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Morton, Jr.

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[54] **MECHANICAL DRIVE MODULE**

[75] Inventor: **William D. Morton, Jr.**, San Diego, Calif.

[73] Assignee: **Delta Design Inc.**, San Diego, Calif.

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 44,401, June 8, 1970, Pat. No. 3,677,401.

[52] **U.S. Cl.** **104/168**

[51] **Int. Cl.** **B61d 13/10**

[58] **Field of Search** 104/134, 135, 168, 139, 104/140, 147, 148, 168, 134–139; 209/73; 191/23

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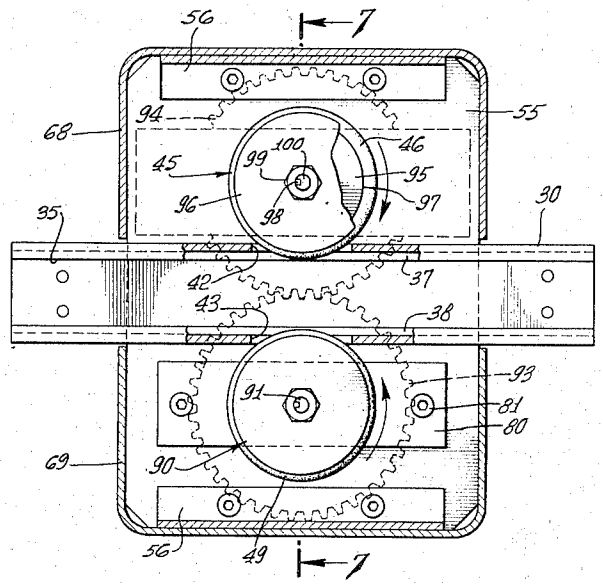
Primary Examiner—M. Henson Wood, Jr.

Assistant Examiner—Richard A. Bertsch

[57] **ABSTRACT**

A modular track assembly for transporting carriers for integrated circuit units has a plurality of track sections of various shapes releasably interconnected to form a continuous track and transport carriers from a loading station to a discharge station. Boosters are built into some of the track sections which consist of counter rotating wheels which while rotating grab each carrier in turn at opposite side edges and project it forwardly in the track.

14 Claims, 7 Drawing Figures



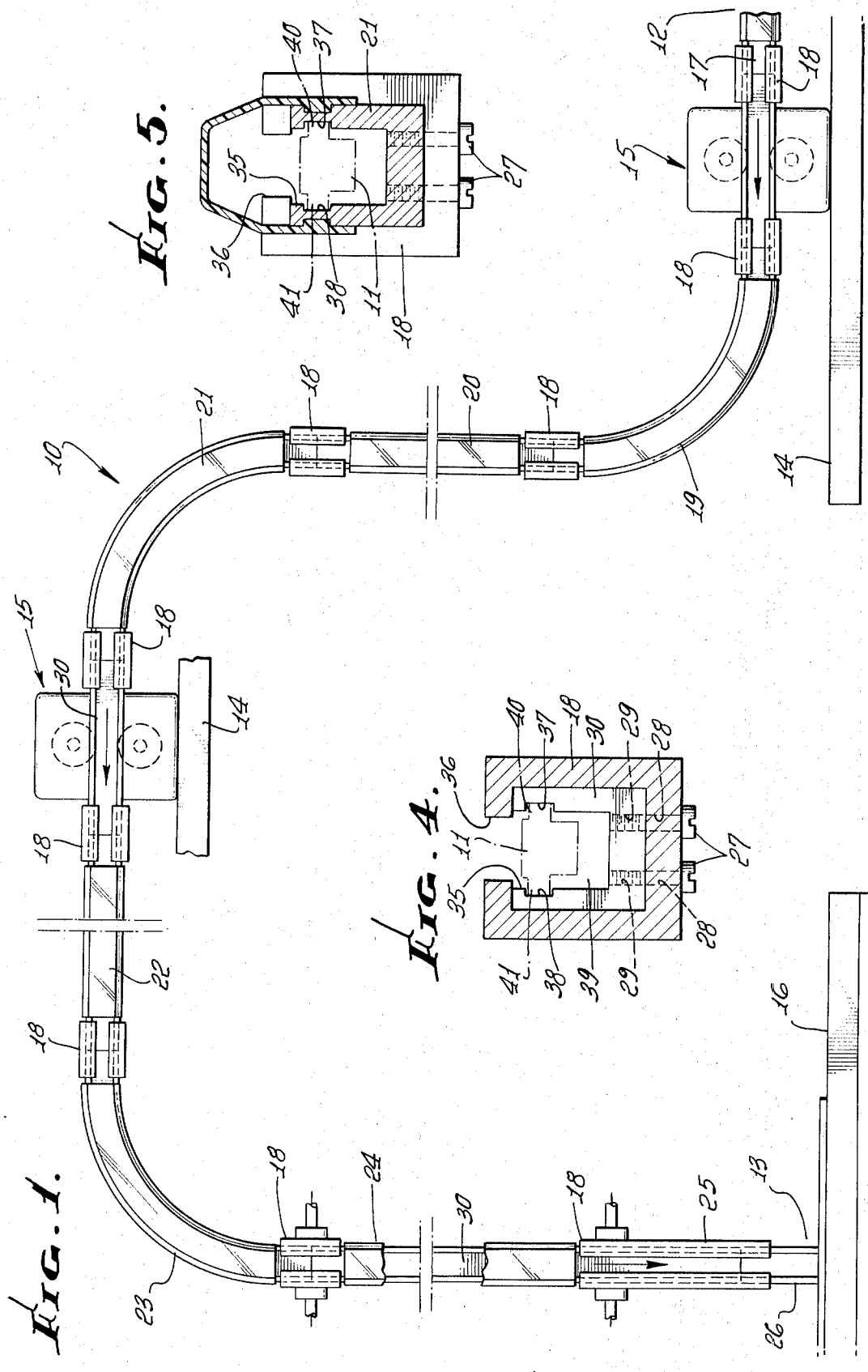


FIG. 1.

FIG. 4.

FIG. 5.

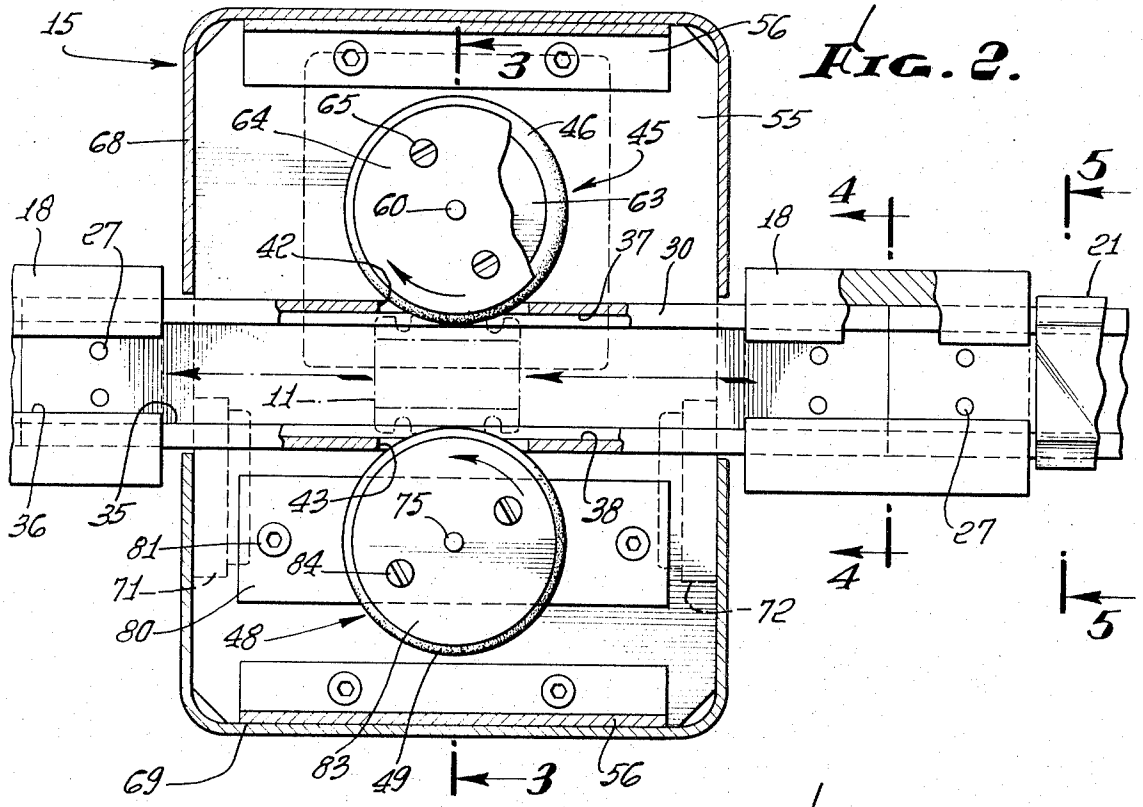

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FIG. 2.

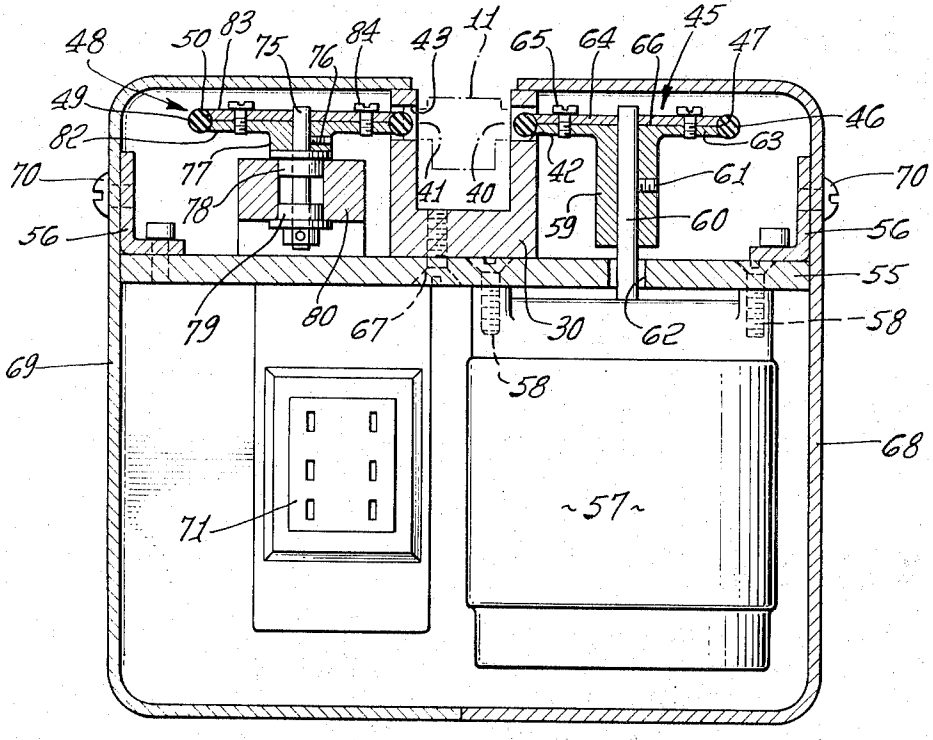

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FIG. 3.

FIG. 6.

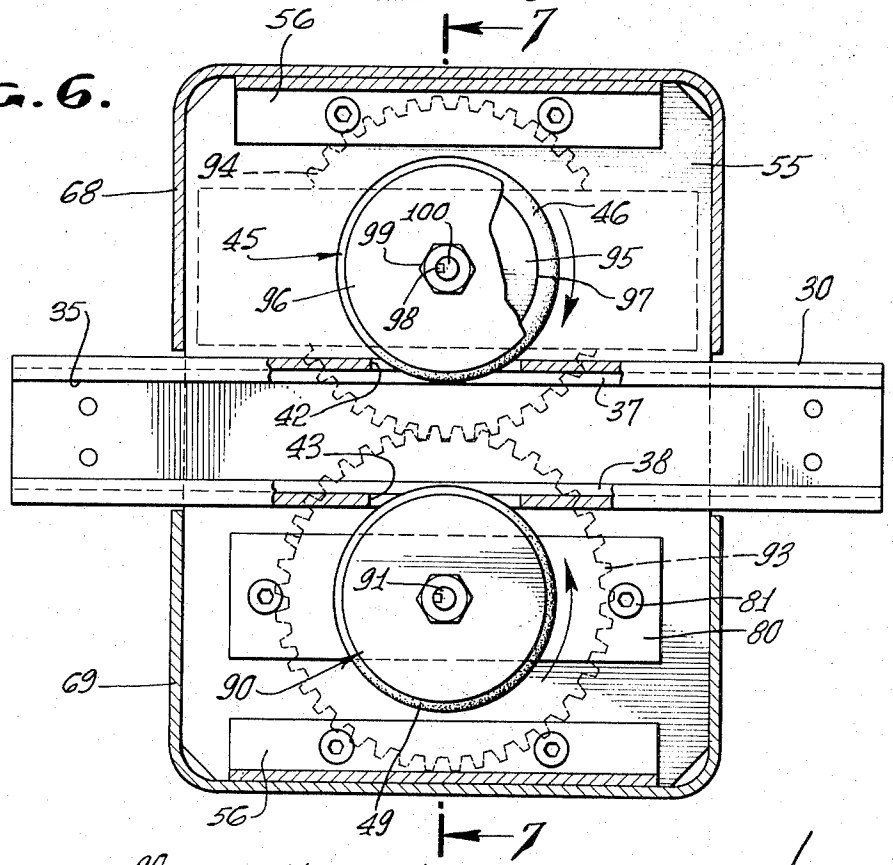
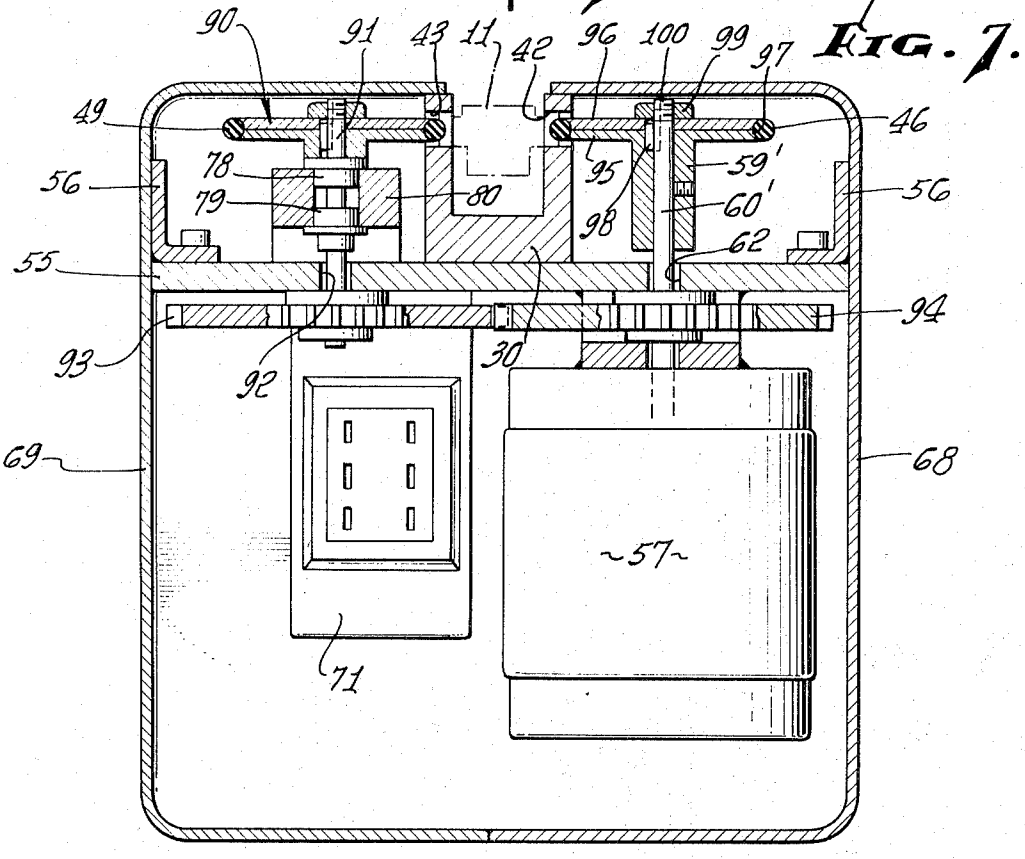

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FIG. 7.


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MECHANICAL DRIVE MODULE

This is a Continuation-in-Part of Copending application, Ser. No. 44,401, filed June 8, 1970 now U.S. Pat. No. 3,677,401.

In the parent application of which this is a Continuation-in-Part, alternative means is disclosed for transporting carriers for integrated circuits from a sorter to a handling mechanism which may be located below the sorter thereby to accommodate a gravity feed or which may be located at some distance from the sorter, at the same level or possibly even at a higher level than the sorter.

Because integrated circuit components are relatively small and may also vary in size, shape and configuration, it is convenient to have carriers of relatively similar configurations as, for example, being possessed with shoes or runners of consistently the same shape and size so that, irrespective of variations in the integrated circuit components, mechanisms and systems for sorting, handling, testing and segregating can be of consistently the same general construction. Furthermore depending upon the arrangement and setup of the various operating units, it becomes advisable to have a track assembly sufficiently variable so that such operating units can be placed at different locations depending upon some particular need and also at different elevations to accommodate the various operators, which means that the track assembly should be such that it can be made continuous from the sorter to the handling mechanism no matter where the operating parts may be located.

Because of the need to vary the setup between different installations to shift it from time to time, a track which can be taken apart and reassembled in different positions and of different lengths is particularly to be desired. Moreover, the track assembly should be capable of being joined together sufficiently smoothly so that there will be no interruption in the transportation of the carriers no matter how many times it may be taken apart and reassembled. Additionally, when the track assembly changes elevation or when it may be longer than anticipated, some means needs to be provided for keeping the carriers moving from the loading end to the discharge end.

It is therefore among the objects of the invention to provide a new and improved carrier system for transporting carriers for such devices as integrated circuits from one location to another, the system being of such character that it can be altered and shifted about quickly and effectively without impairing its efficiency.

Another object of the invention is to provide a new and improved modular track assembly capable of transporting small, lightweight carriers of such character that motor actuated booster units can be incorporated in some of the modules in order to keep carriers moving through the track where there are changes in elevation or direction.

Still another object of the invention is to provide a new and improved booster unit for a modular track assembly which is simple in its mechanical arrangement and of such character that it is capable of positive mechanical engagement with the carrier as the carrier passes in its vicinity thereby to frictionally grip the carrier and speed up its rate of travel along the track.

Still another object of the invention is to provide a new and improved booster unit for incorporation in a modular track assembly which is of such type and construction that it can be easily assembled and which also is such that it can be readily serviced should the frictional engagement elements need replacement.

With these and other objects in view, the invention consists in the construction, arrangement, and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

FIG. 1 is a plan view of a modular track assembly system in which the booster unit incorporated.

FIG. 2 is a bottom plan view of the booster unit and accompanying section of track.

FIG. 3 is the cross-sectional view on the line 3—3 of FIG. 2.

FIG. 4 is a cross-sectional view on the line 4—4 of FIG. 2.

FIG. 5 is a cross-sectional view on the line 5—5 of FIG. 2.

FIG. 6 is a bottom view similar to FIG. 2 but showing a dual drive unit.

FIG. 7 is a cross-sectional view on the line 7—7 of FIG. 6.

In an embodiment of the invention chosen for the purpose of illustration, there is shown a modular track assembly system indicated generally by the reference character **10** set up to transport carriers **11** from a loading end **12** to a discharge end **13**. A platform **14** is shown at the loading end capable of supporting a booster unit **15** and also capable of supporting other appropriate items of equipment such, for example, as a sorter (not shown). At the discharge end **13** there may be provided some other appropriate component such, for example, as a handling mechanism **16**.

As shown in FIG. **1**, the system **10** comprises a fragment of track section **17** at the loading end with an appropriate collar **18**, two booster units **15**, and successive curved and straight track sections **19, 20, 21, 22, 23, 24, 25** and a fragment of track section **26** at the discharge end. Collars **18** interconnect the track sections.

The collars **18** are connected to respective ends of the track sections **19, 20, 21, 22, 23, 24,** and **25** by use of cap screws **27** which extend through bores **28** in the collar and then into tapped holes **29** in the respective track section **30** of one of the booster units **15** as shown in FIGS. **1** and **4**.

Making reference, by way of example, to the booster unit **15** in the upper mid portion of FIG. **1**, the track section **30** has an open side **35** throughout its length with which an open side **36** of the collar **18** coincides. All of the track sections and collars are similarly constructed. Within the open side **35** of the track section are inwardly facing channels **37** and **38**, facing an elongated central space **39** which accommodate shoes or flanges **40** and **41** of any one of the carriers **11**. A loose sliding fit is provided between the shoes and the channels so that the carriers will move easily through the track section unimpeded by frictional resistance.

As shown in FIGS. **2** and **3**, the track section **30** is provided with openings **42** and **43** which extend from the exterior of the track section **30** into the respective channels **37** and **38**. A wheel **45** on the circumference of which is a resilient O ring **46** in a circumferential re-

cess 47 has its outermost perimeter extending through the opening 42 and into the respective channel 37.

Similarly a wheel 48 on the opposite side has an O ring 49 in its circumferential recess 50 which extends through the opening 43 into the respective channel 38.

A partition 55 on which are supporting brackets 56 provides support for an electric motor 57, attached thereto by bolts 58. A bushing 59 of the wheel 45 is anchored to a drive shaft 60 of the electric motor 57 by means of a set screw 61. A hole 62 in the partition 55 accommodates the drive shaft.

Attached to and forming part of the bushing 59 is a circular disc-shaped section 63 of the wheel against which a complementary disc-shaped section 54 is secured by means of screws 65, there being a flat area of contact 66 between the sections. Constructed in this fashion the sections can be separated by removal of the screw 65 to remove and replace the O ring 46 whenever that becomes necessary.

The track section 30 is likewise mounted upon the partition 55 and there secured by means of screws 67. Housing parts 68 and 69 are secured respectively to the brackets 56 by means of screws 70. Appropriate contact plates 71 and 72 accommodate the motor 57.

The wheel 48 is an idler wheel attached to an idler shaft 75 by means of a set screw 76 extending through a bushing 77 of the wheel. The idler shaft 75 is rotatably mounted in stationary bearings 78 and 79 in a mounting block 80, secured to the partition 55 by screws 81. Separable wheel sections 82 and 83 secured in face-to-face relationship by screws 84 comprise the wheel 48, the circumference of which extends through the opening 43 and into the channel 38 as shown in FIGS. 2 and 3.

In the form of invention illustrated in FIGS. 6 and 7, a wheel 90 is a driven wheel rather than being an idler wheel and one wherein a wheel shaft 91 extends through an appropriate hole 92 in the partition 55 to the opposite side where a gear 93, preferably made of some appropriate synthetic resin, is non-rotatably attached. The gear 93 meshes with and is driven by a similar gear 94 anchored to the drive shaft 60 of the electric motor 57. Interconnected as shown and described, the gears are counter rotating causing a counter-rotating motion in the respective wheels 90 and 45, in the direction of the arrows of FIG. 6 whereby both wheels when engaging the carrier through respective O rings 46 and 95 squeeze the carrier 11 between them and project or propel it onwardly through the track section 30.

In this form of the device a bushing 59' of the wheel 45 has a disc-shaped wheel section 95 which is complementary to a disc-shaped wheel section 96, together forming a circumferential recess 97 for the O ring 46, and both wheel sections are keyed to the drive shaft 60 by means of a key 98.

A lock nut 99 on a threaded end 100 of the drive shaft 60' holds the wheel sections releasably in engagement with each other such that they can be separated by removal of the lock nut when the O ring is to be replaced. The wheel 90 is similarly constructed.

With the booster units equipped as shown and described such booster units can be placed wherever necessary in the track assembly so that they are close enough together to catch the carrier 11 while it is still travelling through the track assembly, slowed down somewhat, thereby to boost its speed and send it along through succeeding sections of the track assembly until it finally reaches either a section like the section 24 where it can fall by gravity to the discharge end, or be propelled to a discharge end should it chance to be in a horizontal position.

By having the booster unit include a track section like the section 30, such booster units can be placed virtually anywhere in the track assembly by use of the collars 18 interconnecting the booster unit with any other track section.

While the invention has herein been shown and described in what is conceived to be a practical and effective embodiment, it is recognized that departures may be made therefrom within the scope of the invention which is not to be limited to the details disclosed herein, but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described the invention, what is claimed as new in support of Letters Patent is:

1. A booster unit for a modular track assembly for transporting carriers, said carriers having oppositely disposed first guide members, said booster unit comprising a track section for said carriers having an upstream end and a downstream end and having opposite inwardly facing second guide members in free sliding engagement with said first guide members with a clearance there between, supporting means for said track section, a propulsion unit for said carriers in the track section at a selected location intermediate the ends of said track section, said propulsion unit comprising means forming an opening into each of said second guide members from the exterior of said track section, said openings being opposite each other, a wheel for each opening, each wheel being rotatably mounted on the supporting means and having a portion of the circumference thereof extending through the respective opening into the adjacent portion of the respective guide section, yieldable friction means extending around the circumference of each wheel adapted while the wheels are rotating to frictionally grab a carrier and project it through the track section, and power means connected to at least one of the wheels for rotating said one wheel.

2. A booster unit as in claim 1 wherein the power means is an electric motor on the frame having a drive shaft with the respective wheel connected to the drive shaft.

3. A booster unit as in claim 1 including power interconnecting means for said wheels whereby said wheels are driven respectively in clockwise and counter-clockwise directions for simultaneously projecting the carrier through the track section.

4. A booster unit as in claim 3 wherein said power interconnecting means is a system of interconnecting gears.

5. A booster unit as in claim 1 wherein each wheel has a circumferential recess and the friction means is an O ring located in said recess.

6. A booster unit as in claim 1 wherein there is a collar section for each end of the track section for interconnecting the track section to adjacent track sections whereby to form a continuous track made up of multiple track sections and means for releasably attaching said collar sections to the track sections.

7. A booster unit as in claim 1 wherein the track section has an open side throughout its length and wherein there is a transparent cover releasably secured to the track section and extending over said open side.

8. A booster unit as in claim 1 wherein each track section has longitudinal portion exceeding the length of the carrier by many times and in which there is no propulsion unit.

9. A booster unit as in claim 1 wherein the respective wheels are in transverse alignment on opposite sides of the propulsion unit whereby to simultaneously engage the carrier on opposite sides thereof during projection of the carrier along said track section.

10. A booster unit as in claim 1 wherein said first guide means comprises outwardly projecting flanges and said second guide means comprises a channel on respectively opposite sides spaced apart a distance greater than the space between said flanges.

11. A booster unit for a modular track assembly for transporting carriers having oppositely disposed flanges, said booster unit comprising a track section for said carriers having opposite inwardly facing channels receptive of said flanges on the carriers, a frame attached to said track section, means forming an opening into each channel from the exterior of said track section, said openings being opposite each other, a wheel for each opening, each wheel being rotatably mounted on the frame and having a portion of the circumference thereof extending through the respective opening into the adjacent channel and yieldable friction means extending around the circumference of each wheel adapted while the wheels are rotating to frictionally grab a carrier and project it through the track section, and power means connected to at least one of the wheels for rotating the wheel, each wheel having a circumferential recess and an O ring comprising the friction means located in said recess, each wheel comprising two wheel sections with a common area of engagement between said wheel sections, the plane of said area adjacent the recess being substantially midway between opposite sides of the recess, and attaching means releasably holding said wheel sections together in O ring retaining engagement.

12. A booster unit for a modular track assembly for transporting carriers having oppositely disposed flanges, said booster unit comprising a track section for said carriers having opposite inwardly facing channels receptive of said flanges on the carriers, a frame attached to said track section, means forming an opening into each channel from the exterior of said track section, said openings being opposite each other, a wheel for each opening, each wheel being rotatably mounted on the frame and having a portion of the circumference thereof extending through the respective opening into the adjacent channel and yieldable friction means extending around the circumference of each wheel adapted while the wheels are rotating to frictionally grab a carrier and project it through the track section, and power means connected to at least one of the wheels for rotating the wheel, a collar section for each end of the track section for interconnecting the track section to adjacent track sections whereby to form a continuous track made up of multiple track sections, means for releasably attaching said collar sections to the track sections, said means for releasably attaching said collar sections comprising screws extending from one section to the other.

13. A booster unit for a modular track assembly for transporting carriers having oppositely disposed flanges, said booster unit comprising a track section for said carriers having opposite inwardly facing channels receptive of said flanges on the carriers, a frame attached to said track section, means forming an opening into each channel from the exterior of said track section, said openings being opposite each other, a wheel for each opening, each wheel being rotatably mounted on the frame and having a portion of the circumference thereof extending through the respective opening into the adjacent channel and yieldable friction means extending around the circumference of each wheel adapted while the wheels are rotating to frictionally grab a carrier and project it through the track section, and power means connected to at least one of the wheels for rotating the wheel, a collar section for each end of the track sections for interconnecting the track section to adjacent track sections whereby to form a continuous track made up of multiple track sections, means for releasably attaching said collar sections to the track sections, said means for releasably attaching said wheel sections comprising central axially aligned openings, a shaft extending through said openings and a lock nut device on said shaft in engagement with one of said sections.

14. A transportation system having a loading end and a discharge end, carriers for use in said system having oppositely disposed first guide members, said transportation system including a plurality of booster units each comprising a track section having opposite inwardly facing second guide members adapted to slidably receive said first guide members, a propulsion unit for each booster unit comprising a wheel on each side of the unit in transverse alignment, yieldable friction means on the circumference of each wheel, innermost points on the circumference of the wheels being spaced apart a distance less than the space between opposite sides of the carrier, and power means in driving relationship with at least one of said wheels adapted to propel the carrier downstream from one propulsion unit to the next propulsion unit.

* * * * *