United States Patent [19]

Borst

[11] **3,774,548**

[45] **Nov. 27, 1973**

[54] **GRIPPING LOCOMOTIVE FOR SUSPENDED RAILWAY**

[76] Inventor: **Adolf H. Borst**, Alte Steige, 7441 Altenriet, Germany

[22] Filed: **Jan. 13, 1971**

[21] Appl. No.: **106,222**

[52] **U.S. Cl.** .... **105/30,** 104/95, 104/99, 104/102, 104/139, 104/148 R, 105/73, 191/11, 191/48

[51] **Int. Cl.** **B60l 5/40,** B61b 3/02, B61j 1/06

[58] **Field of Search** .... 104/89, 93, 94, 95, 104/106, 107, 108, 109, 110, 111, 139, 140, 141, 142, 143, 144, 145, 146, 148 R, 99; 105/148, 150, 152, 153, 154, 155, 156, 73, 30; 191/11, 45 A, 45 R, 48, 50, 52

[56] **References Cited**

UNITED STATES PATENTS

573,772	12/1896	Feldman	105/153 X
621,080	3/1899	Henquin	191/48 X
3,518,947	7/1970	Borst	105/153 X
3,525,306	8/1970	Edel	104/95
3,568,605	3/1970	Pettit	105/153 X

FOREIGN PATENTS OR APPLICATIONS

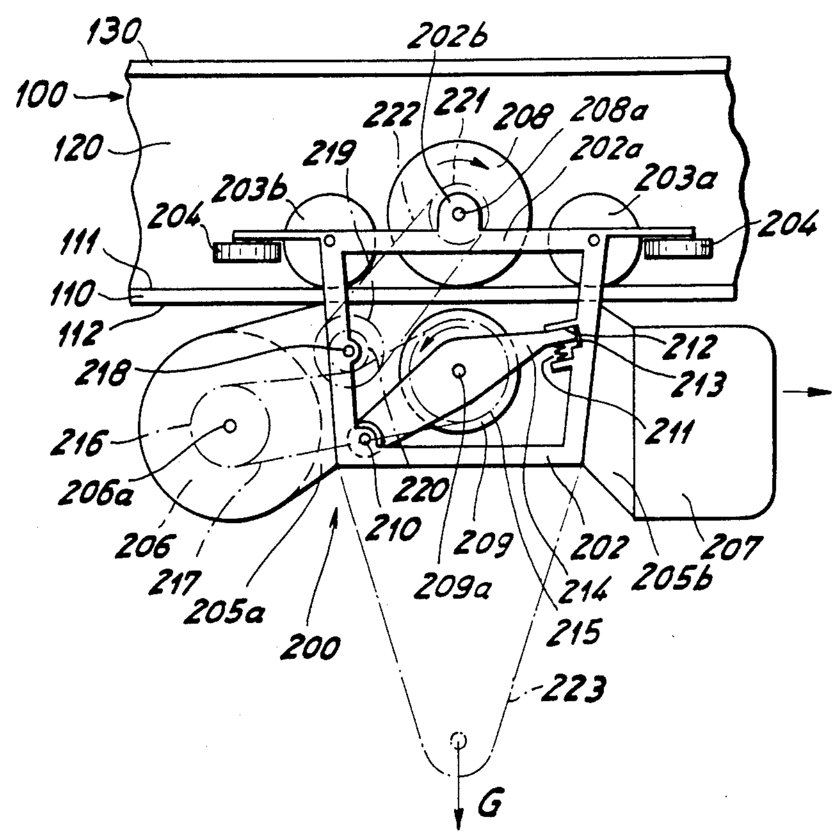
432,859	8/1926	Germany	105/153

Primary Examiner—Gerald M. Forlenza
Assistant Examiner—Howard Beltran
Attorney—Edwin E. Greigg

[57] **ABSTRACT**

This invention relates to a series of different types of electrically driven trolley devices arranged to be suspended from and driven along a network of overhead trackways by frictional drive rollers. The trolleys disclosed may be driven in alternate manners by the frictional drive rollers either engaging the upper flange of the trackway as well as the lower flange thereof or only by engagement with the lower flange of the trackway. Current is derived from a cart which may be arranged to travel with the trolley or by electricifying portions of the trackways per se. Also revealed is a system of trackway controlling switches for moving the trolleys from horizontal to vertical directions and through junction points therebetween as well as means by which one trolley can pass another in the network system when desirable. Herein is also disclosed a system for accumulating containers of a particular design adjacent to a vertical shaft the accumulation area including mechanism for shifting the containers from a horizontal plane relative to the accumulation area and into the shaft to be attached to a trolley or for removing the containers from the trolleys to be returned to the accumulation area. Further, also disclosed is a support structure for novel containers which is controlled electrically to prevent the containers from deviating from desired positions while in transit on the trackway.

45 Claims, 52 Drawing Figures



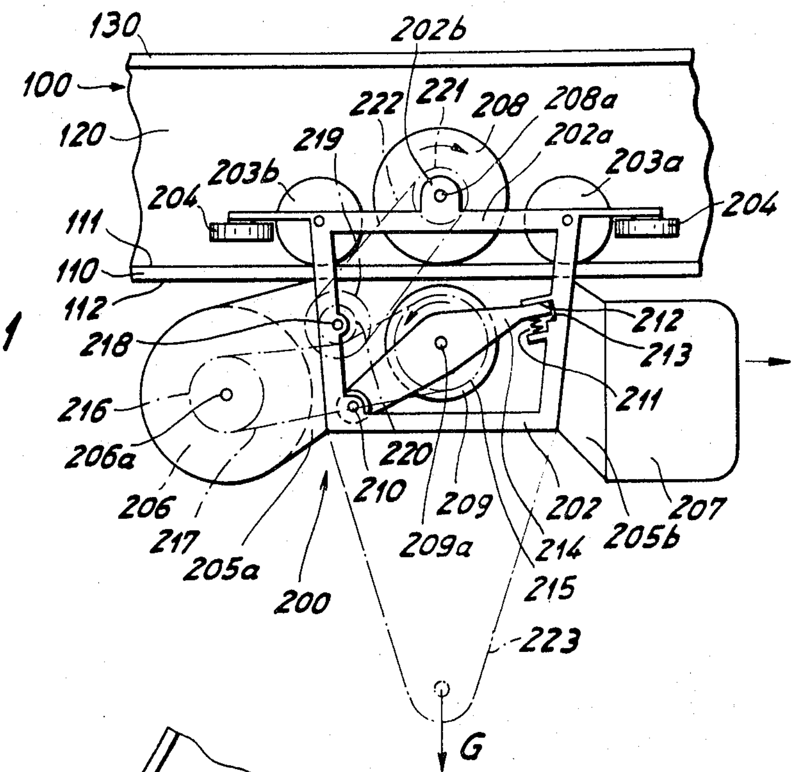


Fig.1

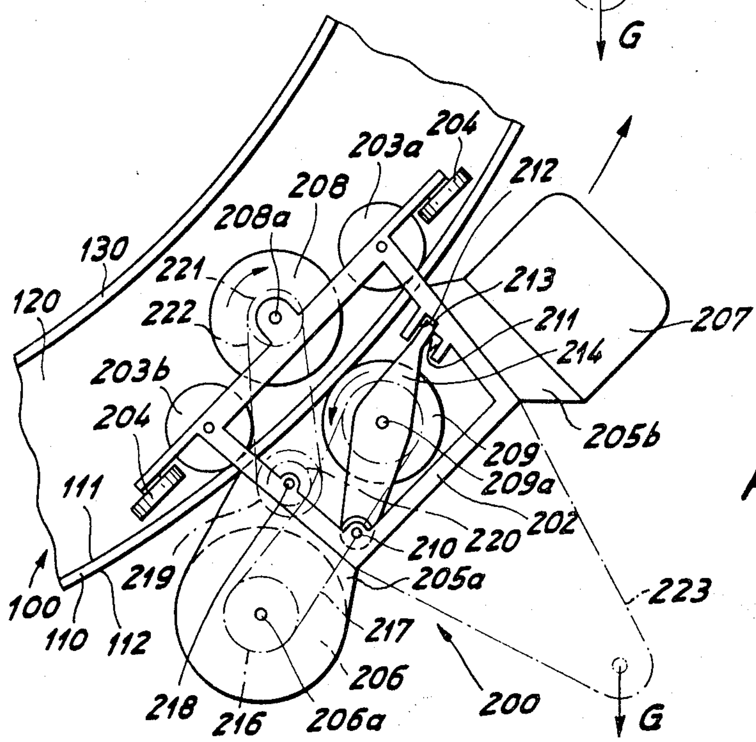


Fig.2

Inventor:
Adolf H. Borst
by
Edwin E. Greigg

Fig.3

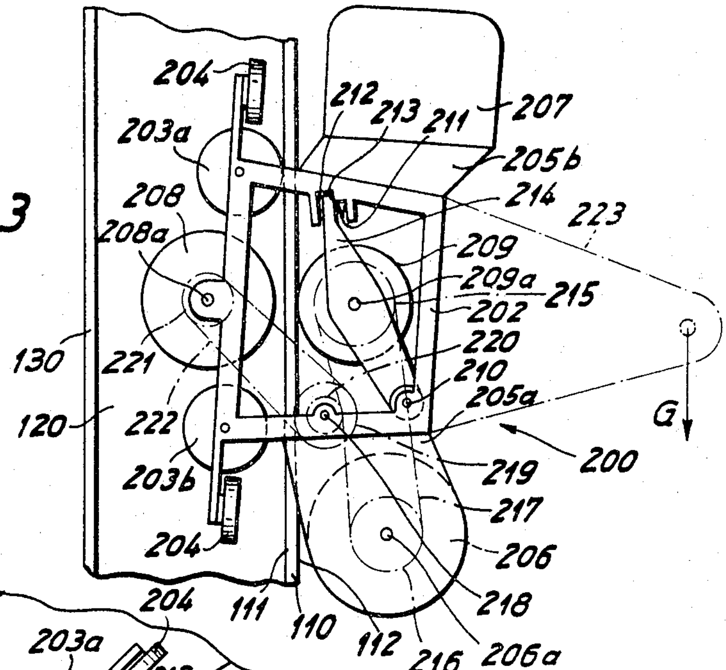
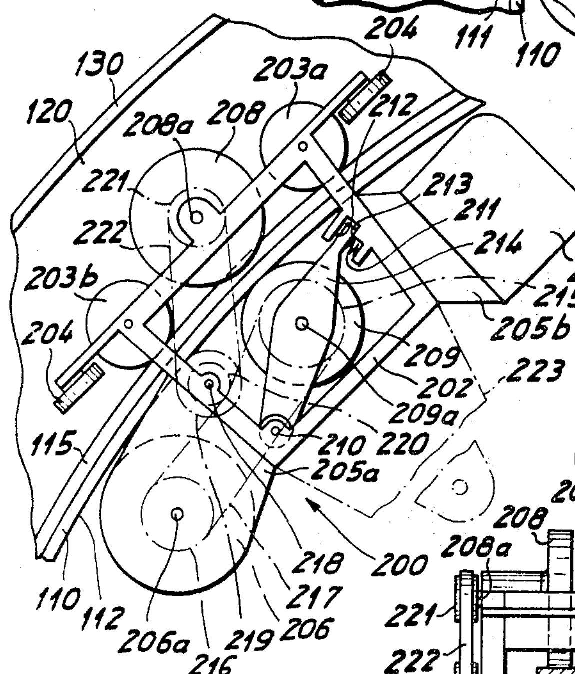


Fig.4



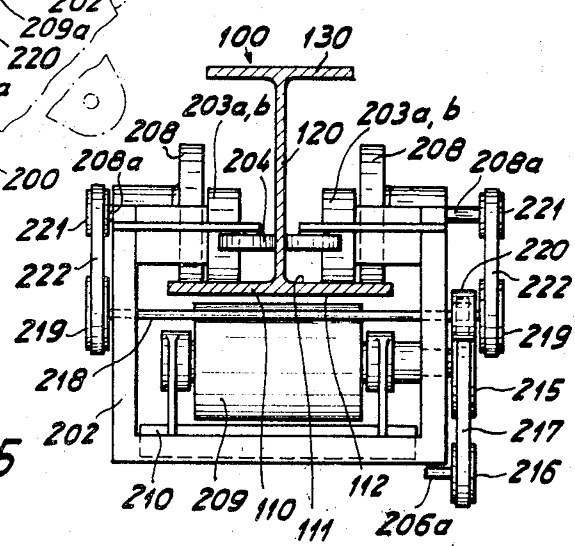


Fig.5

Fig.6

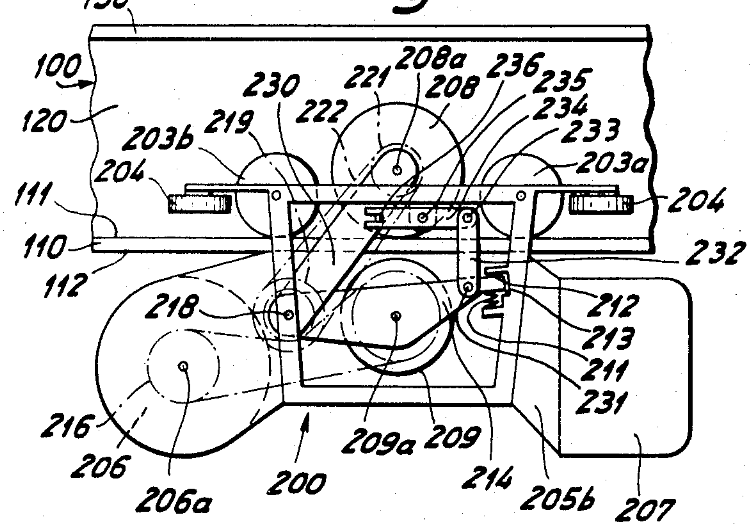
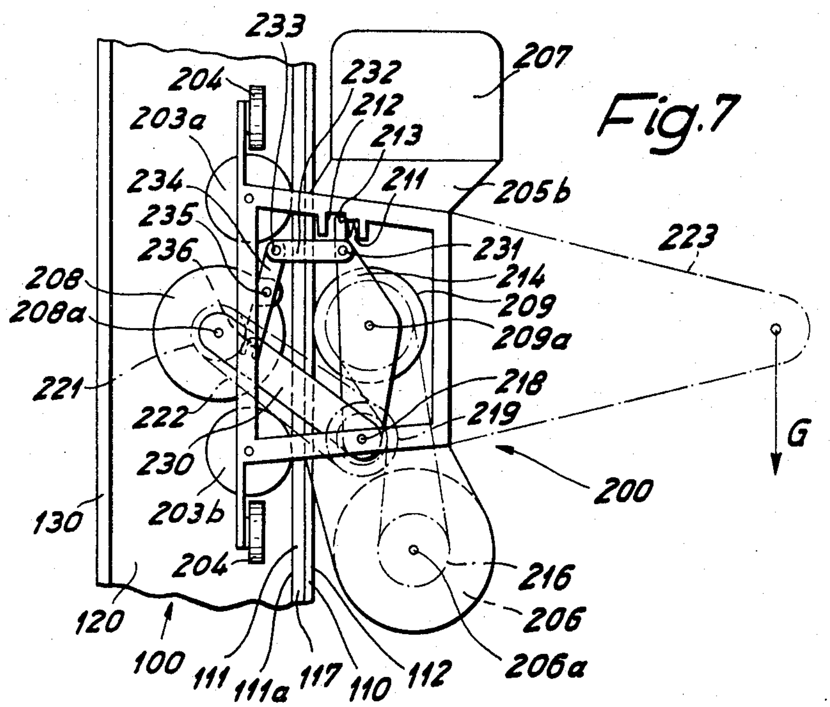

130
100
120
111
110
112
203b
204
219
230
222
221
208a
208
236
235
234
233
203a
204
232
218
212
213
211
231
216
206
206a
200
209a
209
214
205b
207

Fig.7


233
207
204
232
212
203a
213
211
205b
234
235
223
231
236
214
208
209
208a
209a
221
218
222
219
G
230
200
130
203b
204
216
120
206
100
111
111a
117
110
112
206a

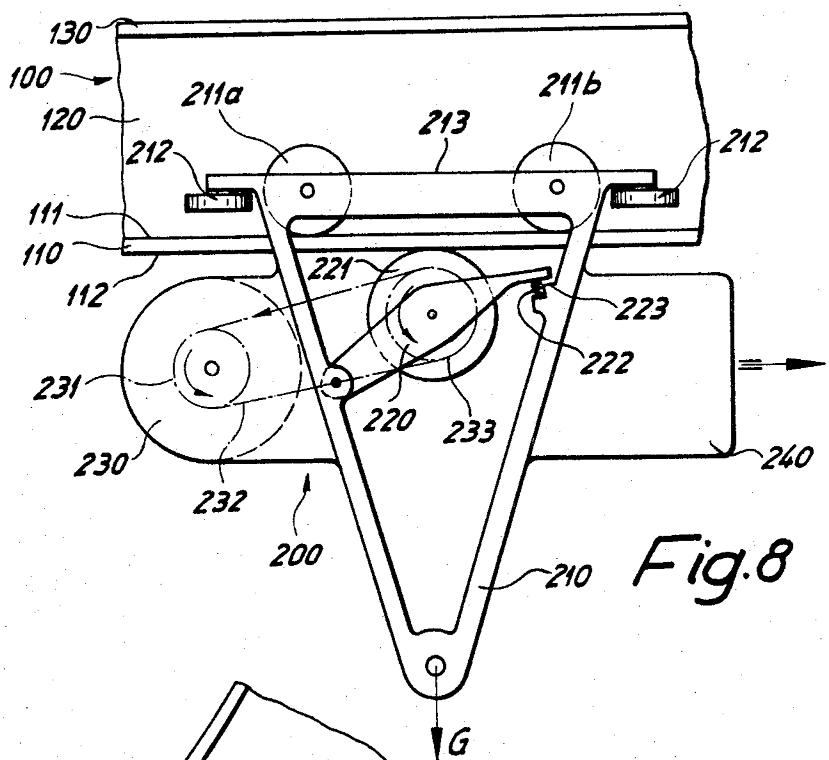

130
100
120
211a
213
211b
212
212
111
110
112
221
223
222
231
220
233
240
230
232
200
210
G

Fig.8

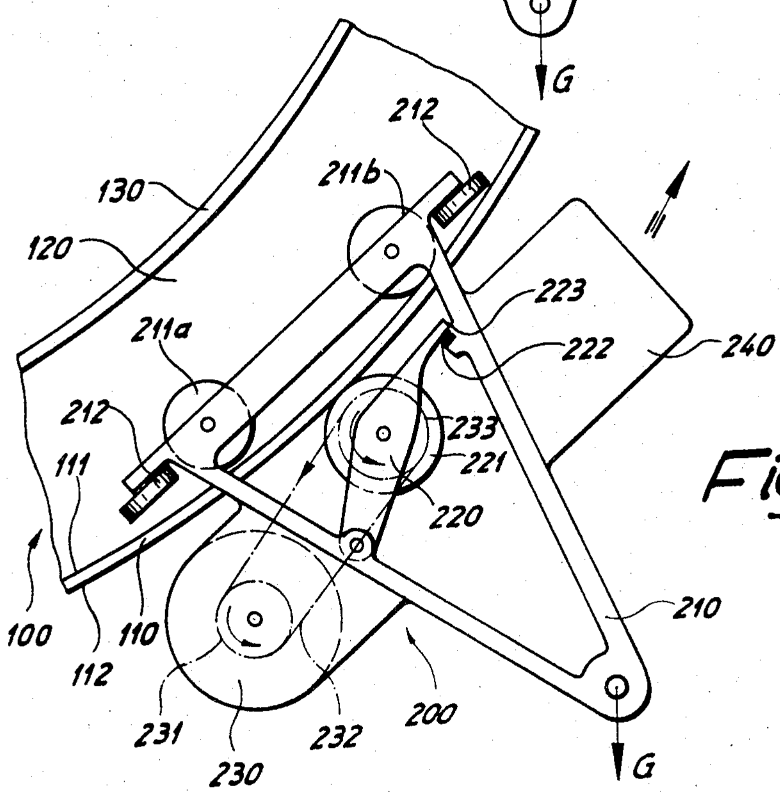

212
211b
130
120
223
222
240
211a
212
233
221
111
220
210
100
110
112
231
232
200
230
G

Fig.9

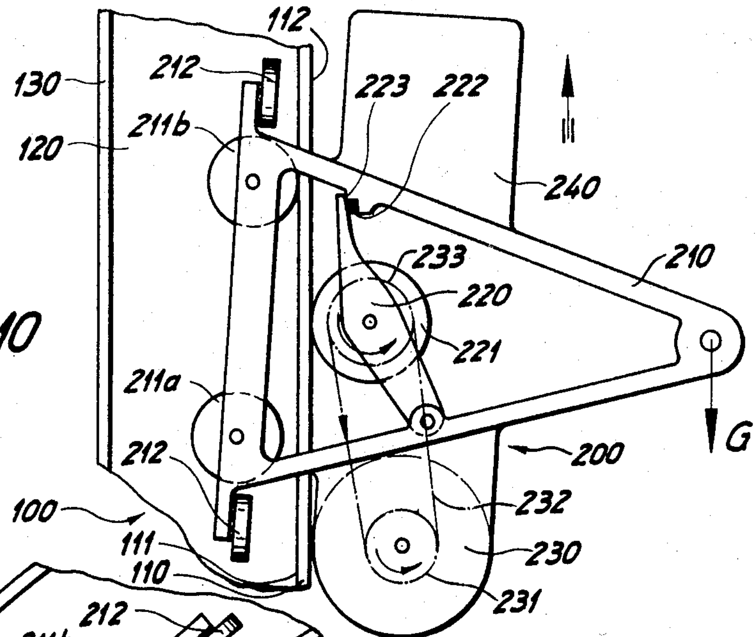


Fig.10

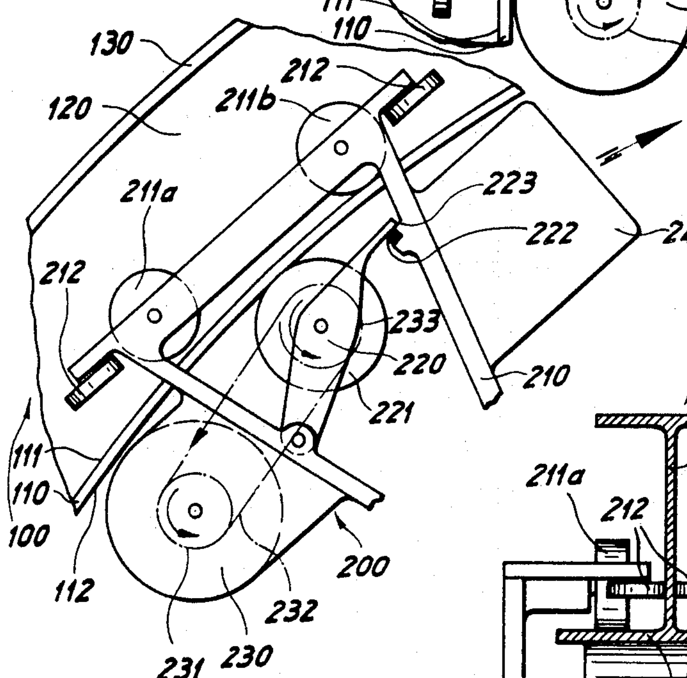


Fig.11

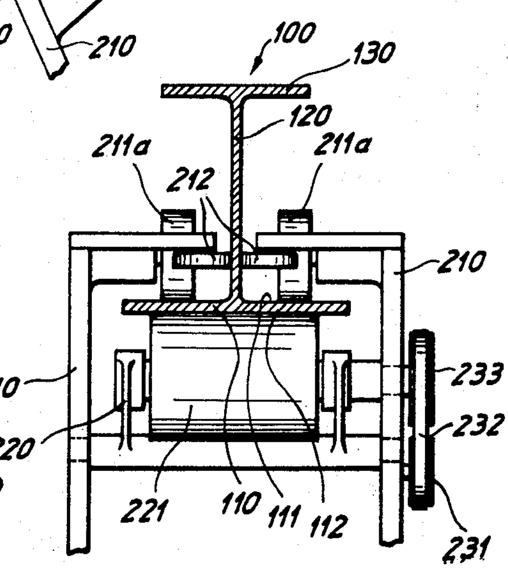


Fig.12

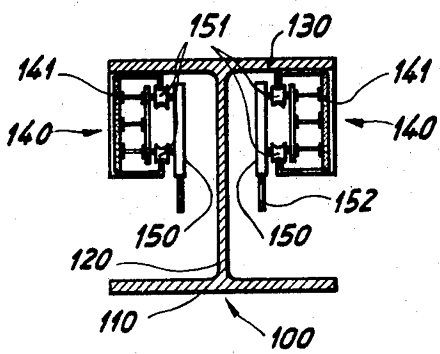


Fig.13

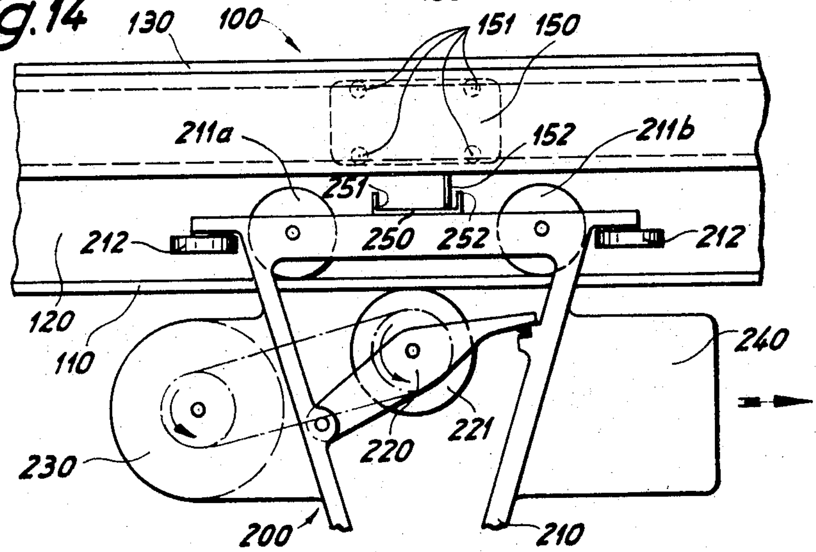


Fig.14

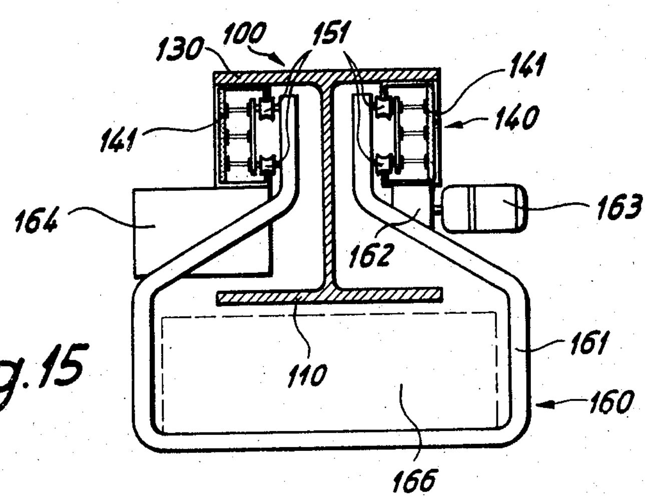


Fig.15

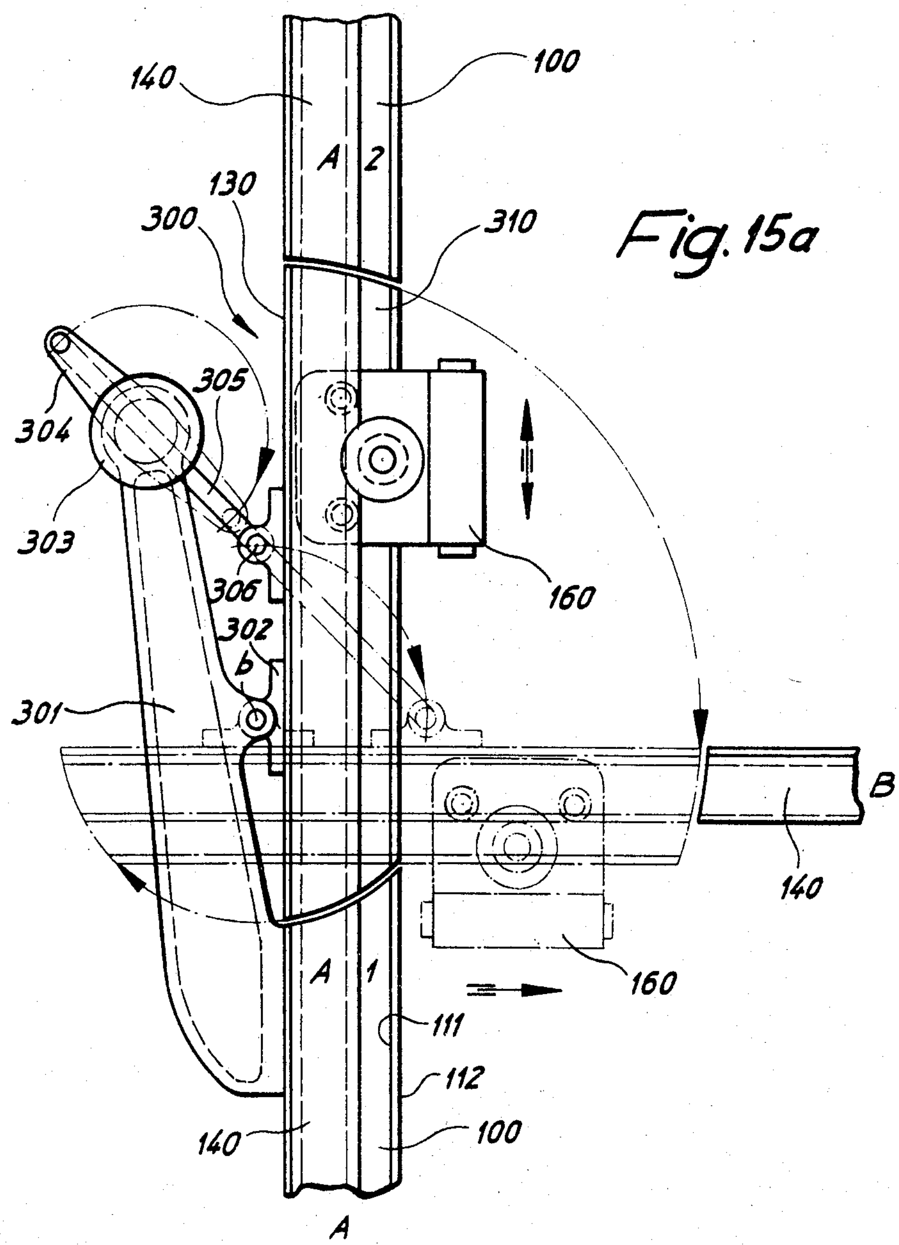
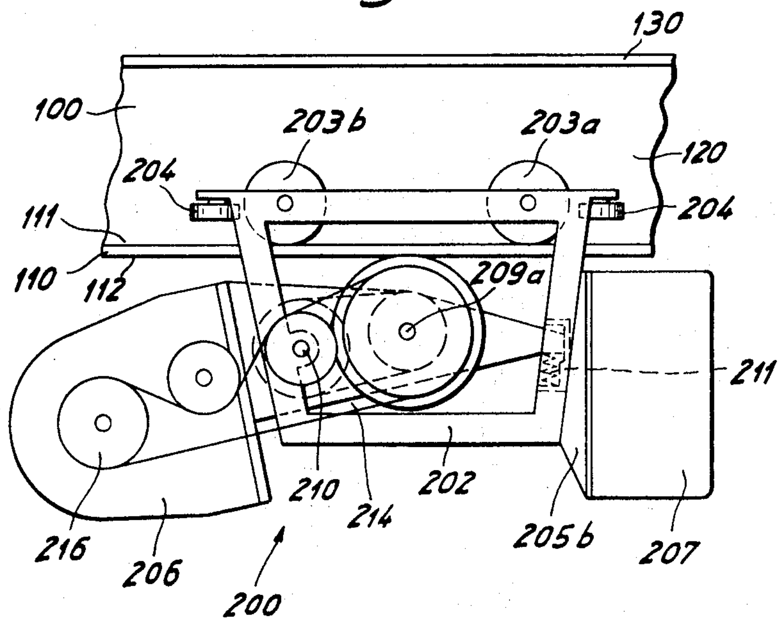

140
100
A
2
130
300
310
305
304
303
306
302
b
160
301
B
140
160
A
1
111
112
140
100
A
Fig. 15a

Fig. 16


130
100
203b
203a
120
204
204
111
110
112
209a
211
216
206
200
210
214
202
205b
207

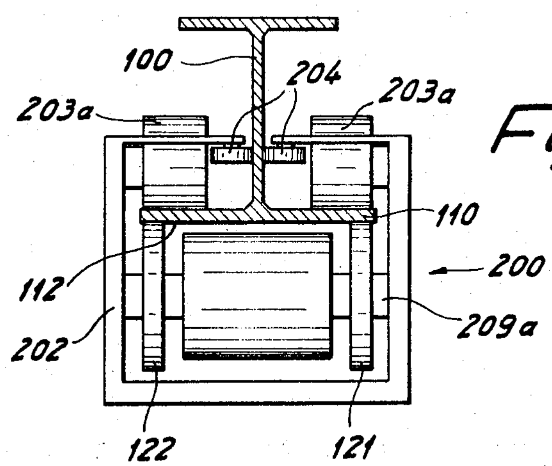

100
204
203a
203a
110
112
200
202
209a
122
121

Fig. 17

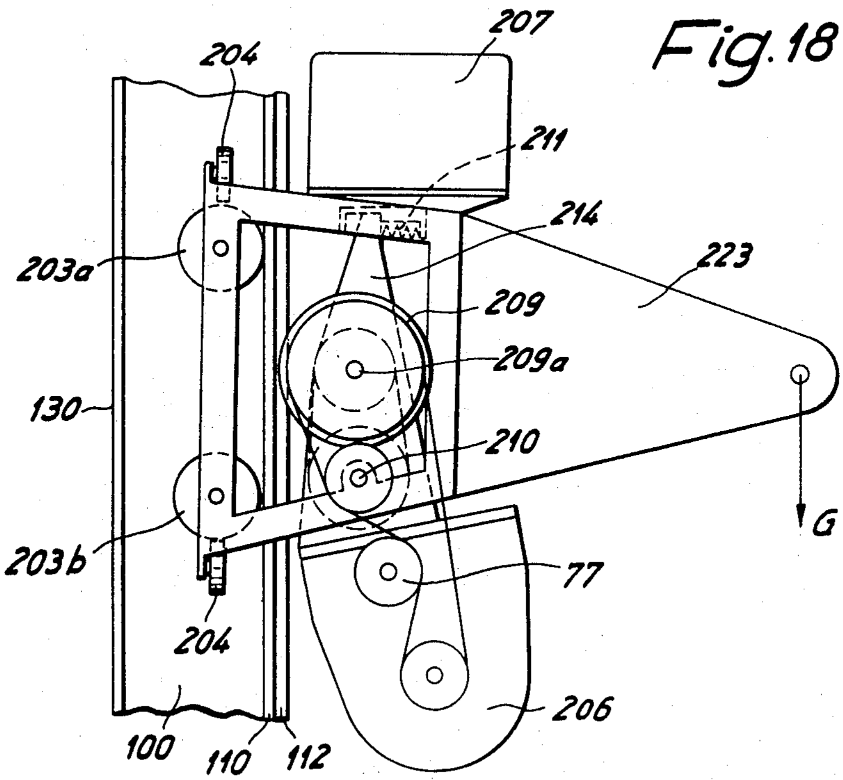

207
204
211
214
223
203a
209
209a
130
210
G
203b
77
204
206
100
110
112

Fig.18

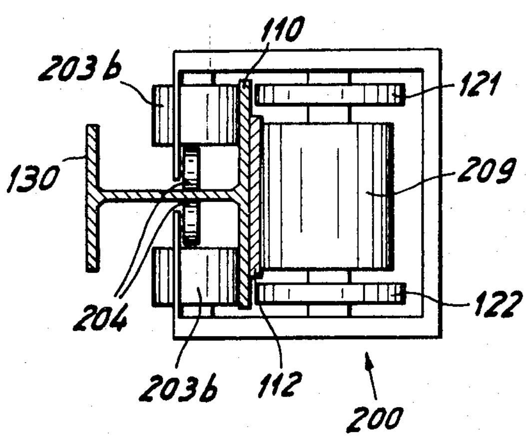
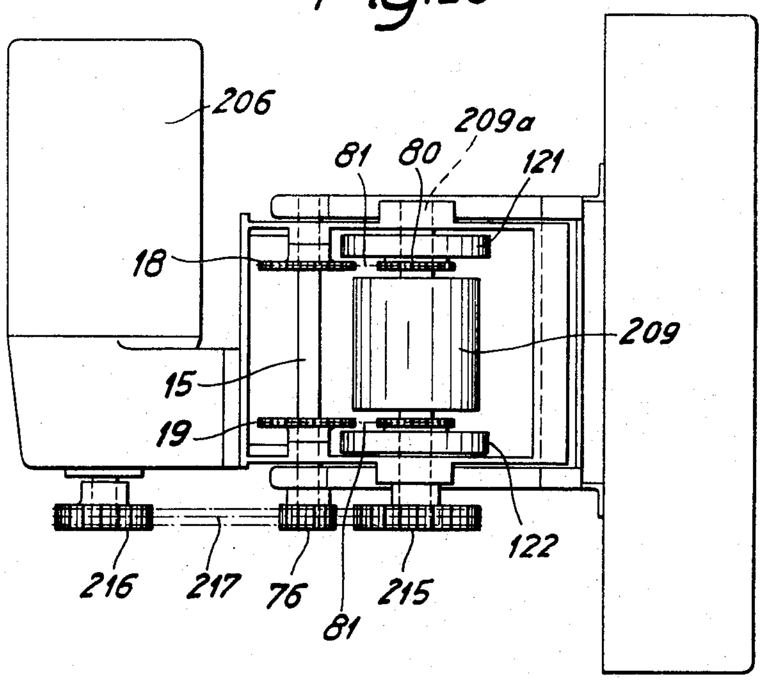

110
203 b
121
130
209
204
122
203b
112
200

Fig.19

Fig. 20


206
209a
81
80
121
18
209
15
19
122
216
217
76
215
81

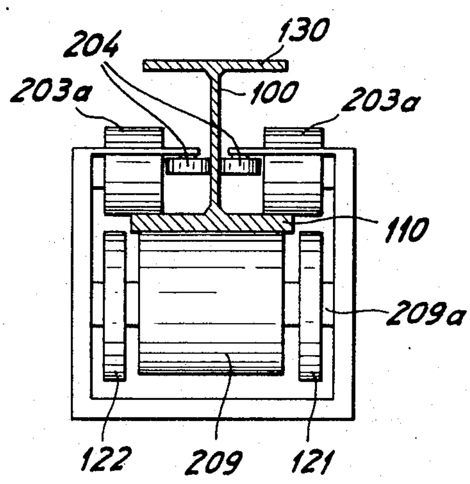

130
204
203a
100
203a
110
209a
122
209
121

Fig. 21

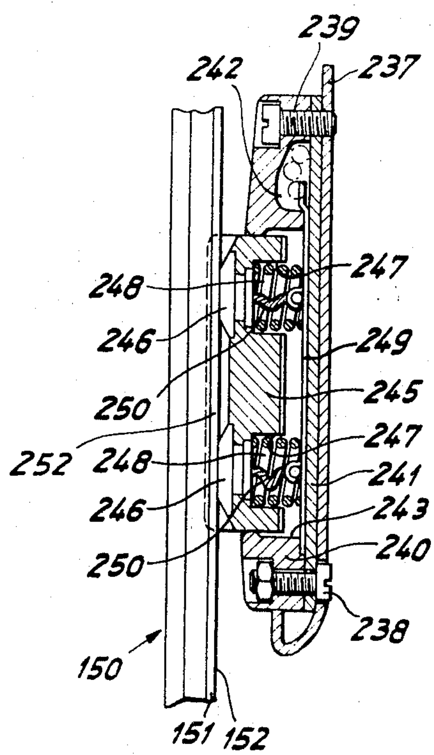

239
237
242
248
247
246
249
250
245
252
248
247
241
246
243
250
240
238
150
151
152

Fig.22

Fig. 23

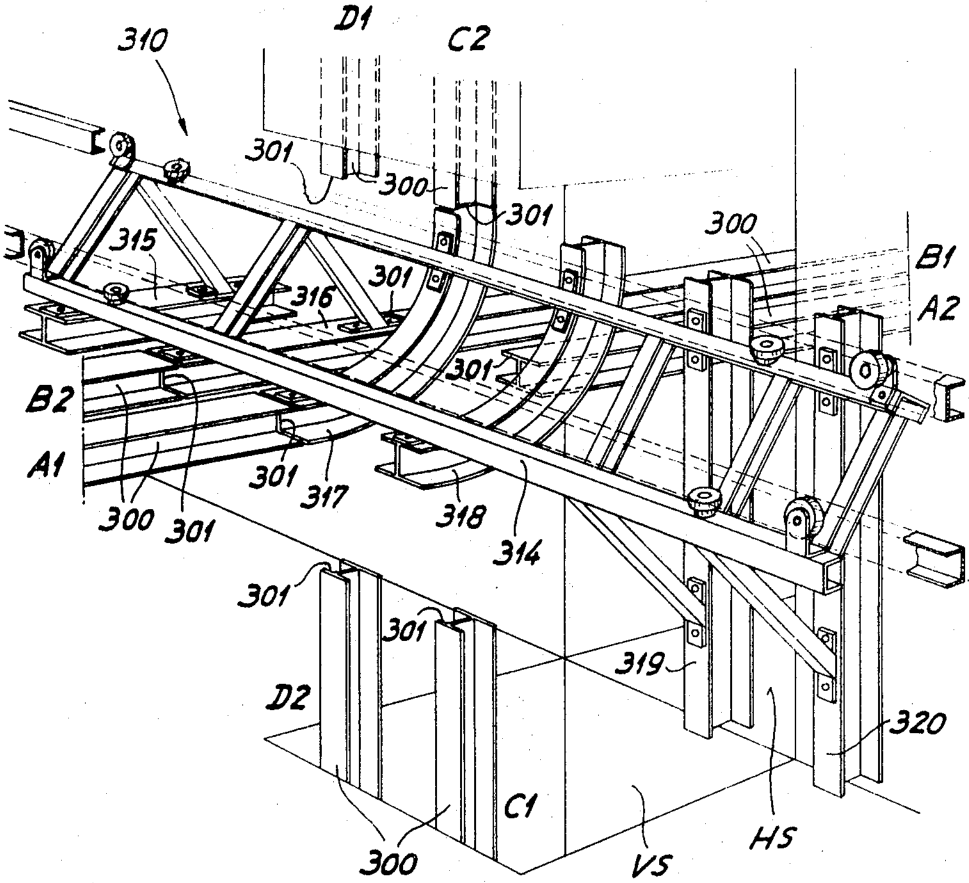

310
D1
C2
301
300
301
300
B1
A2
315
316
301
301
B2
A1
301
317
318
314
300
301
301
301
319
320
D2
C1
300
VS
HS

Fig.24

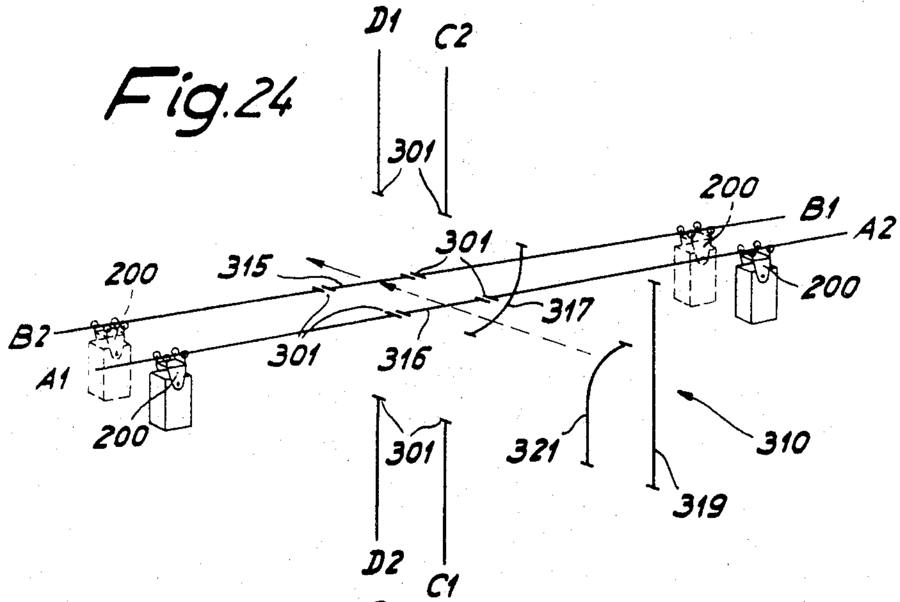
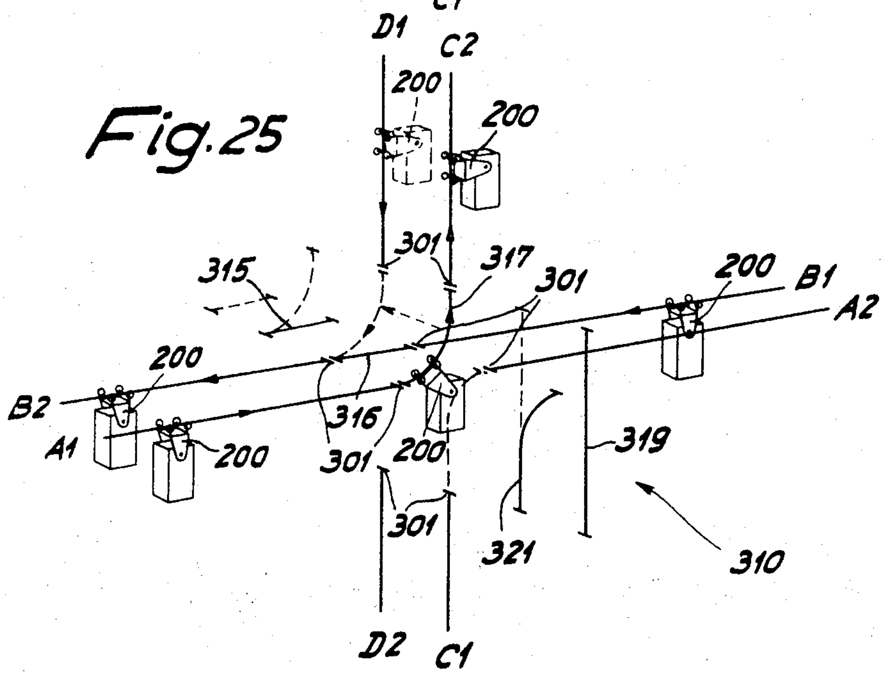

D1
C2
301
200
B1
A2
301
315
317
200
B2
A1
301
316
200
321
301
310
319
D2
C1

Fig.25


D1
C2
200
200
301
317
315
301
200
B1
A2
200
B2
A1
316
200
319
301
200
301
321
310
D2
C1

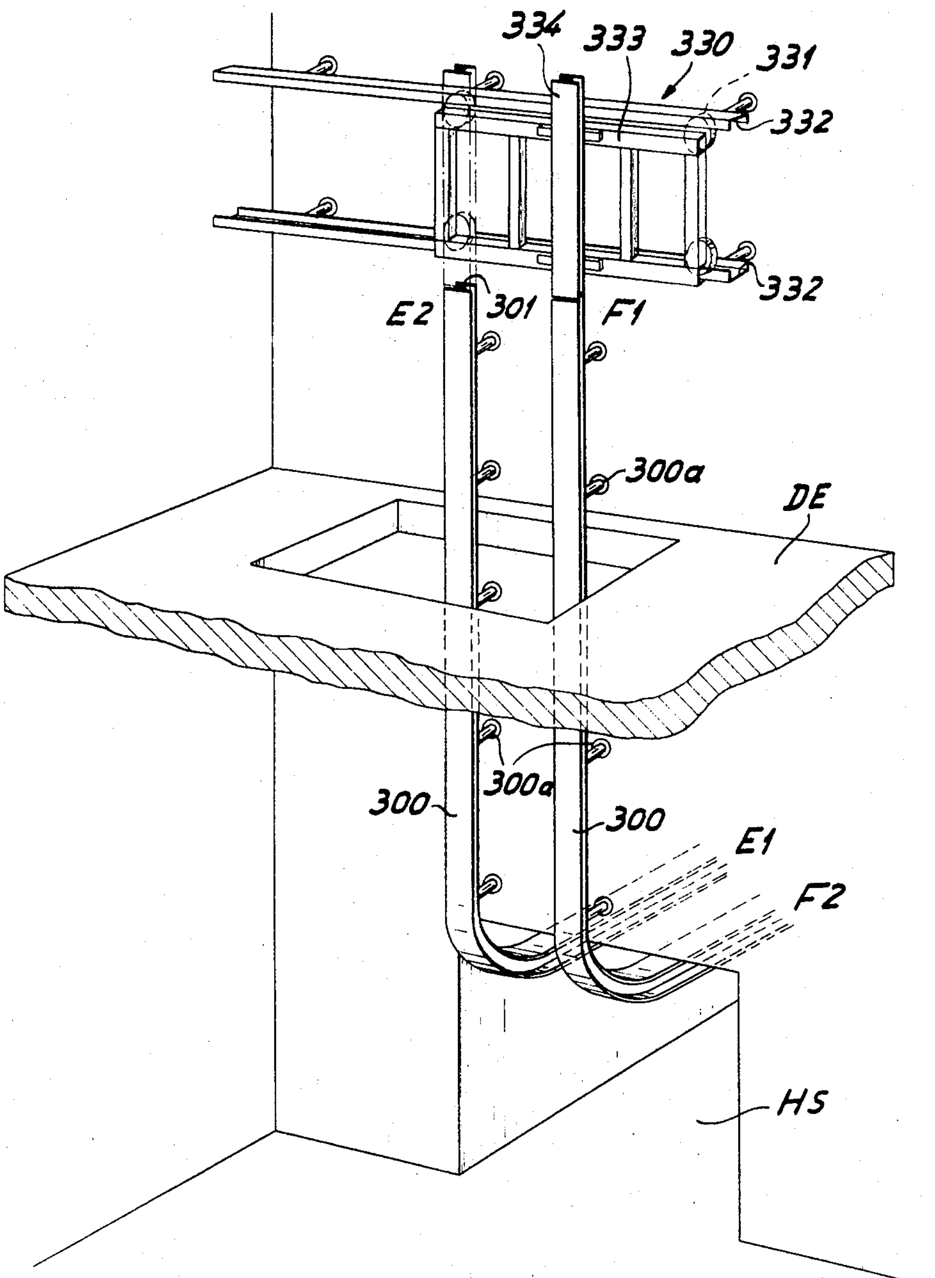


Fig. 26

Fig.28

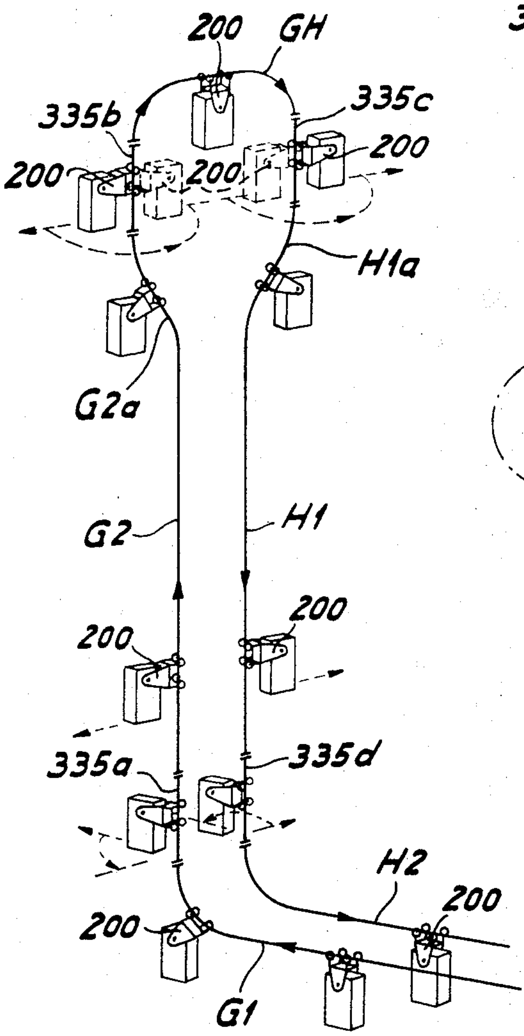
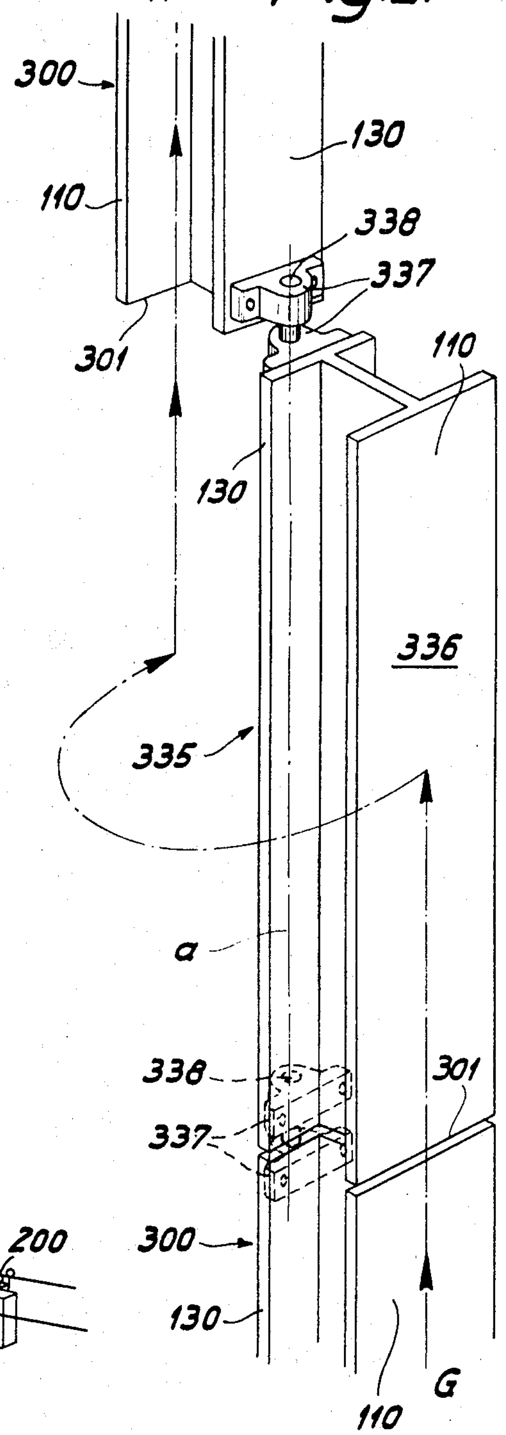

200
GH
335b
335c
200
200
200
H1a
G2a
G2
H1
200
200
335a
335d
H2
200
200
G1

Fig.27


H
300
130
110
338
337
301
110
130
336
335
a
338
301
337
300
130
G
110

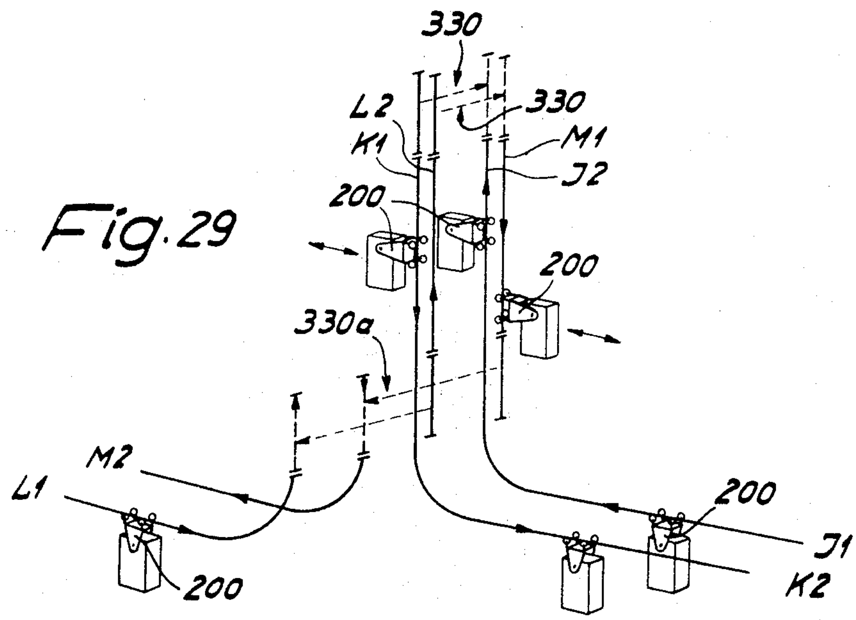

330
330
L2
K1
M1
J2
200
200
330a
M2
L1
200
200
J1
K2

Fig. 29

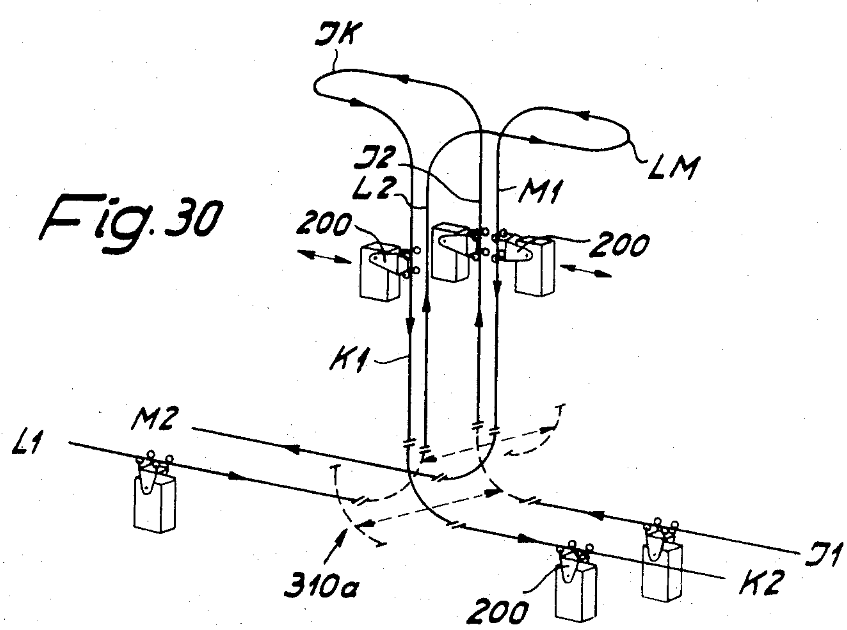

JK
LM
J2
L2
M1
200
200
K1
M2
L1
310a
200
J1
K2

Fig. 30

Fig. 31

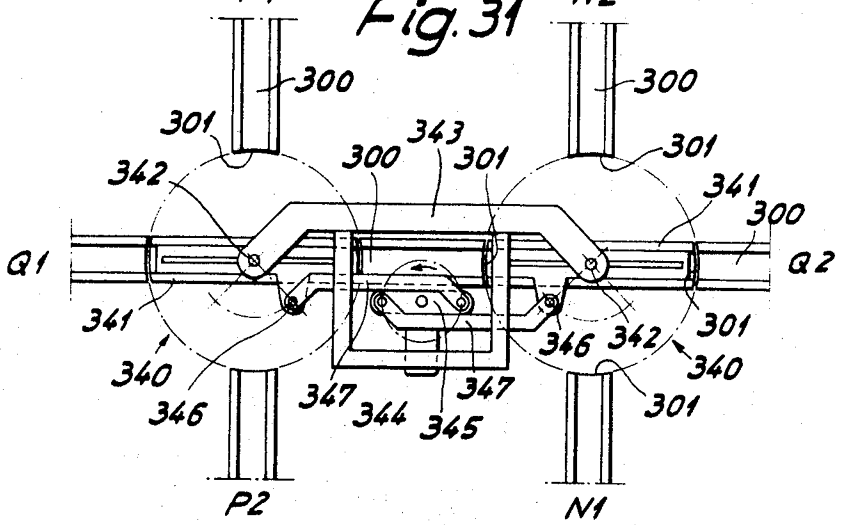

P1
N2
300
300
301
343
300
301
301
342
341
300
Q1
Q2
341
301
346
342
340
340
347
347
346
344
345
301
P2
N1

Fig. 32

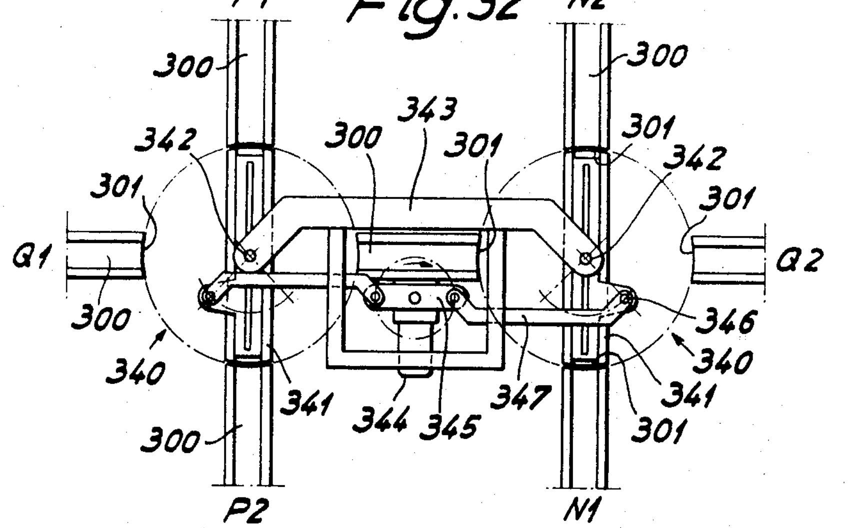
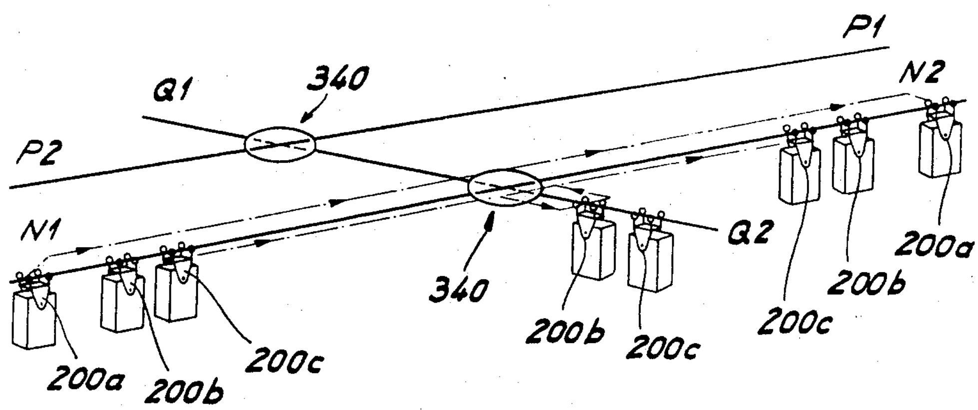

P1
N2
300
300
343
342
300
301
301
342
301
301
Q1
Q2
300
346
340
340
341
341
344
345
347
301
300
P2
N1

Fig.33


P1
N2
Q1
340
P2
N1
Q2
340
200a
200b
200c
200b
200c
200c
200b
200a
200a
200b
200c

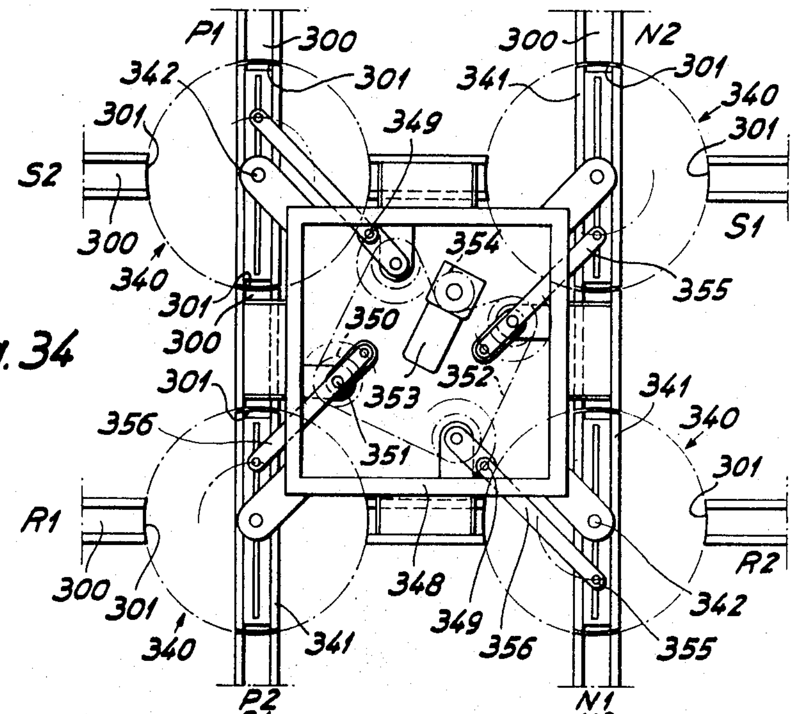

P1
300
342
301
349
300
N2
341
301
340
S2
S1
300
354
355
340
350
352
353
356
351
341
R1
R2
348
342
349
356
355
340
P2
N1

Fig. 34

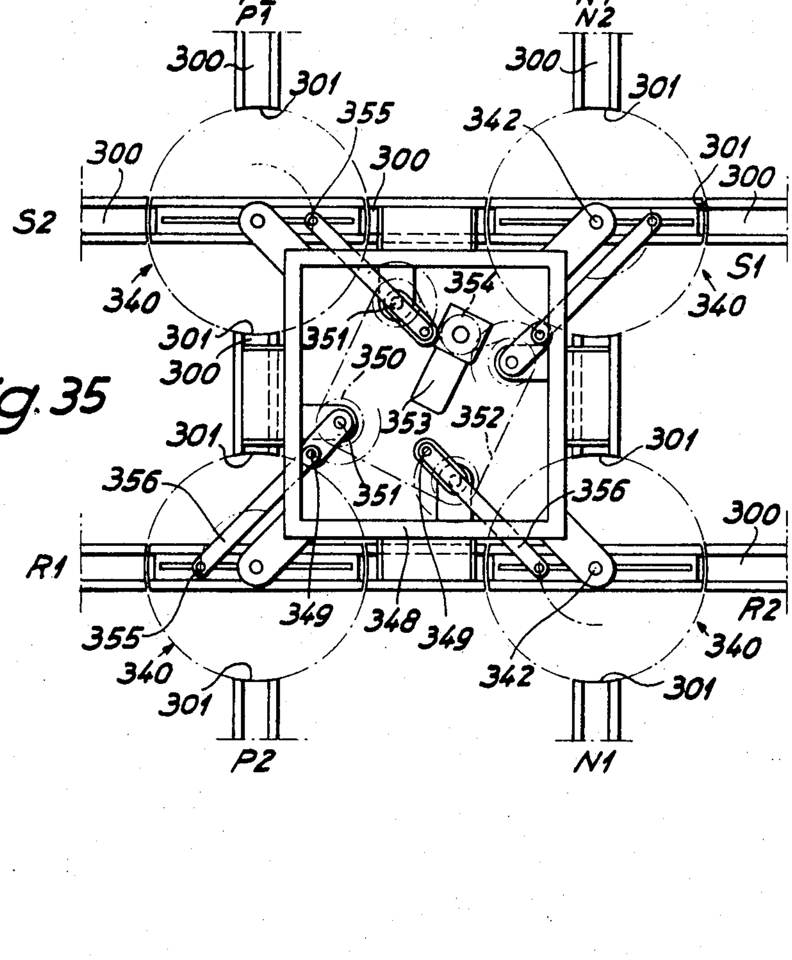

P1
N2
300
301
355
342
300
S2
S1
340
354
351
350
353
352
356
R1
R2
349
348
349
355
342
340
301
P2
N1

Fig. 35

Fig. 37

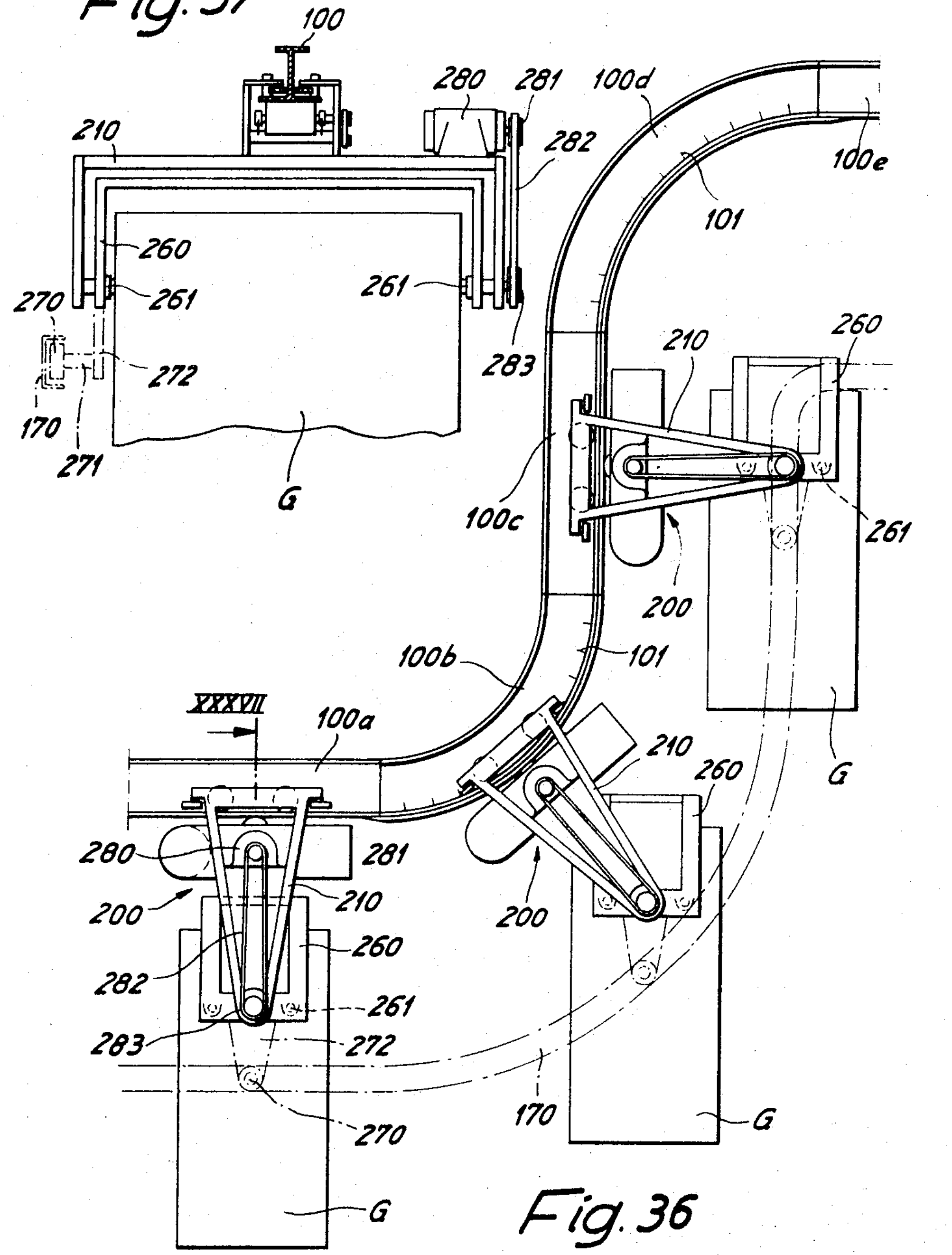
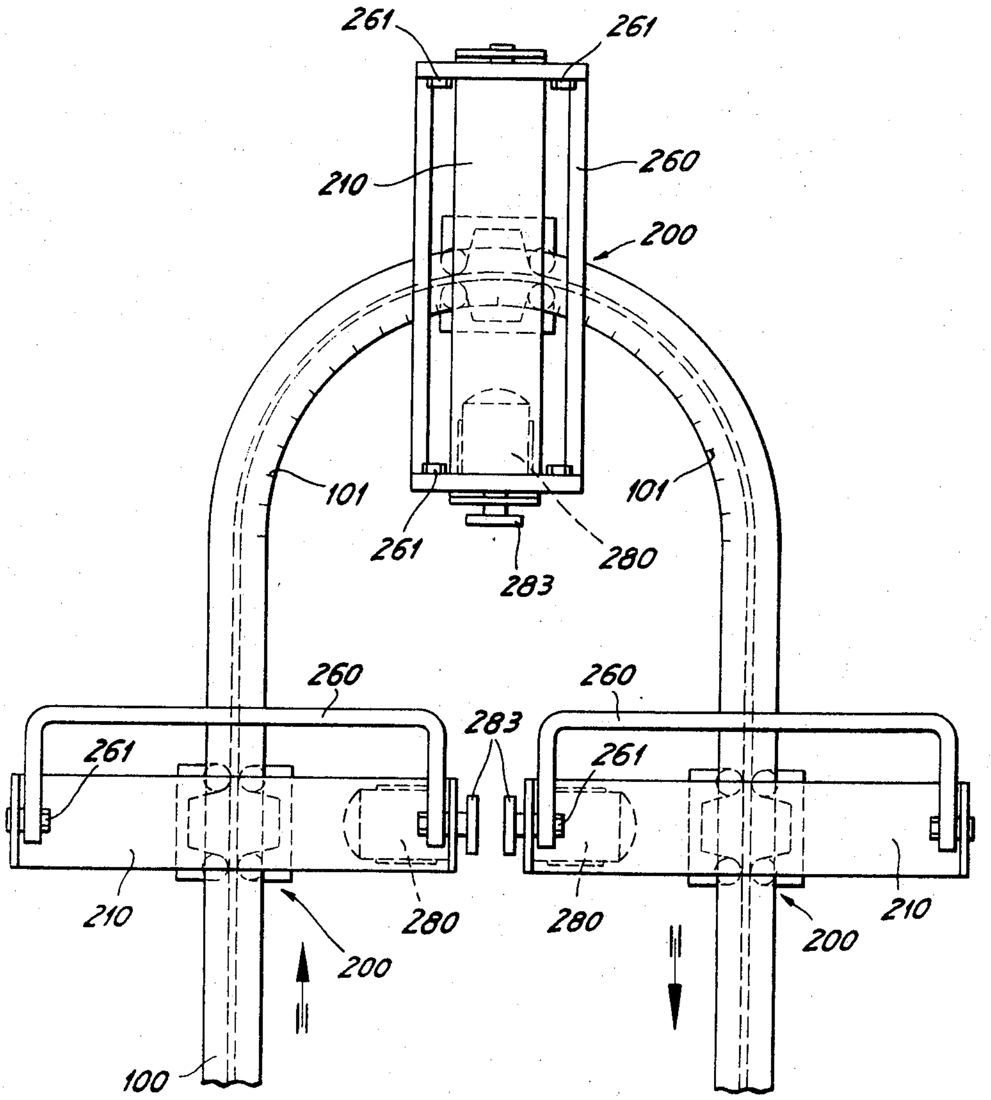

100
280
281
100d
210
282
100e
101
260
261
270
261
283
210
260
272
170
271
G
100c
261
200
101
100b
XXXVII
100a
210
260
G
280
281
200
210
200
260
282
261
283
272
270
170
G
G

Fig. 36

Fig. 38


261
261
210
260
200
101
101
261
280
283
260
260
283
261
261
210
280
280
210
200
200
100

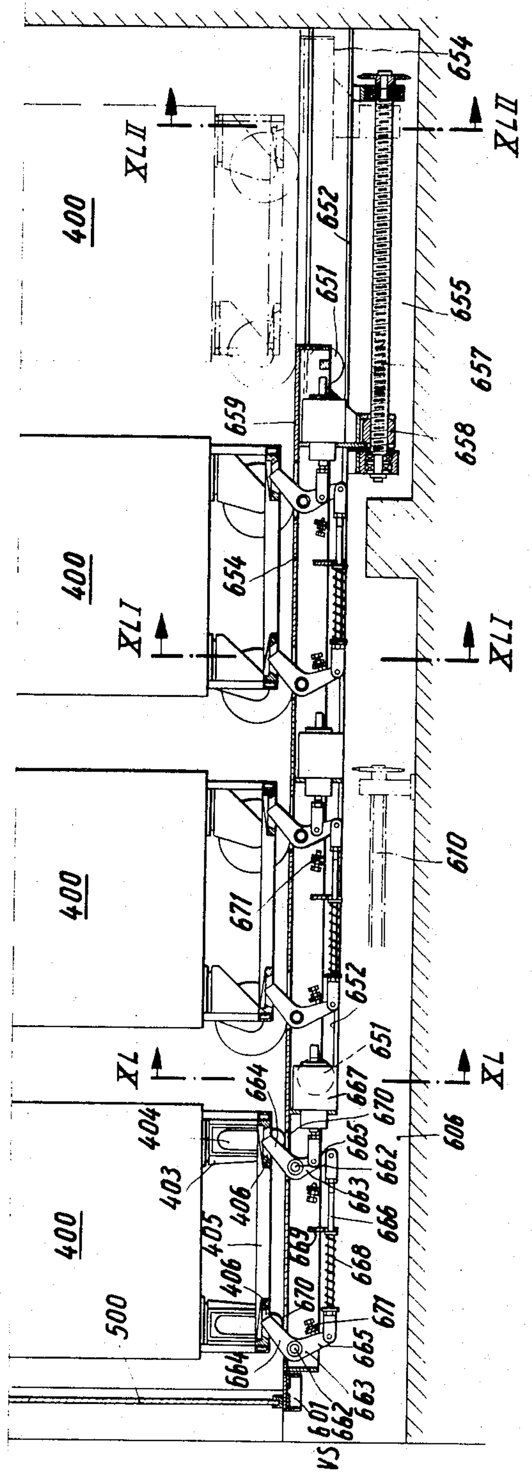

654
XLII
400
652
651
655
657
658
659
654
XLI
400
610
671
400
652
651
XL
664
667
670
665
662
606
404
403
406
663
666
405
406
669
668
400
670
671
500
664
665
663
601
662
VS

Fig.39

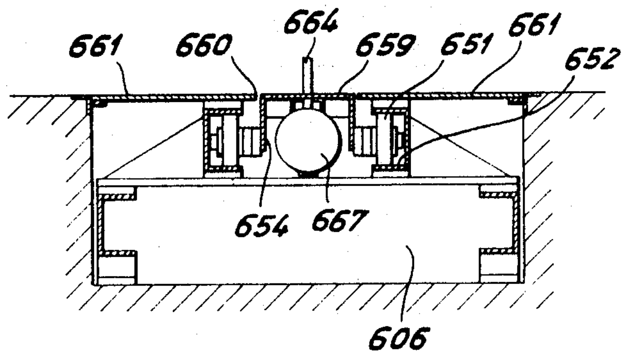


Fig.40

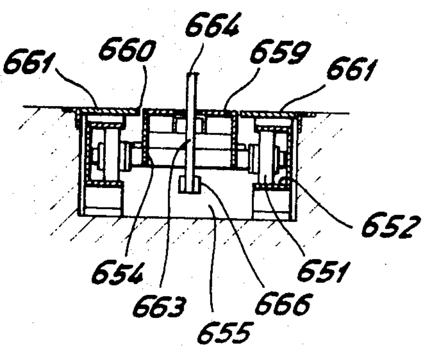


Fig.41

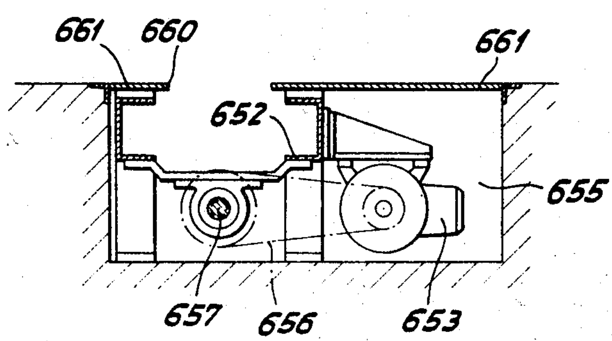


Fig.42

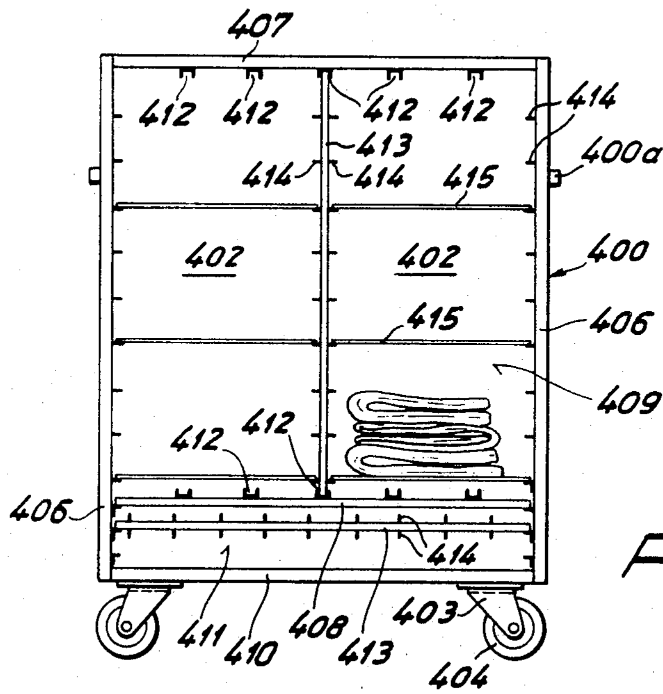

407
412
412
412
412
414
413
414
414
415
400a
402
402
400
415
406
409
412
412
406
414
411
410
408
413
403
404

Fig.44

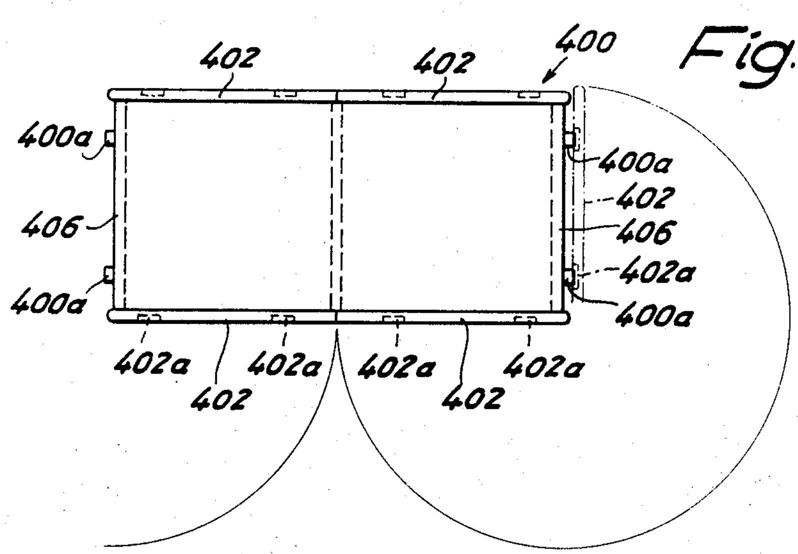

402
402
400
400a
406
400a
400a
402
406
402a
400a
402a
402a
402a
402a
402
402

Fig.43

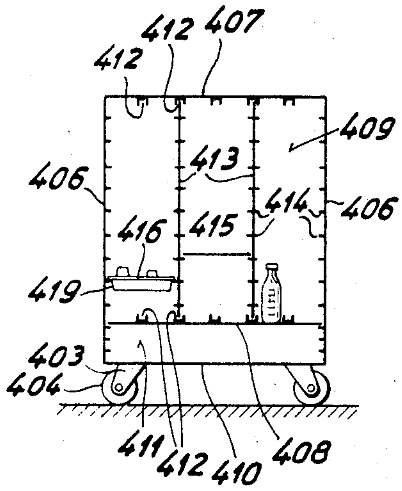


Fig.45

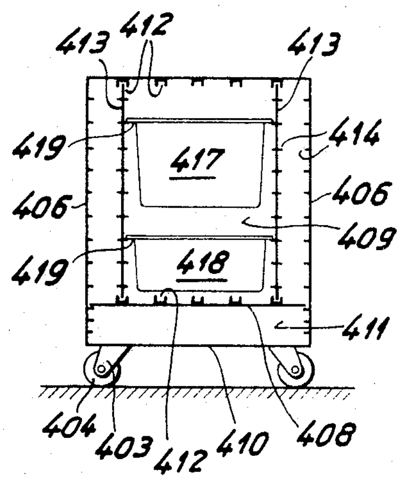


Fig.46

Fig.47

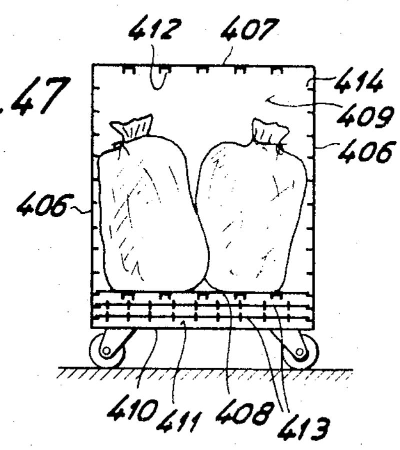


Fig. 48

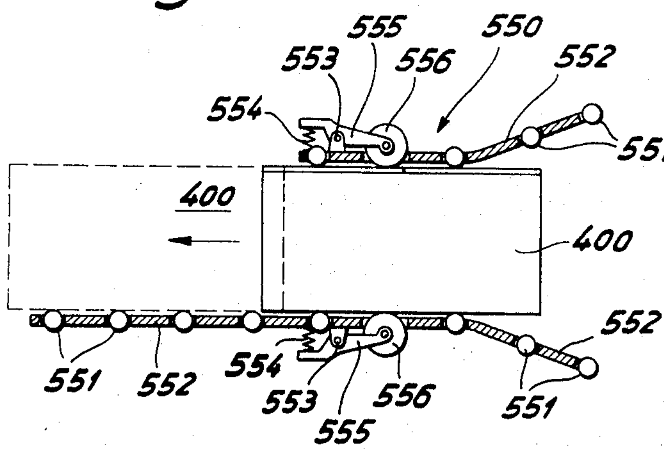

555
550
553
556
552
554
551
400
400
552
551
552
554
556
553
551
555

Fig. 49

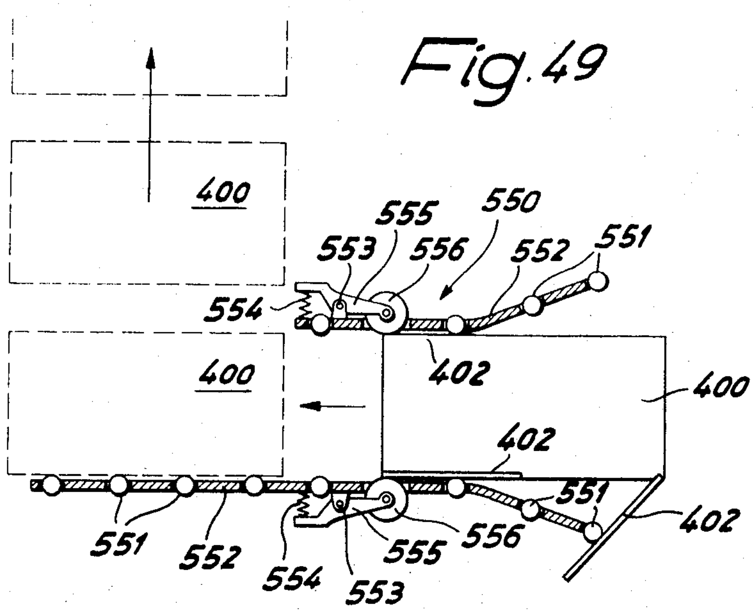

400
555
550
553
556
552
551
554
400
402
400
402
551
402
551
552
555
556
554
553

Fig. 50

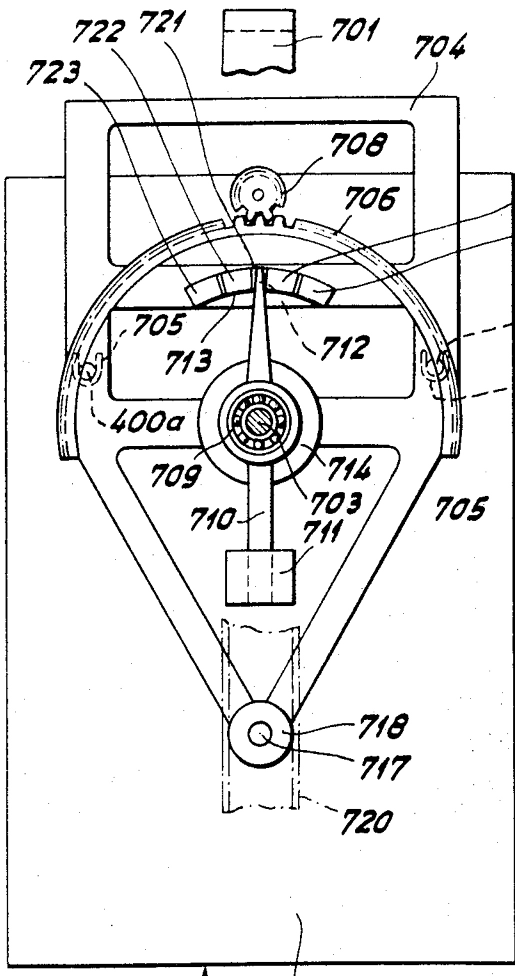
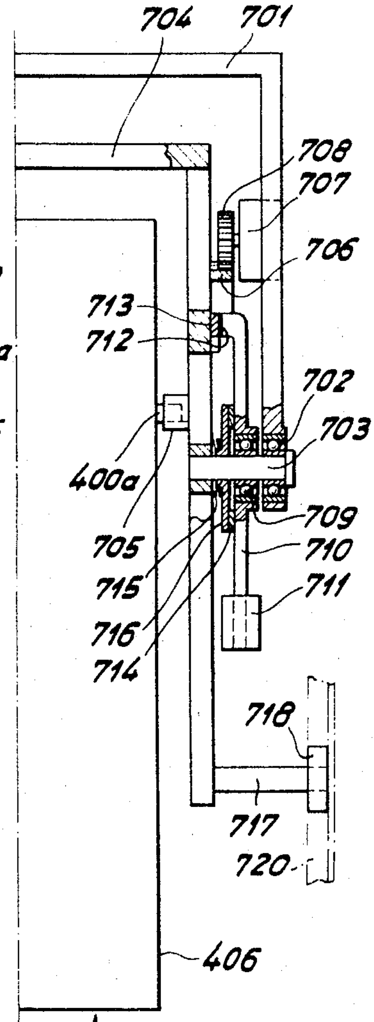

722
721
701
704
723
708
706
722
723
400a
705
713
712
705
400a
709
714
703
705
710
711
718
717
720
400
406

Fig. 51


704
701
708
707
706
713
712
702
703
400a
709
710
705
715
711
716
714
718
717
720
406
400

GRIPPING LOCOMOTIVE FOR SUSPENDED RAILWAY

This invention relates to a conveyor device for overhead trolleys that travel on a supporting rail by means of supporting rollers which are powered by friction using, in each instance, a spearate driving motor supplied via third rails while suspended from these overhead trolleys are scuttles, containers, or the like, which carry the material to be transported by the trolley, there also being provided horizontal lines on which the trolleys can move with relatively minor starting moment and high speed and vertical lines as well as loading and/or unloading stations on which trolleys can run with a relatively high starting moment and slow speed.

There is now known one conveyor device which is equipped with overhead trolleys that runs by means of support ing rollers on a double-T supporting rail and that are powered by means of a friction wheel driven by a motor on the under side of the supporting rail, where, by means of a reduction gear, the starting moment of the friction wheel is changed, depending upon whether it travels on a horizontal line or a vertical line. This conveyor device, however, did not prove itself in practice for a number of reasons, especially because of the great difficulties arising in the switching of the reduction gear and in the maintenance of friction engagement, especially when the trolley ran along an arc.

In order to resolve these difficulties, a different design has been proposed for such a conveyor device. The supporting element of such a device has a box-like cross section which is roughly U-shaped and open toward the top. On both of the lateral walls of this element there are arranged, on the outside by means of struts, two members which are positioned above each other and thereby provides a means for supporting rollers on the running surface. Below respectively, outside the bar-like segment of the U-shaped profile which connects the lateral walls, there is a broad flange with a rectangular cross section and, on this flange, perpendicular thereto there is a narrow flange. On the overhead trolley suspended from the supporting rollers, there are arranged two drive motors, each having a multiple shaft arranged perpendicularly to the direction of movement. To each multiple shaft there is attached one large friction wheel for friction engagement on the narrow lower flange and a small friction wheel for frictional engagement on the wide flange. Depending upon whether there is a load-independent friction drive or the spring stress of the two drive units is directed against each other, the large friction wheel or the small friction wheel will be driven through reduction gears associated with the drive motor. The third rails, which are necessary to supply the two drive motors in this conveyor device are arranged in the U-shaped profile segment in a protected manner with regard to the overhead trolleys. However, they are still exposed to dust and dirt penetrating from above as a result of the open nature of the U-shaped profile segment of the supporting rail. Objects falling into the U-shaped profile segment from above can very easily damage the third rails and the overhead wires. Also, dew water and dripping water can cause short circuits. The supporting rail is characterized by having only a small degree of stiffness so that it must be suspended or retained at close intervals. Also, in this arrangement there is only a very small self-alignment and the overhead trolleys are characterized by unsatisfactory running qualities along curves. Furthermore, the pressure of the small friction wheels is of a lesser degree in this design in the vertical sections of the line when compared to the horizontal sections of the line.

A successful design of the line system must facilitate smooth movement of the overhead trolleys also in the case of many and differing intersections and branch-off points as well as in case of a heavy traffic volume. In the previously discussed, known conveyor device, however, provision is made only for turntable-like diversion devices for the intersections of two "double-track" lines located in a horizontal plane. The parallel supporting rails are arranged in a bent manner toward the diversion device, the three ends of the rails projecting in the direction of the diversion device in a radial fashion so that at each time only one overhead trolley can pass the diversion device. With such an arrangement an overhead trolley coming toward us on the parallel section of the line must wait. The known diversion device thus facilitates branch-offs only in horizontally positioned lines and vertical lines must be converted into horizontal line segments with considerable space requirement. At the ends of "double-track" lines, turnaround loops also necessary in the horizontal plane require a considerable space. Thus, the installation of such a conveyor device very often is not practiced due to the fact that the required space is not available.

The present invention relates to a conveyor device with overhead trolleys in which the previously mentioned disadvantages are avoided and which is characterized by a simple design having favorable running properties, a high degree of operational reliability and safety, as well as good possibilities for adaptation to the most varied operational requirements, coupled with a small space requirement and extensive possibilities for automatic operation. In accordance with this purpose, provision is to be made also for the combination and distribution of line segments in any desired plane. Such steps, furthermore, suffice to meet the requirement for small space and various line network layout desires. This task at the same time includes the efficient development of important details of the conveyor device relating to efficiency thereof.

The present invention also relates to conveyor devices featuring overhead trolleys which run on a supporting rail by means of supporting rollers and which are powered by friction via separate drive motors electrically supplied by third rails in which scuttles, containers, or the like are suspended from the overhead trolleys to carry the material to be transported. The trolley can travel over horizontal line segments with a relatively minor drive moment and high speed and along vertical line segments as well as loading and/or unloading stations with relatively high drive moment and lesser speed. The supporting rail, preferably having a design with a profile like a wide-flanged steel I-beam, is characterized by a relatively wide lower flange. This flange constitutes the running surface for the supporting rollers of the trolley as well as for friction travel thereon of oppositely disposed large friction wheels. The web connecting this lower flange with the upper flange serves as a carrier for a third rail. The overhead trolleys, which run on the narrow lower flange by means of front and rear supporting wheels, with the flanges of the supporting wheels facing toward the web, have interposed therebetween at least two large friction wheels driven by a common motor, which have roughly a uniform number of revolutions. The pair of friction wheels having a small torque and fast circumferential speed are positioned laterally of, or on both sides of the web of the supporting rail, and so arranged in the direction of movement, between pairs of supporting wheels, that they will traverse the upper surface of the flange of the supporting rail. Another smaller friction wheel is arranged, with respect to the pair of friction wheels, also is a horizontal running position and have their respective axes parallel. However, for vertical runs the trolley is arranged in such a manner that — due to the load-dependent tipping of the supporting frame around the upper pair of friction wheels the lower small friction wheel comes into frictional engagement along the under surface of the flange of the supporting rail. The upper friction wheels are then moved out of frictional engagement with the trackway. In this way it is assured that the upper friction wheels, which are placed against the supporting rail by the force of their own weight alone and, if necessary, by the weight of the load of the overhead trolley, and the lower friction wheel will not engage the supporting rail simultaneously. The very short time required for switching from the upper to the lower friction wheel is adequate for switching from the faster to the slower conveyor speed without any reduction in the drive moment due to friction losses — that is, simultaneous frictional engagement of both friction wheels. Furthermore, it is possible, without having to consider any other circumstances, to design the lower friction wheel very wide and to obtain a correspondingly larger friction engagement surface between the lower friction wheel and the supporting rail, because the lower, outer running surface of the supporting rail is reserved for the smaller friction wheel.

In one embodiment the present invention relates to an upper friction wheel which is arranged movably on the supporting frame — if necessary by means of a swing, essentially in a direction toward the lower flange, and is stressed, in case of a horizontal run, by means of levers which can be swung in relation to each other in a flexible manner, as well as around an axle positioned on the supporting frame. Another such axle, pin, or the like, positioned on the swing, moves the small friction wheel against the spring, engaging this swing, in the direction toward the lower flange of the supporting rail. In case of slow-run line segments, especially vertical run line segments and their incoming and outgoing sections in vertical outside and/or inside arcs, as well as on such horizontal line segments, attachment rails or other reinforcement profiles are placed on the surface of the lower flange of the supporting rail facing toward or away from the supporting rollers, so that the distance between the supporting rollers and the small friction wheel is increased in such a manner that the swing of the lower friction wheel is impacted by the latter's contact with the lower flange against the force of the spring. Accordingly, the upper friction wheels are lifted off their running surface on the lower flange by means of the levers. The pressure of the upper friction wheels is increased in case of a horizontal run and is guaranteed if the frictional engagement surface has irregularities on the lower flange. Contact points or butt joints of the adjacent supporting rail might have irregularities. Also, this design makes it possible to reduce the variations of the frictional engagement between the lower and the upper friction wheel, not only in terms of time, but also the exact magnitude of such variations can be determined, especially in vertical outside and vertical inside arcs, regardless of the magnitude of the weight of the additional lead, i.e., the material to be transported. The tipping effect of the trolley along vertical line sections can be combined with the effect of the attachment rail or of the reinforcement profile and the lever.

In a still further embodiment of the present invention the concept relates to a small friction wheel which is positioned in a swing, that is swingably positioned on the supporting frame and which is stressed in the direction of frictional engagement by a weight or a spring, and which is limited in terms of its swing range. The small friction wheel, in case of constant friction engagement, is thus capable of following any vertical arc, no matter how it may be curved. In this particular embodiment the upper friction wheels are not utilized.

Still another embodiment of this invention is as follows: In the area of the third rail, on a current-collector-holder, attached to the overhead trolley and located in a current-collector-housing, there is arranged a current-collector-slide which, in a gliding manner, is spring-stressed in the direction toward the contact surface of the third rail. The current-collector-slide is made of two hard-metal contact pieces arranged one after the other in the direction of movement. Such contact pieces may be cast in the slide. It also has lateral guide skids arranged in such a manner that these skids, upon engagement of the hard-metal contact pieces on the contact surface, laterally grip the flange of the third rail, representing the contact surface. The extent of the appearance of the current-collector-slide in a direction out of the current-collector-housing, which is caused by spring force, e.g., two spiral springs, is determined by the stretched-out length of the cables. The cables are attached to the hard-metal contact pieces and are led from the opposite end of the current-collector-housing. The ends of the cables at the opposite end of the current-collector-housing are attached to a current bar which is braced against the current-collector-housing in the direction toward the third rail or is clamped in the current-collector-housing. Hence, in case of simple design and minor assembly effort we have a safe lateral guidance of the current-collector-slide.

In yet another embodiment of the present invention, a pair of friction wheels can have a larger radius than a single friction wheel. With this embodiment it is possible to pass from one friction drive to the other friction drive in a simple way and still the supporting rail can have a very simple design. As long as the large radius friction heels must come in contact with the supporting rail, the latter can be completely flat, since the small radius friction wheel can then not come in contact with the supporting rail as a consequence of its smaller radius. When the small radius friction wheel must engage the supporting rail, an additional rail having roughly the same width as the small radius friction wheel can be fastened to the lower side of the bottom flange of the supporting rail, or the supporting rail bottom flange can be provided with lateral grooves, which the large radius friction wheels can follow, or the portions of the supporting rail which otherwise should be engaged by said large radius wheels can be removed. Owing to the above described design of the friction wheels and the supporting rail, it is possible to pass from one friction wheel drive to the other at any time and without changes in the inclination of the supporting rail. Thus, a change in the driving condition can be attained, not only when a trolley passes from horizontal travel to vertical travel, but a change of driving speed and circumferential momentum can take place at any time at any place inside a particular line segment of the conveyor device. In this way the friction wheel support can be swingable to the extent that is required for a change from fast friction drive to slow friction drive or the opposite and to quarantee the necessary contact pressure.

In another improvement of the invention just described, each friction wheel of the pair of friction wheels and a sprocket chain, one for each friction wheel and coaxially rigidly connected thereto, are supported by the friction wheel axis and freely rotatable around the axis. An intermediate axis parallel with the friction wheel axis is driven by the two sprockets. The intermediate axis engages the driving chain, through means driven by the motor. The driving chain drives the sprocket which is fastened to the friction wheel axis. This simple drive design and the possibility to use only one drive chain for both friction wheels is rendered possible by the coaxial arrangement of the friction wheels and will be understood as the description progresses.

One gruop of embodiments of this invention primarily refers to the line network of the conveyor device and is as follows:

a. A sliding crossover is provided on line sections meeting or branching off in a vertical plane. Supporting rails are provided for the desired connection between the free ends of the supporting rails and the free ends of other supporting rails on a switch frame and are adjustable perpendicularly to the direction of movement. These latter supporting rails are lined up and/or bent horizontally and/or vertically in segments corresponding to a vertical outside or a vertical inside arc. The switch frame can be moved by a drive motor which causes the switch frame to move along a straight line.

b. A traveling platform is arranged between two or more line sections oriented parallel to each other, especially at their ends, in recesses between free ends of the supporting rails of each of the line sections. The traveling platform can be moved perpendicularly to the direction of movement by means of a drive motor with at least one section of supporting rail in such a manner that the supporting rail section can, as desired, be placed between the free ends of the supporting rails of the line sections or the ends of the line sections. A considerably space saving can be achieved at the end of a "double-track" line since a turn around loop can be eliminated.

c. In the case of a meeting of vertical line sections having conveyor profiles and supporting rails staggered relative to each other the lower flanges of which will point in different directions, the upper flanges at or near a common vertical axis and free ends of the supporting rails are associated with each other at a certain interval. A supporting rail section can be rotated or swung around the vertical axis by means of a drive motor and, in terms of its overall length is adapted to said space. Such a turn around rail opens up the possibility of numerous line arrangements, for example, a line layout in the form of a "U" which lies in a perpendicular plane on one of its shanks. This arrangement, of course, is theoretically conceivable also with a twisting of the supporting rail. However, such an arrangement is impossible to put in practice because of the insufficient length available for such a section. It is also impossible for reasons of safe guidance of overhead trolleys.

d. To cause a desired direction change in the movement of overhead trolleys, a so-called intersection switch is used in the case of "single- and/or multi-track" lines, which meet in a horizontal plane at an angle, which is less than 90°. Such an intersection switch is located and coupled with the maintenance of the lateral intervals of the supporting rails of "multi-track" lines at every one of the intersection points of the supporting rails. The intersection switch is equipped with a section of a supporting rail which can be rotated around the point of intersection, as with a drive motor. The intersection switch connects the free ends of the abutting supporting rails in the manner of a turntable. An intersection switch can be powered by means of an eccentrically guided set of rods and one or more traction and/or pressure elements by one common drive motor. Furthermore, in an intersection point of two "double-track" lines, the axes of the rotatable supporting rail sections are positioned on a common, solid frame and driven by a chain and sprocket arrangement. Eccentric pins are rotatably positioned on the frame. They are connected in the manner of an enclosed drive surrounded by a chain. A chain wheel driven by one drive motor engages into one of the sections of the chain located between two chain sprockets. The eccentric pins on the rotatable supporting rail sections are flexibly connected by an adjusting rod in such a manner than the four rotatable supporting rail sections are lines up parallel to each other in the two terminal positions of their rotatable or swingable state. Thus, the parallel-flowing traffic is not disturbed in case of "two- or multi-track" lines or supporting rails which run parallel.

To develop th laoding and/or unloading stations of the conveyor device, the following is also proposed according to the invention:

a. A raisable and lowerable platform is provided at the loading and/or unloading station. This platform can be shifted horizontally into the shaft and positioned under a container, suspended from the overhead trolley. The horizontal and the vertical movement of the platform can be performed in an alternating sequence so that the platform can be used not only to lift containers out of the overhead trolley but also to lift them into the overhead trolleys.

b. A feeder device is on the loading and/or unloading station for transportation of several containers which are to be placed in the overhead trolleys one after the other. The feeder device can be located below floor level and advance containers at suitable intervals in a direction away from, as well as toward, the shaft by means of pickups, transport hooks or the like which engage the containers by studs provided on these containers. Some of the containers may have already been removed and while some others are yet to be put in to position and are located in front of the shaft. This facilitates semi-automatic loading and unloading of the containers from the trolleys.

c. A section of the feeder device can be arranged on or in the platform, raisable and lowerable with it.

d. The feeder device can consist of a cart which can be run below floor level by a drive motor. A feed unit for one container is provided in the cart. The feed unit consists of two, bell crank levers which are arranged one behind the other in the direction of advance and which are positioned swingably near the floor level. One arm of one of said levers is a transport hook. On the other arms thereof, connected flexibly with the corresponding arm of the other lever by a tandem rod, an electromagnet or the like engages against the force of a spring in such a manner that the transport hooks are erected in case of activation of the electromagnet and they are lowered when the electromagnet is at rest, due to the force of a spring, that is positioned below the floor level. Complemental means such as rings, or the like are provided on the containers for entry of the transportation hooks thereinto.

e. On floor level, perpendicularly to the direction of advancement of the container and engaging in it, ther is provided a series of further feed devices — similar or identical to the feeder device mentioned above — which facilitate the setup of the containers from a surface beside the cart rails.

Other details according to this invention, aimed at the development of the containers of the conveyor device, consist in the folloiwng:

a. The standard containers of a conveyor system, which have a certain height and width, can be modified to provide a proper loading space for a specific material to be transported. This can be accomplished by providing on the floor and the inner ceiling of thee container's gross loading area, roughly U-shaped frails — for the insertion of one or more vertical partitions or walls — and on the side walls of the loading space and/or on the vertical partitions thus inserted horizontal bars to provide for intermediate shelves of corresponding width which can be inserted between the side walls. The partitions and intermediate shelves, which are not needed for the proper loading or placement of the material to be transported, i.e., for setting up the loading space, are stowed on the floor in a flat shelf area under the loading space. Thus, the loading space can be modified and adjusted in accordance with many different requirements.

b. For the transportation of larger or smaller quantities of material, which cannot be stacked or which cannot be placed on the intermediate shelves, there are provided tub-like containers with laterally extending flanges for suspension on the horizontal bars of the side walls and/or partitions. The width of said containers can be adapted to the vertical subdivision, if any, of the loading space by the U-shaped rails at the floor and ceiling of the loading space.

c. The containers can have two doors on the front as well as on the rear side thereof which are arranged so that they can be swung through an angle of 270° around vertical axes, located near the vertical edges of the containers. Said doors are equipped with retaining means, such as spring clamps, magnetic means or the like, in such a manner that the doors, after being swung around by about 270° will come into engagement with the pin or pins which arre provided on the side walls of the container. The doors can be attached to the pins or be held in some other way, preferably so that it can be assured that the doors will not be open and swinging loose so as to interfere during the process of loading or unloading the material to be transported.

Another developmental feature of the invention is as follows: In front of the loading or unloading station, especially in front of an accumulation area with a feeder device, there is arranged a door-closing lock which consists of guide planks that are equipped with rollers which are arranged to approach each other, in a funnel-like manner, up to about the width of the containers. Substantially at the beginning of one section, in which the guide planks run parallel to each other, spring-stressed, swingably positioned levers, at whose ends closing rollers are rotatably positioned, laterally engage the clearance profile for the containers. Thus, one can be assured doors are either properly closed or are opened wide and clamped against movement.

Finally, some developmental features of this invention relate to the suspension of the containers on the overhead trolleys and consist of the following:

a. Means are provided for the swinging suspension of a container on an overhead trolley for the purpose of reducing or preventing swing motions of the container out of the latter's resting position which is determined by the center of gravity. In case the containers swing back and forth excessively, the running qualities of the overhead trolleys can be unfavorably influenced and, in the worst case, damage can be inflicted on the containers as well as on the equipment.

b. A yoke is attached to the supporting frame of the overhead trolley, which yoke spans the width of the container. In this yoke there is placed a suspension yoke which can be swung around a horizontal axes. This suspension yoke is provided on the inside facing toward the side walls of the container with recesses that are open toward the top so as to provide bearings for the pins attached to the side walls of the container. These means, to reduce the swinging movements, engage, on one hand, with the yoke and, on the other hand, with the retaining yoke.

c. Means for the reduction of swinging movements consists of a blocking motor with a pinion engaging a gear rim segment, whereby the blocking motor is attached with the pinion to the yoke and the gear rim segment is attached to the retaining yoke, and with such an arrangement the blocking motor can be adjusted by angle comparison between a freely suspended, weight-stressed pendulum and the retaining yoke.

d. For the angle-dependent adjustment of the blocking motor there are provided a slide contact on the pendulum and a contact bar on the retaining yoke. Thus, an adjustment of the blocking motor in a direction opposite the angle deviation of the retaining yoke and the container can be accomplished.

e. On the contact bar, outside the contacts for the activation of the blocking motor, one, each, additional contact is provided. In case of extraordinary inclination of the retaining yoke and of the container and accordingly large angle deviation of the pendulum and thus an impact of the sliding contact upon one of the outside contacts, the drive motor of the overhead trolley is shut off.

f. Guide rollers are rotatably positioned on the containers or on the retaining yokes and guide rails are arranged for the guide rollers in such a manner that the containers — especially along vertical line sections — can be guided in a manner which is secured against swinging. Such means can be used in addition to the above-mentioned means for the reduction of a swinging motion or under special circumstances, can be used as an alternative thereto.

The invention will be better understood, and further objects and advantages will become more apparent, from a reading of the following specification, taken in conjunction with the drawings, in which:

FIG. **1** is a side elevational view of one form of trolley suspended on a horizontal trackway;

FIG. **2** is a side elevational view of the same trolley climbing an arcuate trackway;

FIG. **3** is a side elevational view of the same trolley climbing a vertical trackway;

FIG. **4** is a side elevational view of the same trolley on a different curved trackway;

FIG. **5** is an end elevational view of the same trolley with the trackway shown in section;

FIG. **6** is a view generally similar to that of FIG. **1** with linkage elements being added thereto;

FIG. **7** is a view of the trolley generally similar to FIG. **3** but showing the linkage feature;

FIG. **8** is a side elevational view of a further embodiment of a trolley;

FIG. **9** shows the trolley of FIG. **8** climbing an arcuate trackway;

FIG. **10** shows the trolley of FIG. **8** climbing a vertical trackway;

FIG. **11** shows the trolley of FIG. **8** traversing an oppositely curved trackway;

FIG. **12** is an end view of the trolley of FIG. **8** showing the track in cross section;

FIG. **13** is a cross-sectional view of one way of applying current to the trolleys;

FIG. **14** shows a partial side elevational view of a trolley with a current cart shown in phantom lines;

FIG. **15** shows an end view of another trolley and the manner in which it can transport a load beneath a trackway;

FIG. **15***a* shows in full and dotted lines a tiltable switch mechanism showing a trolley in full and phantom lines in vertical and horizontal planes, respectively;

FIG. **16** shows still another trolley embodiment in a side elevational view;

FIG. **17** shows an end view of the trolley of FIG. **16** with the rail in cross section;

FIG. **18** shows the trolley of FIG. **16** climbing a vertical trackway;

FIG. **19** shows the trolley of FIG. **16** mounted on a different type of trackway which is shown in cross section;

FIG. **20** shows a bottom plan view of the trolley of FIG. **16** with its driving elements;

FIG. **21** shows an end elevational view of the trolley of FIG. **16** suspended from a different type of trackway which is shown in cross section;

FIG. **22** shows a cross-sectional view of a current collector;

FIG. **23** shows in a perspective view an element in a track network for changing directions of trolleys;

FIG. **24** shows diagrammatically a sliding crossover in one position in a network of tracks;

FIG. **25** shows diagrammatically the crossover in another position;

FIG. **26** shows a perspective view of a crossover at a terminal section in a trackway;

FIG. **27** shows in a schematic perspective view a turn-around rail section in a trackway;

FIG. **28** shows in a schematic perspective view a line section with plural turn-around rail sections

FIG. **29** shows a further arrangement in the trackway system;

FIG. **30** shows a still further arrangement in the trackway system;

FIG. **31** shows in top plan view plural line switches between adjacent trackways;

FIG. **32** shows the switches of FIG. **31** in a different position;

FIG. **33** shows a schematic view of the switches of FIGS. **31** and **32** in a trackway;

FIG. **34** is a top plan view of four switches for a trackway system;

FIG. **35** shows the switches of FIG. **34** in a different position;

FIG. **36** shows graphically how yet another trolley is moved from one horizontal elevational trackway through a vertical track segment to a horizontal trackway in a higher plane;

FIG. **37** shows in end elevation the trolley system of FIG. **36**;

FIG. **38** shows in top plan a complete turn-around track section for the trolley system of FIG. **36**;

FIG. **39** shows in side elevational and cross-sectional views a device for feeding containers into a vertical trackway for assembly therewith or removal therefrom;

FIG. **40** is a cross-sectional view on line XXXX — XXXX of FIG. **39**;

FIG. **41** is a cross-sectional view on line XXXXI — XXXXI of FIG. **39**;

FIG. **42** is a cross-sectional view on line XXXXII — XXXXII of FIG. **39**;

FIG. **43** is a top plan view of a container showing a door attached to one side thereof;

FIG. **44** is a side-elevational view into an open container showing its shelving arrangement;

FIG. **45** shows the container of FIG. **44** with the shelves in one position;

FIG. **46** shows the container of FIG. **45** with the shelves in another position;

FIG. **47** shows the container of FIG. **44** with all shelving at the bottom thereof;

FIG. **48** shows a door closing mechanism for the container shown in FIG. **43**;

FIG. **49** shows the door closing mechanism for the containers adjacent to an accumulation area therefor;

FIG. **50** shows a side elevational and partial sectional view of a mechanism for controlling swinging movement of a container; and

FIG. **51** shows a partial sectional and side elevational view of the elements shown in FIG. **50.**

Turning now to the principal embodiment of the invention disclosed in FIGS. **1–5**, there is shown an overhead trolley conveyor device generally indicated as **200**, which is arranged to travel beneath a wide flange **110** by being supported by rollers traveling on the surface **111**. In describing this and future embodiments reference will be made only to one side of the trolley since both sides are substantially identical and in view of this it is believed that those skilled in the art will understand the operation thereof. From an examination of FIG. **5**, it will be noted that the supporting rail **100** generally simulates an I-beam including a web **120.** The overhead trolley **200** includes a supporting frame **202** of generally U-shaped configuration (as viewed from one side) and at the terminal ends of each portion of the U-shaped members is positioned a series of rollers, some of which support the overhead trolley in engagement with the floor of the I-beam and the others of which travel in engagement with the web thereof. As clearly shown in FIG. 1, it will be noted that at one end of the overhead trolley there is arranged a collar plate **205***a* for supporting the drive motor **206** and at the opposite end of the conveyor trolley a collar plate **205***b* is arranged to support a motor control box **207.**

The U-shaped frame **202** is closed at its top and provided with a horizontally extending element **202***a* connecting the legs of the U-shaped member and at the other end of which is arranged the aforementioned wheels that support the frame on the trackway and prevent lateral displacement thereof relative to the flange and medially of the horizontal element **202**a are provided upstanding perforate ears **202***b* which are bushed and in which large friction wheels **208** are arranged to rotate. As the description progresses a distinction will be made between large and small friction wheels and their functions narrated.

As is best shown in FIG. **5,** the friction wheels **208—208** are mounted outboard of the wheels **203***a* and **203***b*, thus all of the sets of wheels have a particular surface on the trackway **111** on which they travel.

Both sides of the frame **202** are provided with pivot points **210** which are arranged to frictionally receive the several arms **214** (one shown in FIGS. **1** and **2**), with the free end of each arm being received between a pair of ears **212** and **213.** Adjacent to one ear **213** is provided a supporting surface for a spring or other resilient member **211** which abuts the freely swingable arm **214.** The purpose of the swingable arm **214** and its resilient support will best be understood as the description progresses.

Medially of the swingable arm **214** and rotatably positioned in bushings **209***a* is a small friction wheel **209.** This wheel is of lesser diameter than the aforementioned large wheels **208—208** and as shown in FIG. 2 it is used to convey the trolley device **200** through an outside arc and is now traveling on the upper group of wheels in the direction of the arrow but driven by wheel **209.**

Also, both of the frame elements disposed on each side of the supporting flange **110** are perforated intermediate one leg of the U-shaped means and arranged to rotatably receive at **218** sheaves **219** with an endless belt **222** being entrained about that sheave and a sheave **221** whis is carried outboard on the shafts **208***a* that carry the large friction wheels **208—208.** Reference will be made interchangeably hereinafter to "sheave and belt" and "chain and sprocket" and it is to be understood that either may be availed of and the mere mention of either term is not restrictive of its use but merely suggestive.

The motor **206** is supported at **206***a* in the collar **205***a*. At one side of the motor is provided a sheave **216** which drivingly supports and endless belt **217,** the belt being arranged to drive the small diameter friction wheel **209** through the sheave **215.**

Carried on the same shaft **218** on which sheave **219** is supported, is a smaller sheave **220** (FIG. **5**) and by now referring to FIGS. **1–4** it will be noted that the motor **206** continuously drives, by reason of the belt arrangement, large friction wheels **208** which are positioned on opposite sides of web **120** and the smaller diameter friction wheel **209.**

With the benefit of the foregoing and by now referring to respective views shown in FIGS. **1–4,** it will be seen first in FIG. **1** that the conveying device is traversing the horizontal rail, toward the right as viewed in the drawing, with the wheels **208—208** positioned on each side of the web **120** and a supporting frame with its dependent yoke **223** extending vertically downwardly therefrom.

In FIG. **2** it will be noted that the trackway is bent into an inside arc which could occur when a conveying device reaches a predetermined location in its horizontal travel and is then to be diverted upwardly on a vertical extension of the original trackway. Since the wheels **208—208,** as well as the wide friction rollers **209,** are continuously driven through the belts, the weight of the article carried on the yoke **223** causes the wheels **208—208** to be lifted from the track **111** and the driving is then assumed by roller **209.** As viewed in FIG. **2,** the only contact with the vertical extension of the trackway and the frame **202** is by the upper wheels **203***a***—203***a* and **204—204** (one only of each shown) with roller **209** still driving the conveyor. It is well to point out here that the heavier the load G to be transported by the yoke **223,** the greater will be the force with which the friction wheel **209** is urged against its running surface on the beam. The frictional engagement thus depends on the load.

Assuming that at an appropriate location the conveying device is to now assume its horizontal travel, we refer to FIG. **4** where it is noted that the lower friction roll **209** is still driving, but as soon as the conveyor attains the horizontally disposed trackway, the wheels **208—208** will once again be the entire support of the load carried by the yoke **223.**

As distinguished from the condition shown in FIG. 2 where the conveyor is traveling through an outside arc, attention is invited to the fact that, as shown in FIG. 4 where the conveying device is traveling about a vertical inside arc preparatory to assuming its travel on the horizontally disposed trackway, it is to be noted that the wheels **208—208** are lifted from engagement with the trackway **111.** The pairs of supporting wheels **203—203** and **203***b***—203***b* *l*run upon guide rails **115** so that the friction wheels **208** are entirely disengaged from the track.

In the embodiment of the invention shown in FIGS. **6** and **7,** the friction wheels **208—208** are rotatably supported on rocker arms **230,** the lower extremities of which are pivotally attached at **218** to the frame **202.**

In this instance, it is to be noted that the swingable arm **214** instead of being connected at a corner of the frame, as shown in FIG. **1,** is, in FIGS. **6** and **7,** arranged to abut rocker arm **230** and rotate about the same pivot point thereof. In the principal embodiment of this invention shown in FIGS. **1–5,** the rocker arm **214,** which is stressed by spring **211,** facilitates the constant friction engagement of the friction wheel **209** which, in case of small circumferential speed and high torque, produces a starting moment which is higher when compared to the larger friction wheels **208—208.** This condition is also achieved in the structure of this embodiment shown in FIGS. **6** and **7,** only accomplished in a different manner. Here, the swingable arm **214** is provided adjacent to its free end with a lever **232** which is swingably supported on the ivot **231,** the other end of the lever being pivotally attached at **233** to a two-arm lever **234.** This arm is supported substantially medially of its length by means extending from the arm **202***a*, the free end of the arm being provided with a bifurcated portion which straddles a pin or axle extending from the rocker arm **230.**

Referring once again to FIG. 6, it is to be understood that the large friction wheels 208—208 are pressed against the upper surface of the rail 111 due to the force of spring 211 and by reason of the leverage system comprising arms 232 and 234, and this is accomplished whether or not the upper surface of the flange is perfectly flat or is uneven.

In FIG. 7, which illustrates a slow run vertical line section, the small friction wheel 209 is now shown driving the conveyor with the rocker arm moved in such a manner against the force of the spring 211 that the lever system associated therewith has raised the friction wheels 208—208 out of contact with the rail. It will also be noted further from an examination of FIG. 7, and here it must be stated that the following is also understood to be true of vertical outside and inside arc traveling of the conveyor device relative to the trackway, that there is provided on flange surface 100 supplementary rails 117 which provide an additional surface area 111*a* which can serve as a running surface for the supporting rollers 203*a* and 203*b*.

In another embodiment of this invention there is shown in FIG. 8 a structure which generally corresponds to that shown in FIG. 1; however here there is disclosed a trolley 200 which includes a V-shaped frame 210, the upper portion of the frame being supported on the flange 111 by rollers 211*a* and 211*b* with lateral movement of the trolley being controlled by the rollers 212—212 that are carried by the horizontal element 213.

It is to be noted that in the embodiment of FIG. 8, the rollers 208—208 have been eliminated and all driving forces are derived from the broad friction roller 221 which is positioned also in a swingable arm identified here as 220. The friction roller 221 is driven by a gear motor 230 which has a changeable rpm, by means of a chain or belt drive 222 which cooperates with sheaves or sprockets carried by the motor 231 and the friction roller 233, respectively. The control equipment for remote control of the motor 230 is contained in the switch box 240. The material to be transported (scuttles, containers or the like) is removably attached to the crotch of the "V" as indicated at G of the trolley 210 with the containers not being illustrated.

In the case of horizontally disposed trackways, as shown in FIG. 1, the trolley 200 and its load G are completely supported by the supporting rollers 211*a* and 211*b*, while the friction roller 221 is pressed against the surface 211 by reason of the spring 222. Supplementary to the action of the spring, quick starts are achieved by reason of the belt ro chain pull driving in the direction shown which has a tendency to force the roll 221 up into cooperation with the surface 112 of the trackway.

When making a transition of the trolly from the view shown in FIG. 8 to vertical movement in the concave curve according to FIG. 9, the developing tipping moment, between the friction roller 221 and the forward supporting roller 211*b*, progressively increases the pressure against the rail due to the load G, in keeping with the degree of rail inclination. Here, the nose of the swingable arm 220 is shown as being supported on the ear 223 of the trolley frame 210.

Referring now to FIG. 10, which now shows a trolley running in a vertical plane, it will be seen that the weight suspended at G exerts a maximum pressure of the friction roller 221 against the rail thereby assuring reliable transportation of the article suspended at G in a vertical direction. In FIG. 11 the trolley is shown traversing an inside arc on a trackway which generally resembles that shown and described earlier in connection with FIG. 4. When the trolley is traveling through such convex curves as shown in FIG. 11, the same tipping moment develops as during vertical runs or in concave or outside arcs as shown in FIG. 9. Thus, it is seen that perfect frictional roller drive is attained.

By reason of the fact that the relatively wide friction roller 221 extends over a wide area of the flange 112, it is worn down rather unfavorably due to friction particularly on horizontal curves.

It is, therefore, a part of the object of the invention to reduce the wear and tear on this friction roller 221 by virtue of the fact that the friction roller pressure according to FIG. 8 is extraordinarily small due to the load takeover by the supporting rollers 211*a* and 211*b* in such curves. Through the use of a gear motor 230 having an alterable number of revolutions, such as is available in a pole changeable motor, the running speed of the friction roller is reduced shortly before such curves by switching the motor back to a smaller number of revolutions so that no additional pressure is transmitted by reason of the belt or chain driving the friction roller at a high speed when it comes into engagement with the surface 112 of the flange. Also, in vertical curves and perpendicular track sections, the running speed of the trolley is reached, however, here, an increased torque takes effect coupled with load-dependent pressure application of the friction roller 221 against the trackway 112.

Power transmission to the trolley 200 is of decisive significance for the trouble-free operation of a conveyor device with self-propelled overhead trolleys. Essential improvements were achieved by mean of a new design now to be described.

According to FIG. 13, additional rails 140, having a generally C-shaped profile, are attached to the lower surface of the upper flange of the supporting rail 130. A current collector part 150 provided with guide rollers 151 are arranged to travel on the oppositely disposed surfaces of the C-shaped rail member as well shown in FIG. 13. It is also contemplated that the same type of current collector cart could be utilized and arranged to travel on a piece of the oppositely disposed offstanding portions of the head of a T-shaped element if the base of the "T" was secured to the web 120. As viewed in FIG. 13, the current charged rails 141, carried on the inner face of the C-shaped member, are arranged to face toward the web 120 and are embedded in the surface of the C-shaped member in an electrically isolated manner. As is also well shown in FIG. 13, sliding contacts carried by the current collector cart 150 are arranged to pick up current and conduct it by means of cables to the switch box 240 which will transmit suitable impulses to the drive motor 230. It is also to be understood from FIG. 13 that the C-shaped elements which provide the supplementary rails for carrying the current collector cart, are arranged on opposite sides of the web 120, one being utilized for running current and the other being used for a steering current control.

It has been determined that the current surge which develops during the starting operation can be more favorably transmitted if the current cart 150 is not started up simultaneously with the trolley 200 but rather it is preferable if it initially remains at rest. This is achieved, in accordance with FIG. **14**, as another feature of this invention, in the following manner: A pickup pin **152** carried by the current cart **150** extends into a position between two spaced studs **251** and **252** of the pickup device **250** on the trolley **200**. When the trolley **200** starts up, the current cart **150** at first remains standing until the stud **251** has reached the pickup pin **152** and only then is the current cart **150** picked up and taken along. In the meantime, however, the starting current has faded, so that the running current collector merely has to transmit normal current intensities. When braking the trolley **200**, the current cart **150** first of all continues to run until the pickup pin **152** touches the stud **252**, at which time the initial position for restarting has been reached again.

Referring at this time to FIG. **16**, there is shown an overhead trolley **200** which uses the current cart and which is supported by means of support rolls **203***a* and **203***b* on the I-shaped beam previously described. The trolley is guided by lateral guide rolls **204—204** which are pressed against the walls of the web **100.** The trolley has a frame **202** in which an arm **214** is swingably supported by an axis **210.** One arm of the swingable member carries a driving motor **206** for a pair of friction wheels **121** and **122** (see FIG. **17**) and a smaller friction wheel **209** interposed therebetween, all of which are supported by a common axis **209a** and supported by the other arm of the rocker. The latter arm of the rocker is in spring contact with trolley frame **200** via a compression spring **15** and is pressed in the direction of supporting rail **111.**

The view in FIG. **17** shows how friction wheels **121** and **122**, which are freely and coaxially rotatable around axis **14** are placed on each side of friction wheel **209** and symmetrically in relation to the supporting rail. Friction wheels **121** and **122** have the same radius, but are slightly larger than the radius of friction wheel **209** and thus, friction wheel **209** does not come in contact with the lower surface of the bottom flange of the supporting rail when this surface is flat and no lateral portions thereof have been removed.

To bring the small radius friction wheel **209**, which is characterized by a smaller circumferential speed and a higher drive moment than the friction wheels **121** and **122**, into contact with the supporting rail, which, for instance, is necessary in vertical running, an additional rail **112** is fastened to the lower surface of flange **110** of supporting rail according to FIG. **19.** The thickness of the additional rail is greater than the difference between the radii of friction wheels **121–122** and **209.** In this way, the large radius friction wheels are moved away from their contact with flange **110**, and the drive of the trolley is solely accomplished via friction wheel **209.** The additional rail **112** is beveled or champfered at each end so that the trolley will be able to have a smooth entry and exit relative to that portion of the rail. In this way, a comparatively smooth change from one friction wheel to another can be attained. As is shown in FIG. **18**, friction wheel **209** is pressed against the supplemental rail **112** of the supporting rail under the influence of the weight of a container (not shown), but which may be suspended in a holder or yoke **223.** In this way, the rearwardly disposed support roll pair **203***b* (only one shown), is lifted away from the flange. Compression spring **211** counteracts the swing of rocker **214** due to the influence of the weight of motor **206.**

FIG. **20** shows how the driving of friction wheels **121–122** and **209** is accomplished by a common drive chain **217** which is driven by sprocket **216**, this being fastened to the axis of the drive motor **206.** Drive chain **217** is placed around the sprocket of driven means **215** which is fastened to friction wheel axis **209***a*, so that friction wheel **209**, which is also fastened to friction wheel axis **209***a*, can be rotated.

The driving of the large radius friction wheels **212** and **122** is accomplished by intermediate axis **75**, which is provided with a secondary driven sprocket means **76** at one end, this driven means having a smaller radius than sprocket means **215** and also arranged to be driven by chain **217.** To assure a firm engagement between secondary driven sprocket means **76** and chain **217**, a tension wheel **77** (FIG. **18**) is provided which makes the chain travel a more tortuous course. The sprockets **78** and **79** are arranged in spaced relation and are fastened to axis **75** and are rotatable therewith. Also, sprockets **78** and **79** cooperate with sprockets **80** and **81** by means of the drive chain **82.** The sprockets **80** and **81** are rigidly connected to friction wheels **121** and **122** but can be freely rotated around axis **209***a*.

With this design it is possible to give the friction wheels different circumferential speeds and angular momentum with one motor. Also, in case the friction wheels **121** and **122** have a larger radius than friction wheel **209**, the difference in circumferential speed and drive speed will be even greater.

In FIG. **21** another arrangement of this embodiment is shown. The change from the narrow fast friction wheels in contact with the supporting rail to the broad slow friction wheel in contact is accomplished by narrowing the bottom flange of supporting rail **110** to the extent that the fast friction wheel will not come into contact with the flange when the slow friction wheel is pressed into contact with the flange surface. When it is desired to again let the fast friction wheels come into contact with the flange surface during the conveying operation, the flange resumes its previous width and the slow friction wheel is lowered away from the flange surface.

The swing movement, which is necessary for a change from engagement between the fast friction wheels and the flange surface and engagement between the slow friction wheel and the flange surface, is made possible by the swingable support of rocker **10.**

A further embodiment of the invention in FIG. **14** is also shown in FIG. **15.** In this instance, the design of the the additional rails **140**, as explained hereinbefore, provides the basis for another innovation which resides in the utilization of these rails as the trackway of a trolley **160.** The running and guide rollers **151**, which as in the case of the current cart **150**, travel on the confronting edges of the rail **140**, are positioned in a frame **161** of the trolley **160.** This trolley includes a friction roller drive provided with a roller **162** and the gear motor **163** which is supplied by the current charged rails **141—141** and is controlled by means of the switching equipment provided in the box **164.** The trolley **160** is adapted to carry small size articles of raw material, generally depicted in dotted outline at **166.** In this way material can be transported independently of its position and no complications whatsoever develop during vertical travel in a perpendicular or curved plane.

The frame **161** of the trolley **160** is so designed that the supporting rail **110** of the main trolley **200** is surrounded without coming into contact therewith so that it is capable of using the existing main rail trackway, but, on the other hand, can continue on into branch-off lines into which no main support rails **100** lead, but into which merely the supplemental rails **140** extend. By means of this accessory device, one can use a conveyor device intended for heavy material for rapid supply with small-size material and under certain circumstances and conditions one can replace a mail tube installation because with the tipping switch shown in FIG. **15***a* and described hereinafter, it is possible without any difficulty to travel on side lines consisting only of the supplemental rails.

According to FIG. **22**, a current collector assembly is attached by means of screws **238, 239** to a current collector member **237** which is connected, in a manner not shown in any greater detail, with the supporting frames **202** of the overhead trolley **200** (FIGS. **1–7**) and which extends into the area provided between the three rails **150** (only one shown), the current collector consisting essentially of a housing **240** with a bottom portion **241**, a cable channel **242** and a current collector slide **245** which is arranged for sliding motion in the guide shaft **243** of the cable channel **242** in the direction toward rails **150** and perpendicular thereto. In these current collector slides there are molded or cast two hard-metal contact pieces **246** which are arranged one behind the other in the direction of movement; these contact pieces being somewhat wider than the flange **151** of the rails **150** and are slanted in the direction of movement. On the side of the current collector slide **245**, which is opposite the hard-metal contact pieces **246**, there are arranged recesses **247** which are roughly coaxially disposed with respect to these slides and provide abutments and radial guides for springs **248**, the other ends of which are supported on a current bus bar **249** which is clamped or held between the current collector housing **240** and the floor **241** by means of screws **238, 239.** The hard-metal contact pieces **246** and the current bar **249** are connected with each other by means of a cable **250**, the length of which is dimensioned accordingly to limit the path of the current collector slide **245** toward the outside. One end of the bus bar **249** engages the cable channel **242** and there serves for the connection of cables for the current supply of the overhead trolley **200** (FIGS. **1–7**). To the side of the hard-metal contact pieces **246** on the current collector slide **245** there are laterally secured guide skids **252** which surround the flange **151** of the bus bar **150** and which carries the contact surfaces **152.** In this manner the current collector slide **245** can be perfectly guided also normal to the direction of travel in a satisfactory manner.

Relative to the trackway system or the line network by means of which trolleys may be caused to travel universally over great distances, reference is now made to the following.

The first embodiment of a simple type of switch which offers certain operational advantages, is shown in FIG. **15***a*. Here, if any incoming trolley, such as **160** shown in the drawing, is to be diverted into the horizontal side line B, it is brought to a stop at the upper part of the rail portion **310** (as shown in full lines) of the tiltable switch **300** and thereafter by unlocking the switch track section **310** it it tipped into the position shown with the dot-dash line, eithe manually or by remote control. Tilting of the track may be executed in various ways. Preference is given to the illustrated coupled crank drive with sine-shaped movement path which assures a gentle start and a gentle termination of the tilting process.

The vertically extending track A includes spaced end portions A1 and A2 with the section A1 being provided with an angularly extending arm **301,** substantially medially of which is provided with transverse means a portion of which thereon is secured to a tiltable track section **310,** as shown. Motor means **303** mounted adjacent the free end of arm **301** is associated with links **304** and **305** with the latter being pivotally affixed to the rail section at **306.** It will be readily understood how the tiltable track section **310** can be moved from the vertical full line position into a horizontal disposition where it will provide for communication of a trolley with track section B (only the section B to the right side of the drawing being shown).

According to FIGS. **23, 24** and **25**, two "double-track" lines A1–A2, B1–B2, C1–C2, D1–D2 intersect each other in horizontal and vertical planes; these double-track lines being made up of supporting rails **300** — substantially identical to or similar to the supporting rail **100** disclosed in FIGS. **1–7.** The horizontal line sections A1–A2 and B1–B2 are placed in a shaft HS, while the vertical lines C1–C2 and D1–D2 are placed in a shaft VS; the supporting rails **300** of the lines end in free end portions **301** at the intersection and these ends are arranged to terminate in the same plane.

Whether it is desired to retain or change the direction of movement of overhead trolleys **200** (FIGS. **1–7**), use is made of a sliding crossover **310** (FIG. **23**) which consists of an adjustable switch frame **314** that is guided into various positions.

It will be understood from a study of FIG. **23** that the trackway **310** can perform a multiplicity of functions, e.g., the trackway comprises a pair of short horizontal portions **315** and **316** which can be moved between the ends of horizontal tracks **301—301** so as to provide for uninterrupted travel in one direction on lines A1–A2 and B2–B1. This same section also includes vertically disposed track sections **319** and **320** which can be positioned between D1–D2 and C2–C1 for vertical travel of the conveyor trolley. In addition, when one desires to alter travel of the trolley from horizontal to vertical or vice-versa, then the trackway **310** is moved a predetermined distance until the arcuate sections **317** and **318** are positioned between B2 and A1 so that these horizontal sections now communicate with D1 and C2, respectively.

In the more schematic illustrations according to FIGS. **24** and **25**, the sliding crossover **310** is equipped only with one supporting rail section **317** corresponding to a vertical outside arc and only one vertically oriented supporting rail section **319**, in addition, however, it is also equipped with a supporting rail section **321** corresponding to a vertical inside arc.

The following line connections for a trolley are established by reason of the location of the sliding cross-over **310** illustrated in each case: according to FIG. **23**, A1–C2 and B1–B2; according to FIG. **24**, A1–A2 and B1–B2; and according to FIG. **25**, A1–C2 and B1–B2. In FIG. **25**, for example, the sliding crossover **310** is moved by one step farther toward the left in the drawing — when compared to the position according to

FIG. 24. If another step were to be taken in the same direction, one would thus attain the position indicated with the broken lines, in which one then has established a line connection C1—A2 and D1–B2. As explained earlier, the sliding crossover 310 can be adapted in a very simple manner to the requirements of any desire line layout.

According to FIG. 26, a "double-track" line E1–E2 and F1–F2, coming from a horizontal shaft HS, ends, e.g., above the ceiling DE on the second floor of a building, whereby vertical outside arcs according to FIG. 2 are contained in the supporting rails 300 attached to holders 300*a*. On the free ends 301 of each of the supporting rails 300, there is arranged a traveling platform 330 which consists of a frame 333, which can be shifted normal to the direction of movement of the trolley by means of guide rollers 331 that are supported in fixed guide rails 332—332 and the transfer rail section 334 can be moved in such a manner that this rail section 334 can, as desired, be placed at the end of either line E1–E2 or the line F1–F2. From the foregoing it will be apparent that an overhead trolley 200 can arrive on line E1–E2 and be held at transfer section 334, then by moving the platform 330 from the dotted line position indicated by means of a drive motor, not shown, to the full line position where it coincides with the end of trackway F1, the overhead trolley can then drive away in the opposite direction.

In FIG. 27, there is an enlarged view of two vertical lines G and H which are spaced apart by a rotatable rail section 335 for a purpose now to be described. The swingable rail section 336, which is adapted to fill the space between the free ends 301 of the supporting rails 330, is supported thereon by means of bearings 337 and bearing pins 338, these being attached near the opposite ends of the supporting rail section 336 and to the surface of the upper flange 130. To swing or rotate the turnaround rail 335 at suitable or predetermined intervals one may use a drive motor which is not illustrated.

FIG. 28 schematically illustrates the utility of the turnaround rails 335. Here, two such rail sections 335*a* and 335*b* are inserted between line sections G1 and G2, arranged as a "double-track" line, of a vertical turnaround loop GH with two other rotatable sections 335*c* and 335*d* being inserted in line sections H1 and H2. The maneuverability of the overhead trolley conveyor 200, determined by the position of the supporting rails, is depicted by broken arrows. The normal location of the horizontal line segments G1 and H2, as well as those of the vertical line segments G2 and H1, are normally too close together to provide for a rail section turnaround. The tracks must be placed farther apart to provide a loop GH and this can be done through the use of terminal segments G2*a* and H1*a* which are inserted in line segments G2 and H1, as shown. In order to be able to guide the overhead trolleys 200 in accordance with this concept, they are, in the case of this transition from line segment G1 into line segment G2, swung around by 90° by means of the turnaround rail 335, so that they can run on the "overhanging" terminal segment G2*a*. In order to run on and run into the turnaround loop GH — in which the overhead trolley of course must likewise run in a "suspended" manner — this trolley is swung by 180° by means of the turnaround rail 335*b*. In the opposite sequence of movement, the overhead trolley 200 reaches the line segment H2 via the turnaround rail 335*c*, the line segment H1, and the turnaround rail 335*d*.

The overhead trolleys 200 can also be sent back by using rail slide device 330 (see FIG. 26). However, the line layout illustrated in FIG. 28, in which the trolleys follow a predetermined or easily alterable path, naturally lends itself much better to varying loading and unloading conditions along the path. Here we illustrate at the same time that, in the conveyor device according to this invention one can in each case meet requirements regarding a certain loading and unloading device.

Other possibilities of varying a line layout are shown schematically in the examples according to FIG. 29 and FIG. 30. In both of these examples it is considered that two "double-track" lines J1–J2 and K1–K2, as well as L1–L2 and M1–M2, with conveyor paths facing away from each other, must be housed in a common vertical shaft, not illustrated further, which are arranged to meet in a horizontal plane.

At the upper end of the two "double-track" lines J1–J2 and K1–K2 as well as L1–L2 and M1–M2, a line change for the turnaround of the overhead trolleys 220, according to FIG. 29, is facilitated by means of two traveling platforms 330 (see FIG. 26) and according to FIG. 30 by means of vertical inside arcs (according to FIG. 4) of connected horizontal turnaround loops JK and LM.

The ends of the vertical line sections at their point of transition into the horizontal line sections, the supporting rails and the conveyor profiles of the lines J1–J2 and M1–M2 as well as K1–K2 and L1–L2, overlap in an intersecting manner because the upper flanges of the supporting rails face towards each other in the vertical shaft.

According to FIG. 29, this problem is solved in the following manner: The horizontal segments of lines L1–L2 and M1–M2 are staggered parallel to those of lines J1–J2 and M1–M2 and a double traveling platform 330*a* (in the manner of traveling platform 330 shown in FIG. 26) is inserted to balance out the lateral shift within the lines L1–L2 and M1–M2, while the lines J1–J2 and K1–K2 are designed in a throughgoing manner.

The same problem is solved according to FIG. 30 by a sliding crossover 310*a* (in the manner of the sliding crossover 310 according to FIG. 23) which is accordingly equipped with four sections of supporting rails arranged to provide pairs of trackways extending in opposite directions.

According to FIGS. 31, 32 and 33 a "double track" line is provided with a switch means 340 which is capable of being rotated 90° to divert travel from P1–P2 from trackways 300 across rail segments 341 so that travel of the trolley may go in the direction of Q1–Q2. It is apparent that such a transfer can also take place between N2–N1 on the adjacent turntable 340 either by going into Q1–Q2 or by coming from Q1–Q2 into N2–N1.

The foregoing is accomplished by the two intersection switches 340 which, together with their supporting rail sections 341, are held with their axes 342 in a common frame 343 to which at the same time is attached a common driving motor 344 with a two-arm swing lever 345. The ends of the two-arm swing lever 345 and the pivot points 346, which are arranged eccentrically on the supporting rail sections 341, are flexibly connected with each other by traction and pressure rods **347** in such a manner that the two intersection switches **340** are activated simultaneously by the driving motor **344** so as to attain either the position shown in FIG. **31** or that shown in FIG. **32.**

Thus, it is believed apparent from the foregoing that the intersection switches **340** facilitate both a straight-line passage of overhead trolleys and a change in the direction of movement, whereby the overhead trolley, which has been run up on the supporting rail section **341,** can be turned by means of intersection switch **340** and can be then placed on another line segment.

In FIG. **33,** we have an illustration of another way of employing the intersection switches **340,** that is to say, in order to have one trolley pass another. In the overhead trolleys **200***a*, **200***b* and **200***c*, coming from **N1,** it is assumed that the overhead trolley **200***a* has precedence and should therefore bypass those which are ahead thereof, i.e., trolleys **200***b* and **200***c*. This is achieved in a very simple manner by having the trolleys **200***c* and **200***b* guided, by means of the intersection switch **340** into the line section located in the direction toward Q2, so that the trolley **200***a* can drive on through. After that, the trolleys **200***b* and **200***c*, which have been overtaken, are again returned to the line and may proceed toward N2.

A bypass procedure, however, can also be facilitated for example — although it is often required at the same point, which is not illustrated any further — by arranging, in a horizontal line section, a traveling platform with two supporting rail sections which can be inserted into the line segment as desired. Here, one of the two overhead rail sections can be taken laterally out of the line with one or more trolleys which have been run up on it and which are to be overtaken and the other supporting rail section can be placed into the line, as a result of which one or more trolleys can be allowed to pass by on a priority basis. After renewed activation of the traveling platform (similar to FIG. 24), the bypassed trolleys can then continue their run.

In connection with FIGS. **31–33,** it should be noted also that the lines of course can also intersect at an angle other than an angle of 90°, whereby the swing-angles of the intersection switches are adapted to the intersection angle of the trolley lines.

According to FIGS. **34** and **35,** there are shown four intersection switches **340,** the support axes **342** of which form the point about which rail sections **341** can rotate between the ends of the adjacent ends of rails **300** with the sections **341** being positioned together on a fixed frame **348.** This frame is provided with four rotatable chain sprockets **350,** each of which is arranged to drive a link **349** about an axle **351** with said wheels being all interconnected by a drive chain **352.** At an appropriate position a chain wheel **354,** driven by a driving motor **353,** is provided so that the tracks **341** can suitably rotate as is well shown by FIGS. **34** and **35** where the links are shown as assuming different positions as the tracks are moved from the position shown in FIG. **34** to that shown in FIG. **35.** The links **349** are connected with pins **355** to the swingable supporting rail sections **341** through rod means **356** in such a manner that the rotatable supporting rail sections **341** of the four intersection switches **340** are pointed alternately parallel toward each other in the two terminal positions and permit through-passage either on lines N1–N2 and P2–P2 or the lines R1–R2 and S1–S2.

One variation of the arrangement according to FIGS. **34** and **35,** not illustrated, can, for example, consist in the following: The rotatable supporting rail sections may be made longer so that in each case they are placed against each other in pairs and also, so that the supporting rail sections **300,** arranged between two intersection switches **340** and shown in the drawing, will not be required. This is referred to as a quadruple intersection switch.

According to FIGS. **39–42,** there is provided on the loading and unloading station a platform **601** which can be raised and lowered and can be shifted horizontally into the vertical shaft BS and into a position where an overhead trolley **200** can be picked up. The platform **601** can be raised and lowered by a hoisting device and is arranged to hold and lift a cart that can be moved horizontally into position on rails by means of its wheels. The cart moves below the floor level in a groove **606** (see FIG. **35**). In its resting state, the platform **601** lies adjacent to the level of the floor.

According to FIGS. **39–42,** a feeder device consists of a cart **654** which is guided below floor level by means of rollers **651** in fixed rails **652** using a drive motor **653.**

It is part of the scope of all of these innovations that precautions have been taken in order to prevent too great a swinging of the transport containers during starting, while running through curves, or during the course of their being tilted by switch **300.** This is accomplished in the simplest fashion through the guide roller **370** and guide rail **170,** both of which are illustrated later herein in FIGS. **36** and **37** in dot-dash lines and where it is shown that rail **170** follows the course of the supporting rail **100** in such a manner that the vertical retention of the transport material yoke **260** will be assured, which yoke is pivotally positioned in the trolley frame **210.** Thus, a horizontal alignment of the transport material being carried will be assured.

For this purpose, the transport material yoke **260** is provided with the guide roller arm **272** and the latter is provided with the guide roller pin **271** which carries roller **270.**

According to another version of the invention (see FIG. **37**) a stepping motor **280** which is actuated via the impulse transmitters **101** in the arched portions of the supporting rail **100** is arranged to control the position of the transport material yoke **260.** The stepping motor **280** is arranged on the rigid trolley frame **210** (see FIG. **35**) and is associated with the transport material yoke **260** which is rotatably positioned in the trolley frame **210** by means of the chain drive **282** which includes sprockets **281** and **283.**

In the horizontal rail section **100***a*, transport material yoke **260** is thus held in a fixed manner by means of the stepping motor **280** with respect to trolley frame **210** and cannot swing out either during accelerating or deceleration and braking. In the inside arc section **100***b*, the transport material yoke **260** is advanced step by step by means of the impulse transmitters **101** so that when it reaches the vertical rail section **100***c*, it has been swung around by 90° so that the trolley is elevated with constant speed until it enters into the outside arc portion **100***d* where again by means of the impulse transmitters **101,** it is swung back until the fixed horizontal running position is reached in the upper horizontal rail track **100***e*.

As described, it is in the nature of the conveyor device with overhead trolleys, that turnaround loops are required for the turnaround of the transport device. This is believed to be apparent from the application. Thus, with a view to the position of the supporting rails **100** and of the trolley frame **210**, necessarily required by the loading and unloading stations, it is necessary to place the turnaround loop in a horizontal plane as well as in a vertical plane. Since this is connected with a great additional effort and space requirement, and since, on the other hand, the terminal loop can always be run through without transport material, the invention also relates to a simplification of the design used so far.

According to FIG. **38** there is shown a vertical loop which runs in a plane parallel to the flange surfaces **111, 112** of the supporting rail **100.** This vertical loop is considerably simpler, cheaper, and provides a manner of saving space when compared to the horizontal loop referred to hereinbefore because of the saving of two turnaround arcs; however, when the trolley **200** runs through, it requires the transport material yoke **260** to be swung around by 180°. This swing-around is very difficult to be brought about by means of guide rail and guide roller **270.** However, the previously described controlled swing-around by means of the stepping motor **280** offers a reliable solution to the problem.

In the arc of the support rail **100** there are attached the impulse transmitters **101** which control the stepping motor **280** in such a manner that the transport material yoke **260** is swung around by 180° as the trolley **200** runs through the loop and has changed its direction from an uphill course to a downhill course. The drive motor **653** is arranged in a fixed position in a well **655,** adjacent to well **606** for the hoisting stage, and is connected, via a casing drive **656,** with a spindle **657** which extends axially below the cart **654** and on which is positioned a cam **658** that is firmly connected with the cart **654.**

The upper floor section **659** of cart **654** (see FIGS. **40** and **41**) is level with **661** and passes through the narrow slit denoted at **660** which is provided in the cover **661** of both wells **655** and **606** which intersect each other.

In cart **654** there is a feeder unit for one container **400** provided with two bell crank levers **663** which are arranged one behind the other in the direction of travel, with both being positioned swingably near the floor level on axles **662.** One arm of the bell crank lever is a transport hook **664** while the other arm **665** is connected to the corresponding arm **665** of the other bell crank lever **663** by means of a connecting rod **666.** An electromagnet **667** attracts the arm **665** against the force of a spring **668** which surrounds the rod **666** which at one end abuts stop **669.**

To enable the transport hook **664** to communicate with the container **400** openings **670** are provided in the upper section of cart **654.** To limit and adjust the swing motion of the bell crank levers **663** adjustable studs **671** are provided.

The section of cart **654** which faces toward shaft VS engages the platform **601** of the lifting stage. Its drive spindle **610** is not shown in detail here. Near the edge of the platform **601,** which is located adjacent the shaft VS, a door **500** is arranged to meet this platform.

A container **400** is brought, by means of the lifting stage, to the place nearest the shaft VS, at the left in the drawing. It is then advanced to the right and the transport hooks **664** are swung high by activating the electromagnet **676** against the force of spring **668.** Thus, said hooks **664** engage in means defining openings **406** on the containers **400,** said openings being arranged in a frame **405.**

In this condition, the cart **654** is guided by the drive motor **653** shown in the drawing, toward the right. The electromagnet **667** is disconnected, as a result of which the transport hooks **664** are returned into the cart **654** and into its upper section **659,** due to the force of springs **668.** Cart **654** is returned into the starting position by means of drive motor **653** and another advance operation begins.

Since the platform **601** of the lifting engages within the pivoted bodies **403** from below and adjacent to the wheels **404** of the container **400,** it is impossible for the latter to roll off the platform. When the container or containers **400** are advanced by means of the feeder device, their pivoted bodies **403** are swung up to the floor level as a result of the traction exercised by the transport hooks **664** and the friction of the running wheels **404** so that the containers **400** run on their wheels **404** on floor level (FIG. **39**).

One variation in the design of a feeder device according to FIGS. **39–42** may, for example, consists in the following: the section of cart **654,** which is located toward the shaft VS and which contains a feeder unit, can, as desired, be connected or coupled with the lifting platform or with the feeder device.

In a further embodiment of this invention a preferred type of container is shown in FIG. **26.** The doors **402** are provided with double hinges and are positioned on both the front and back sides of the container **400** and are designed in such a manner that they can be swung through an arc of about 270° around a vertical axis located near the vertical edge portions of the container **400.** The doors are equipped with magnets **402*a*** as retaining means which, when the door **402** is swung open, are arranged to engage on the suspension pins **400** provided on the side walls **406** of the container **400,** so that the doors **402** cannot flap back and forth. Thus, it will be possible to have the vehicles transported by the trolleys when the doors **402** are open. This will also facilitate removal of any material to be transported without the necessity of opening the doors when stops are made.

According to FIGS. **43–47,** container **400** suitably has, when its height is greater than its width, a loading space **409** defined by its side walls **406,** its ceiling **407** and a bottom **408** and includes as well a flat shelf **411** supported by the side walls **406.**

On the ceiling **407** and on the bottom **408** within the loading space **409** there are optionally attached U-shaped rails **412** for the insertion of vertical partitions **413** and attached to them, as well as to the inside of each of the side walls **406,** are horizontal bars **414** arranged for supporting intermediate shelf elements **415** to be inserted as desired between the side walls **406.** From an examination of FIGS. **44–47** it will be readily appreciated how versatile the shelving and their supports can be made in order to transport a wide variety of articles, whether it be dishes, bottles, trays, linen, large receptacles or laundry bags. Any partitions **413** and intermediate shelf elements **415,** which are not needed to set up the loading space **409**, are stored in the area beneath the flat shelf **411**. The loading space **409** can thus be set up or adjusted in any desired configuration to meet the particular requirements without accomodate being any need for any extra storage areas to ccommodate any of these subdivision elements.

For transporting larger or smaller quantities or units of material that cannot be stacked or that cannot be placed on the intermediate shelf elements **415**, cup-like and tub-like containers **416, 417, 418** can be provided which include flange areas **419** for the suspension of the containers **416, 417, 418** by means of the horizontal bars **414.**

In still another embodiment of the invention there is shown according to FIGS. **48** and **49**, a door closing lock means **550** which is provided in front of a trolley loading or accumulation station. This lock consists of converging guide planks **552** which are equipped with rollers **551** and, as shown, include a throat area approximately the width of the containers **400.** At the beginning of a section, in which the guide planks **552** run parallel to each other, closing rollers **556** are so arranged rotatably, on levers **555,** rotatably positioned around a vertical axis **553** and stressed with a spring **554,** that the closing rollers **556** will laterally engage the clearance profile of the containers **400** so that doors **402,** which are not completely closed, can be pressed inwardly and therefor shut. Doors **402,** which are opened by a rather wide angle, may be opened more when they enter the door closing lock **550,** so that the attention of the operating personnel can thus be attracted. Of course, the doors **402** can also be so designed that it will be all but impossible to have one of these vehicles run through the door closing lock **550** when the door **402** of container **400** is opened.

A further embodiment of this invention that also has considerable utility, particularly where there is need for smooth flow of the containers by the trolley is now described. According to FIGS. **50** and **51,** there is firmly attached to the support frame **202,** not shown, of an overhead trolley **200,** FIGS. **1–7,** of the conveyor device, a yoke **701** which spans the width of the container **400.** In ball bearings **702,** provided near the ends of a yoke, there is swingably positioned by means of fixed axle **703** a suspension yoke **704.** This suspension yoke freely spans the width of container **400** inside the yoke **701.** On yoke **704,** roughly above the axles **703,** there are arranged loops **705** which open upwardly and in which the container **400** is suspended by means of pins **400*a*.**

On suspension yoke **704** where is also attached a gear rim segment **706,** the centering point of which lies on the axis of the axles **703.** On yoke **701** there is arranged a blocking motor **707** which through a pinion **708** engages the gear rim segment **706.**

From the axle **703** there depends by means of a ball bearing **709,** a two-arm pendulum **710,** the lower arm of which is stressed with a weight **711,** while the upper arm, pointing upward, has a sliding contact **712** which is arranged to glide over an arc-shaped contact bar **713** provided on the suspension yoke **704.**

Pendulum **710** is furthermore equipped with a friction brake in order to reduce its swinging motion; this friction brake comprising a brake ring **714** and a brake disc **716,** which is placed under pressure by a sprping **715.**

The suspension yoke **704** includes at its terminal end a pin **717** which bears a guide roller **718** arranged to be guided in a fixed guide rail **720** and which can, in special cases, be used to determine the position of the suspension yoke **704** and thus also the position of the container **400.**

The contact bar **713** is provided with five contacts; more specifically, in the middle it is provided with a resting contact point **721.** On either side thereof it is provided with one each of contacts **722—722** adapted to activate the blocking motor **707** and at each of the ends it is provided with a contact **723** for turning off the drive motor **706** of the overhead trolley **200** (see FIGS. **1–7**).

In case the suspension yoke **704,** with its container **400,** for example, due to any swinging motion resulting from acceleration, now assumes a slanted position with respect to the overhead trolley **200,** then the contact bar **713** glides in relation to the pendulum **710** which is always kept vertically by the weight **711,** into a position in which the sliding contact **712** hits one of the contacts **722,** as a result of which the blocking motor **707** carried by the yoke **701** is turned on in the corresponding direction of rotation and, due to the engagement of the pinion **708** on the gear rim segment **706,** the retaining yoke **704** guides the container **400** back into the upright position shown in FIG. **50.** As a result, the sliding contact **712** is moved into depression **721** and blocking motor **707** is again shut off.

In case of excessively slanted position of the container **400,** especially where damage might occur by reason of the exaggerated position, the sliding contact **712** will then engage the corresponding outer contact **723,** as a result of which the drive motor **206** of the overhead trolley **200** is turned off and the trolley comes to a halt. Thus, the only thing then that has to be done is to eliminate the cause of the unusual slanted position and any damage that might otherwise occur can be prevented.

The conveyor device according to the present invention offers many variations, both in terms of the overhead trolleys, their containers and their means of suspension, as well as in terms of the line layout and the loading and/or unloading stations, whereby fully automatic operation can be achieved, preferably by electrical controls.

What is claimed is:

1. A tiltable trolley mechanism for overhead railways having a driving motor means therefor, the combination comprising: a rigid suspension frame arranged to straddle and depend from the offstanding flanges of a suspension rail means, each flange including an upper and a lower surface, and have opposed pairs of wheels mounted thereon for travel on said upper surface; a biased pivotal link means connected to said frame beneath the suspension rail means; a friction drive wheel means rotatably supported by said link means; and drive means connecting said motor means with said frictional drive wheel to cause said trolley mechanism to traverse said railways.

2. A tiltable trolley mechanism as claimed in claim **1,** wherein the pivotal link means includes a free end portion received within a control recess formed on said frame for controlling the operation of said link means.

3. A tiltable trolley mechanism as claimed in claim **2,** wherein said control recess includes a resilient means, said last-named means being interposed between one limiting surface of said control recess and the free end portion of said link means.

4. A tiltable trolley mechanism as claimed in claim **3,** wherein the force of the resilient means and the drive means connecting said motor means with said frictional drive wheel urge said frictional drive wheel into contact with the suspension rail means.

5. A tiltable trolley mechanism as claimed in claim **1,** wherein said frictional drive means is positioned substantially medially of said opposed pairs of wheels which travel on the upper surfaces.

6. A tiltable trolley mechanism as claimed in claim **1,** wherein the suspension rail includes an upstanding web portion, and wherein said frame is further arranged to have mounted thereon opposed roller means that travel in engagement with the web portion, whereby lateral swinging motion of said frame is reduced.

7. A tiltable trolley mechanism as claimed in claim **1,** wherein dual frictional drive means, comprising said frictional drive wheel and a second frictional drive means, are interposed between said opposed pairs of wheels and are arranged to be driven by said motor means.

8. A tiltable trolley mechanism as claimed in claim **7,** wherein said dual frictional drive means are associated with rocker arm means on said frame.

9. A tiltable trolley mechanism as claimed in claim **8,** wherein said link means and said rocker arm means are interconnected by lever means.

10. A tiltable trolley mechanism as claimed in claim **9,** wherein said lever means is pivotally mounted on said frame adjacent to said dual frictional drive means.

11. A tiltable trolley mechanism as claimed in claim **1,** wherein the driving motor means is arranged to receive electrical power from a current cart means associated with the suspension rail means.

12. A tiltable trolley mechanism as claimed in claim **11,** wherein the current cart means is arranged to traverse the suspension rail means together with said trolley mechanism.

13. A tiltable trolley mechanism as claimed in claim **11,** wherein the suspension rail means includes web means and the current cart traverses on means affixed thereto.

14. A tiltable trolley mechanism as claimed in claim **11,** wherein the electrical power from the current car is transmitted through lost motion means to the motor means.

15. A tiltable trolley mechanism as claimed in claim **11,** wherein the current cart includes dual current supply, one of said currents being arranged for driving the trolley and the other being arranged for steering thereof.

16. A tiltable trolley mechanism as claimed in claim **11,** wherein the current cart means is arranged to support means straddling said suspension rail means.

17. A tiltable trolley mechanism as claimed in claim **16,** wherein the support means for said current cart includes supplemental drive means.

18. A tiltable trolley mechanism as claimed in claim **1,** wherein the suspension frame for the trolley mechanism includes cargo carrier means arranged to depend therefrom.

19. A tiltable trolley mechanism as claimed in claim **18,** wherein the cargo carrier means includes means arranged to cooperate with at least one secondary trackway means which extend parallel to the suspension rail means.

20. A tiltable trolley mechanism as claimed in claim **18,** wherein the suspension frame includes impulse transmitter means.

21. A tiltable trolley mechanism as claimed in claim **20,** wherein the cargo carrier further includes other motor means adapted to receive current from said impulse transmitter means.

22. A tiltable trolley mechanism as claimed in claim **18,** wherein the cargo carrier means includes power means for controlling the path of travel thereof.

23. A tiltable trolley mechanism as claimed in claim **22,** wherein the power means for controlling the path of travel of the cargo carrier includes endless drive means.

24. A tiltable trolley mechanism as claimed in claim **1,** wherein the suspension rail means includes impulse transmitter means.

25. A tiltable trolley mechanism as claimed in claim **1,** wherein the suspension rail means includes a web element having oppositely extending surfaces each of which has affixed thereto supplemental parallel rail means, said parallel rail means arranged to slidably support a current collector.

26. A tiltable trolley mechanism as claimed in claim **25,** wherein the current collector includes means to grasp the rail means.

27. A tiltable trolley mechanism as claimed in claim **25,** wherein the curent collector includes resilient means.

28. A tiltable trolley mechanism as claimed in claim **27,** wherein the resilient means surround conductor means.

29. A tiltable trolley mechanism as claimed in claim **1,** wherein the suspension frame is arranged to support a yoke means, said yoke means including means to support a container in a dependent position.

30. A tiltable trolley mechanism as claimed in claim **29,** wherein the means arranged to support a container in a dependent position includes means to control the deviation thereof.

31. A tiltable trolley mechanism as claimed in claim **30,** wherein the means to control the deviation of the container includes second motor means.

32. A tiltable trolley mechanism as claimed in claim **31,** wherein the second motor means includes means to control the operation of the motor means.

33. A tiltable trolley mechanism as claimed in claim **30,** wherein the means to control the deivation of the means arranged to support the container includes a pendulum means.

34. A tiltable trolley mechanism as claimed in claim **30,** wherein the means to control deviation of the containers includes a brake means.

35. A tiltable trolley mechanism as claimed in claim **1,** wherein the motor means is carried by the link means.

36. A tiltable trolley mechanism as claimed in claim **35,** wherein the link means includes idler means.

37. A tiltable trolley mechanism as claimed in claim **35,** wherein the frictional wheel means is coaxially arranged with other frictional drive wheel means.

38. A tiltable trolley mechanism as claimed in claim **37,** wherein said frictional drive wheel means and said other frictional drive wheel means have different angular momentums and circumferential speeds.

39. A tiltable trolley mechanism as claimed in claim 37, wherein said other frictional drive wheel means has a larger radius than said frictional drive wheel means.

40. A tiltable trolley mechanism as claimed in claim 1, wherein the frictional drive wheel means includes axle means rotatably associated with said frame, and secondary frictional drive means are positioned above said first frictional drive wheel means.

41. A tiltable trolley mechanism as claimed in claim 40, wherein the secondary frictional drive means includes means to drive the same independently of the frictional drive wheel means.

42. A tiltable trolley mechanism as claimed in claim 40, wherein the secondary frictional drive wheel means is arranged to be driven by means lying in a plane adjacent to the axis of said frictional drive wheel means.

43. A tiltable trolley mechanism as claimed in claim 1, wherein the lower surface of the suspension rail means includes a supplemental rail.

44. A tiltable trolley mechanism as claimed in claim 1, wherein the drive means includes idler means.

45. A tiltable trolley mechanism as claimed in claim 44, wherein the idler means is associated with the suspension frame.

* * * * *