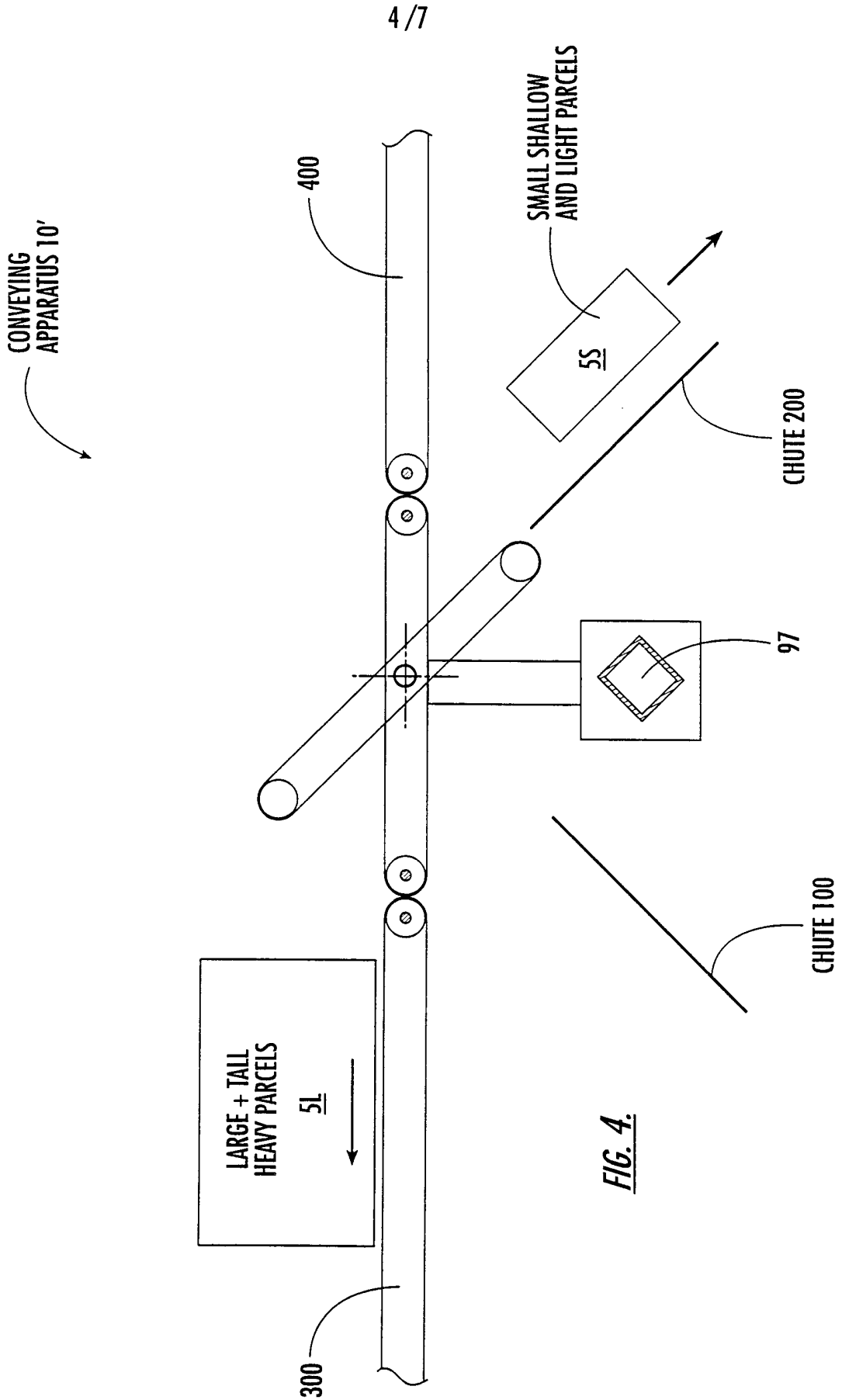


FIG. 4.

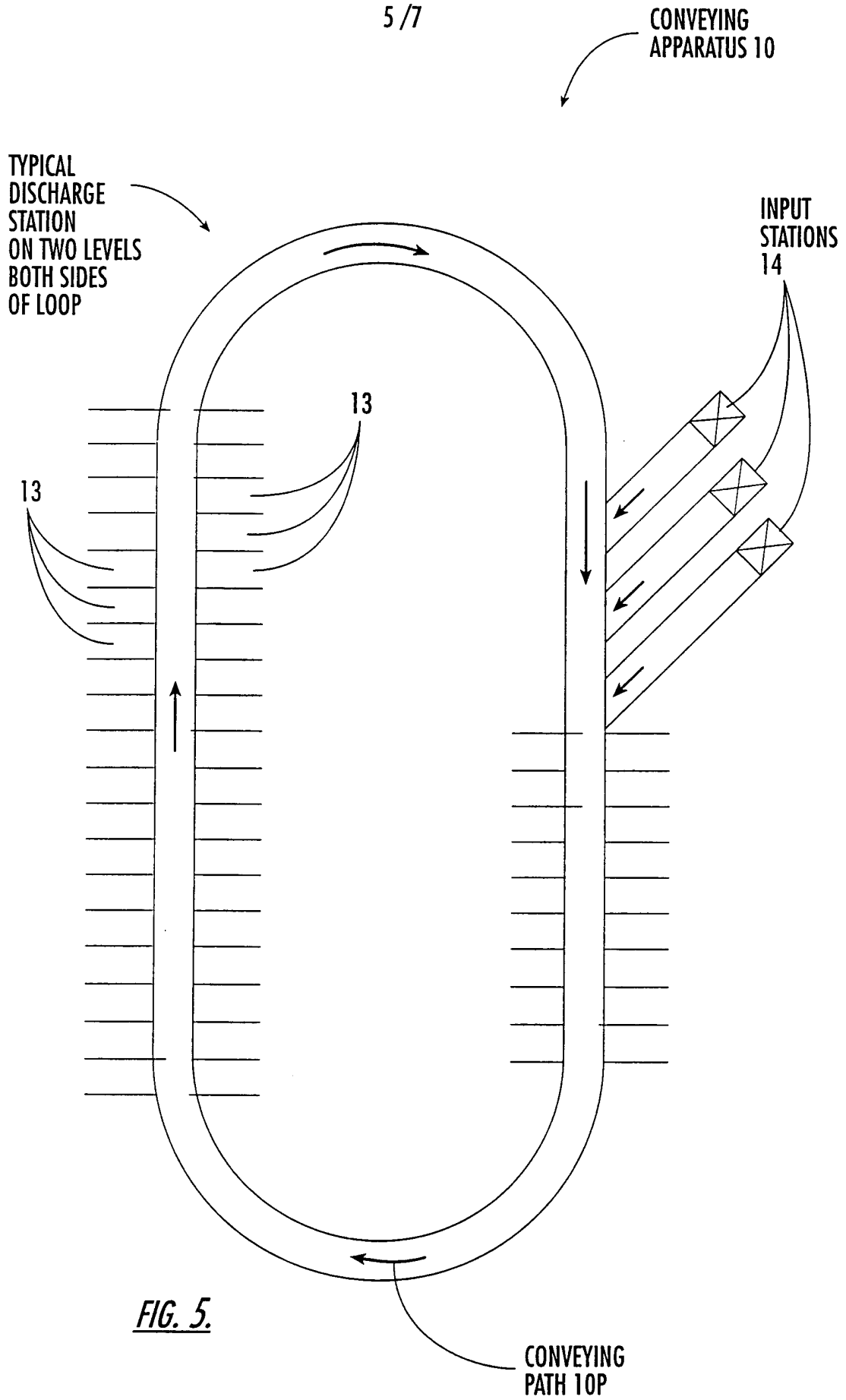


FIG. 5.

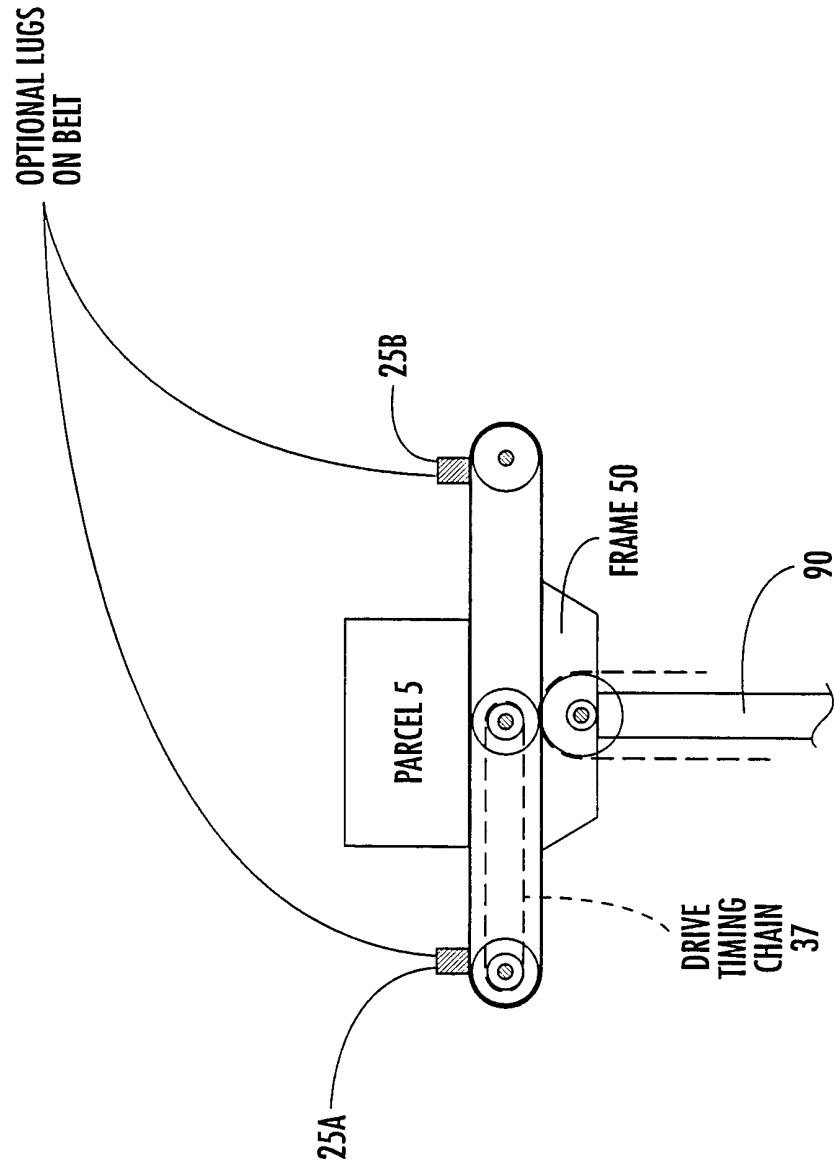


FIG. 6.

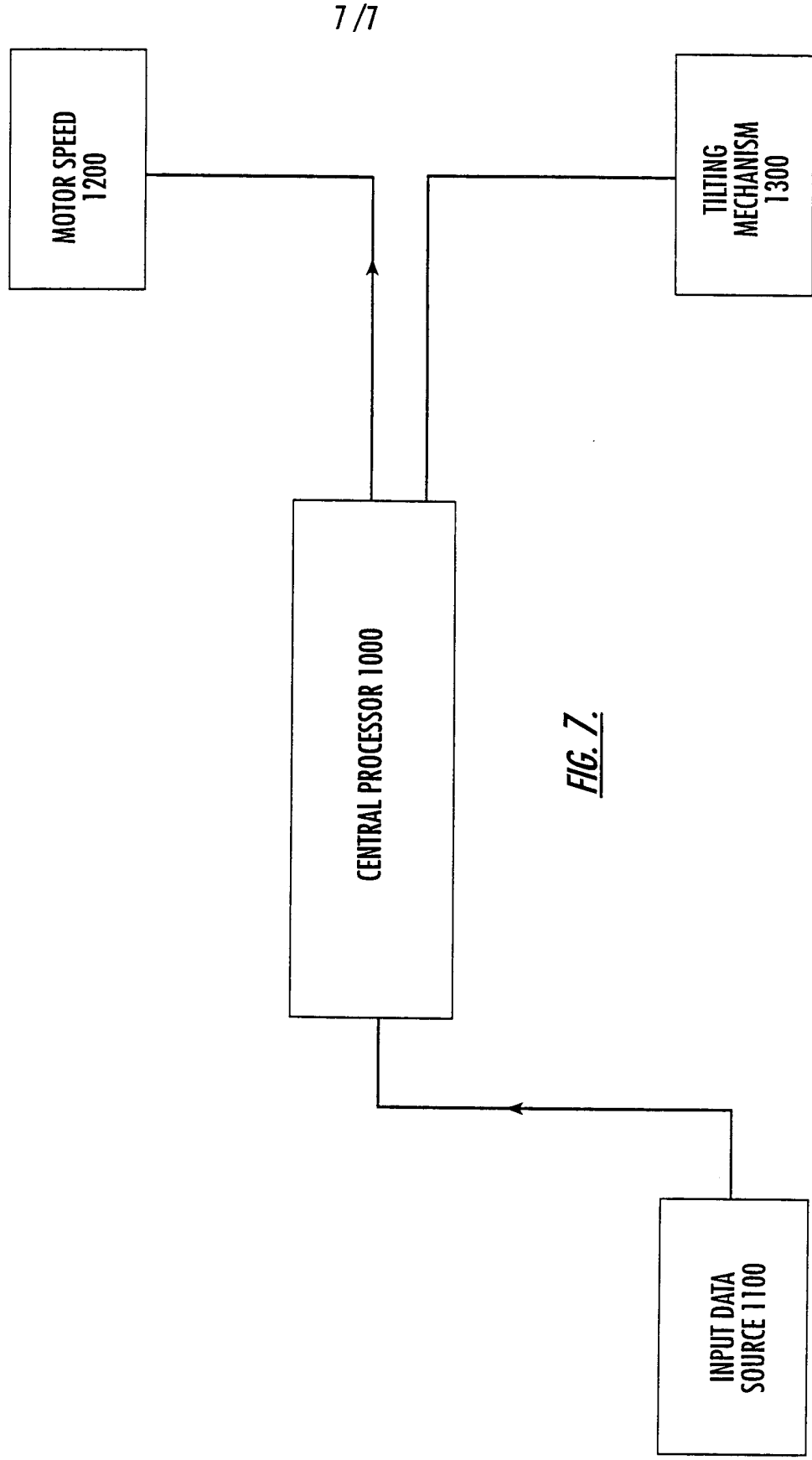


FIG. 7.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/33614

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 B65G17/34 B65G47/94 B65G47/96

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 7 B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 771 313 A (PLUS SYSTEMS B) 28 May 1999 (1999-05-28)	1-5, 15
Y	page 4, line 19 -page 6, line 22 figures 1-4 ---	6-14, 16-21
Y	FR 2 475 015 A (CANZIANI FRANCESCO) 7 August 1981 (1981-08-07) page 2, line 11 -page 3, line 14 figures 1,2 ---	6-14, 16-19
Y	DE 43 38 801 A (AHBEL THOMAS A) 18 May 1995 (1995-05-18) column 3, line 55 -column 4, line 16 --- -/--	20

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

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Date of the actual completion of the international search

1 March 2001

Date of mailing of the international search report

13/03/2001

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/33614

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FR 2 576 528 A (HOTCHKISS BRANDT SOGEME) 1 August 1986 (1986-08-01) page 3, line 11 -page 5, line 3 figures 1-4 ---	21
X	US 4 763 771 A (GEERTS JOHANNES G C) 16 August 1988 (1988-08-16) column 3, line 35 -column 4, line 26 column 4, line 60 -column 5, line 27 figures 1-6 ---	1-5,15
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