C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406. Patented Jan. 23, 1912.

13 SHEETS—SHEET 1.

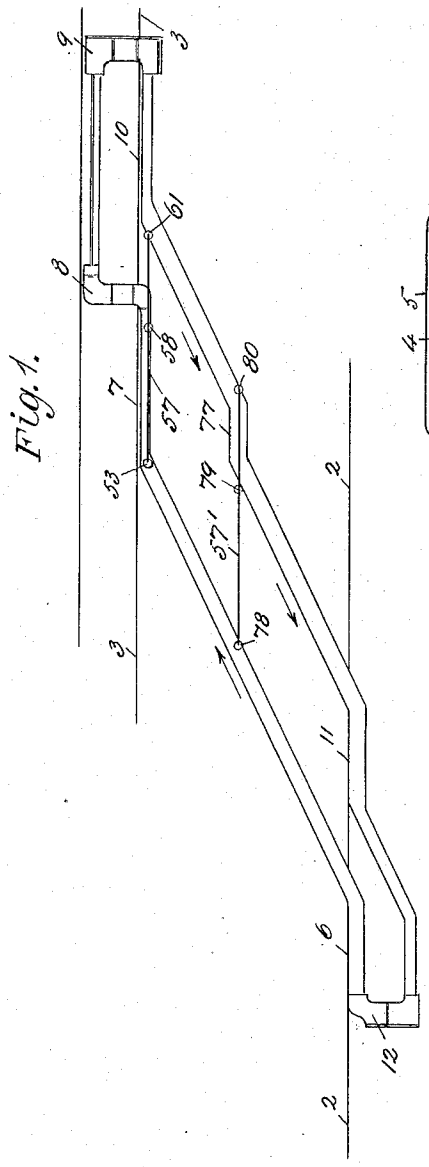


Fig. 1.

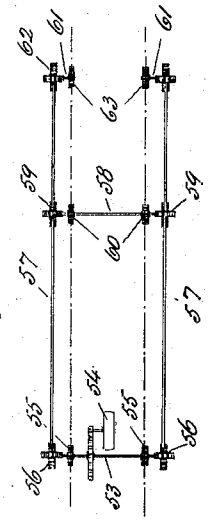


Fig. 2.

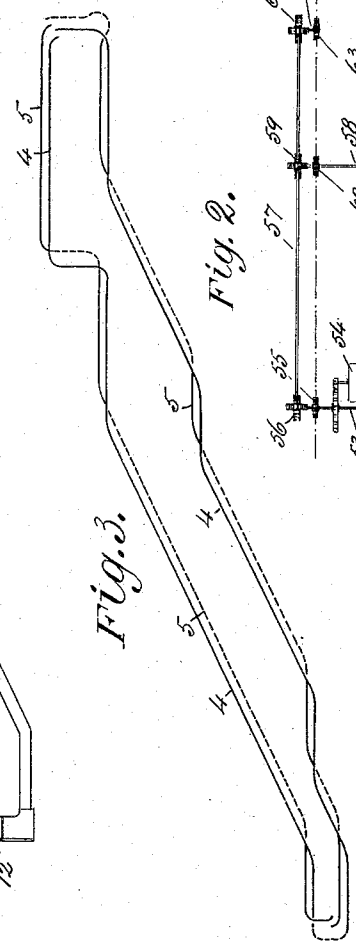


Fig. 3.

WITNESSES:

J. H. Kelbon

Carl Strobirk.

INVENTOR

CHARLES D. SEEBERGER.

BY Coburn & McRoberts

ATTORNEYS

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406.

Patented Jan. 23, 1912.

13 SHEETS—SHEET 2.

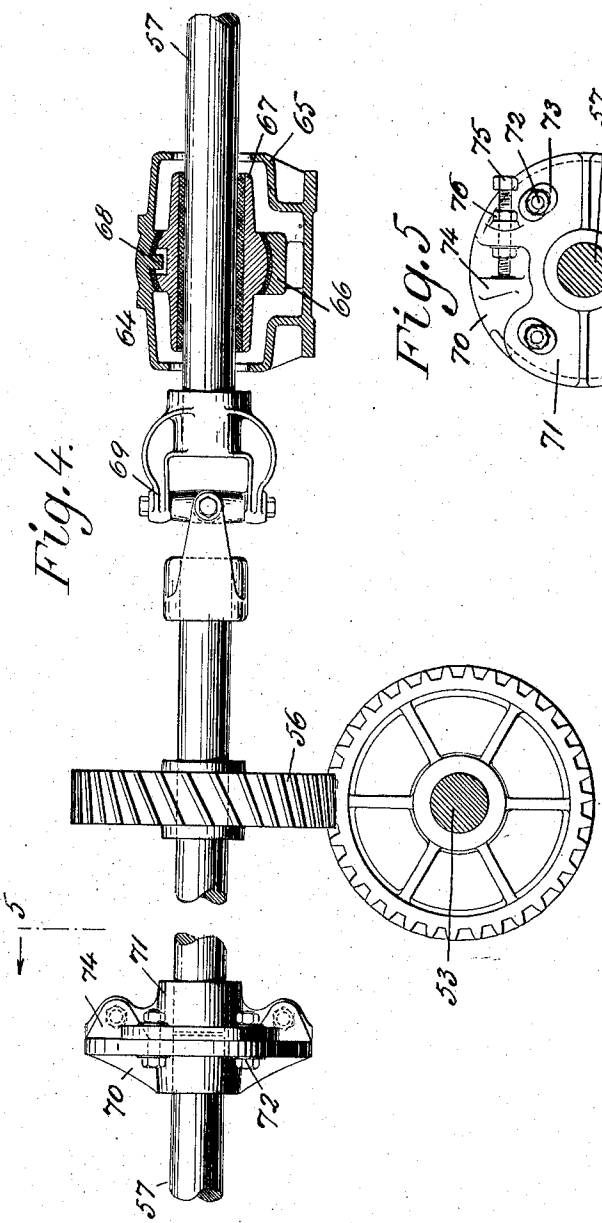


Fig. 4.

Fig. 5.

WITNESSES:

A. B. Seibert

Carl Strobirk.

INVENTOR

CHARLES D. SEEBERGER.

BY

Coburn & McRoberts

ATTORNEYS

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406.

Patented Jan. 23, 1912.

13 SHEETS—SHEET 3.

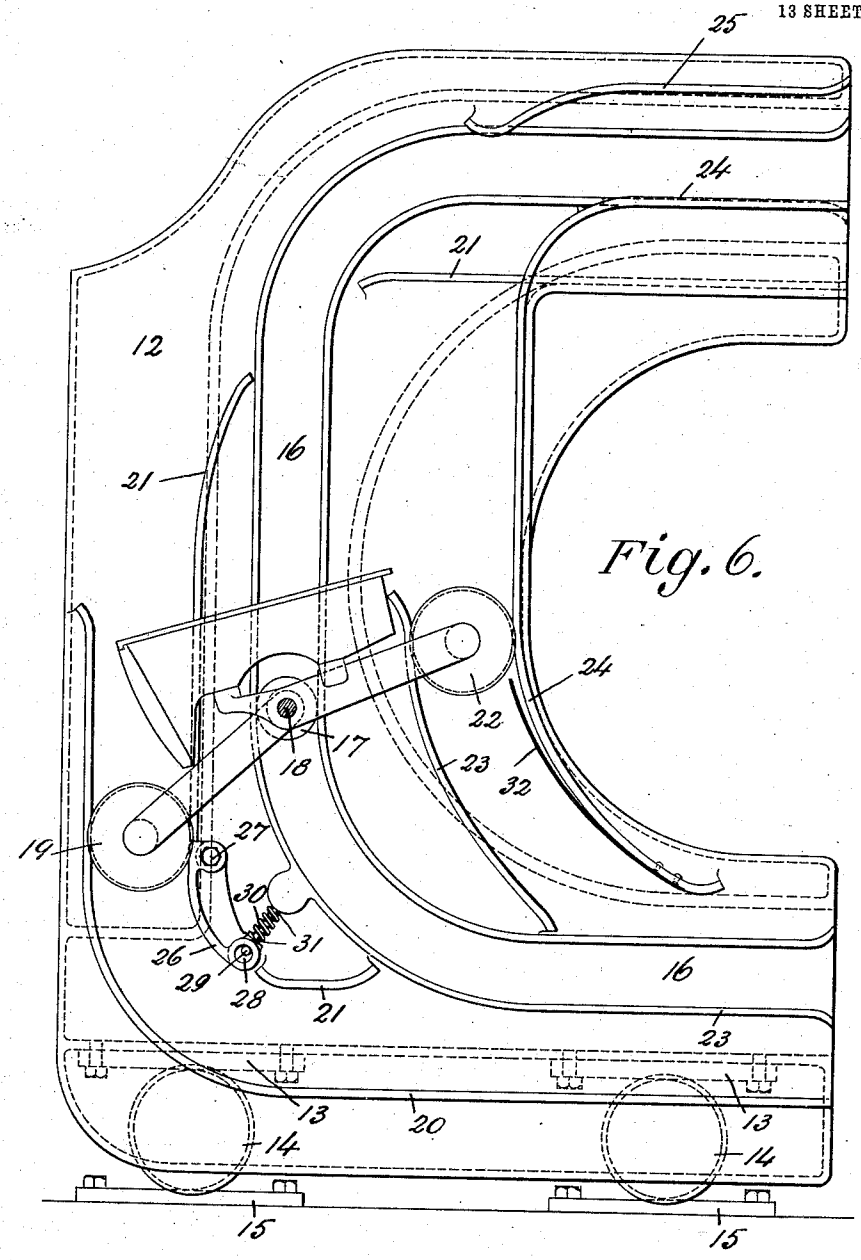


Fig. 6.

WITNESSES:

Carl Strobirk.

INVENTOR

CHARLES D. SEEBERGER.

BY

Coburn & McRoberts

ATTORNEYS

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406.

Patented Jan. 23, 1912.

13 SHEETS—SHEET 4.

Fig. 7.

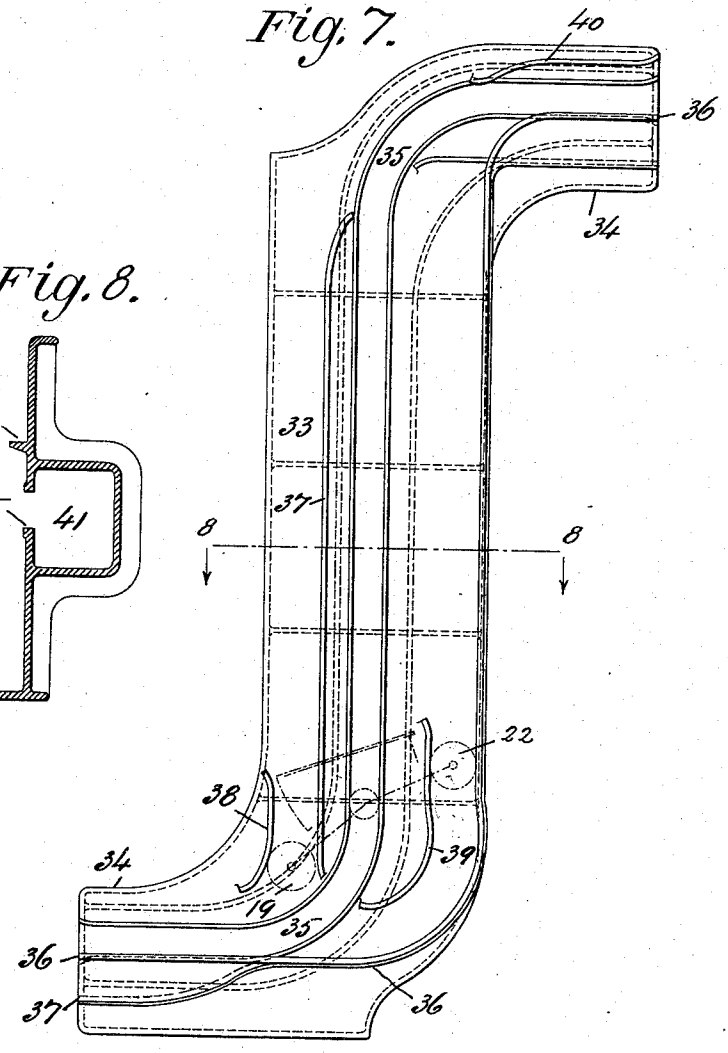


Fig. 8.

WITNESSES:

J. H. Hellwor

Carl Strokirk

INVENTOR

CHARLES D. SEEBERGER.

BY

Coburn & McRobert

ATTORNEYS

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406.

Patented Jan. 23, 1912.

13 SHEETS—SHEET 5.

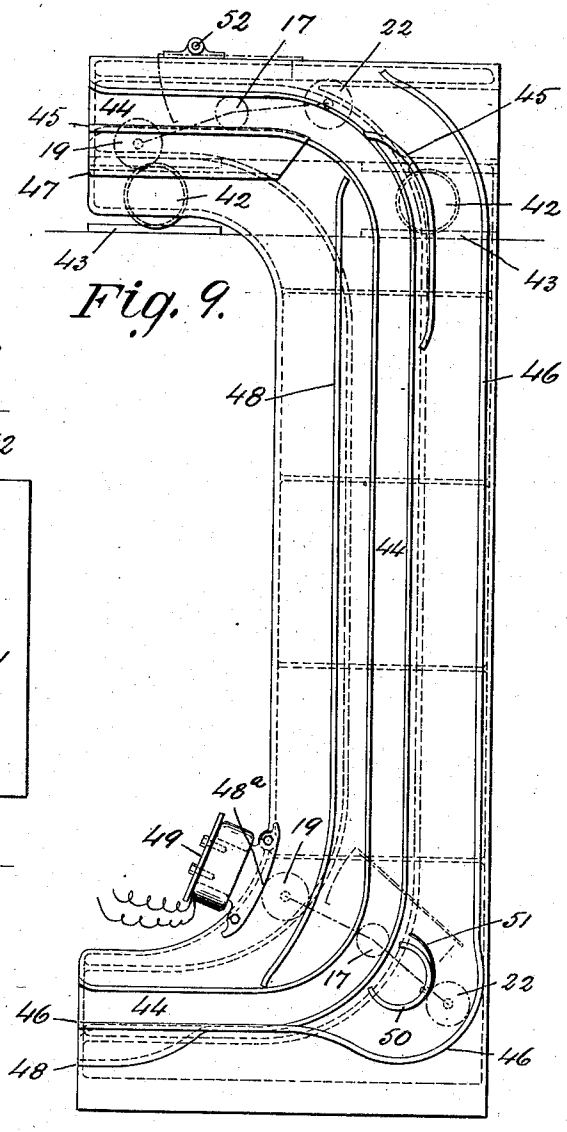
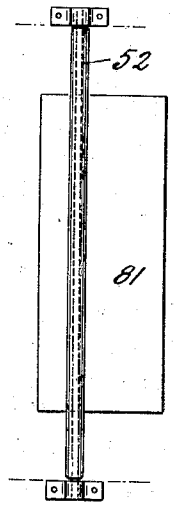


Fig. 9.

Fig. 10.



WITNESSES:

Carl Strobirk.

INVENTOR

CHARLES D. SEEBERGER.

BY Coburn & McRoberts

ATTORNEYS

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406.

Patented Jan. 23, 1912.

13 SHEETS—SHEET 6.

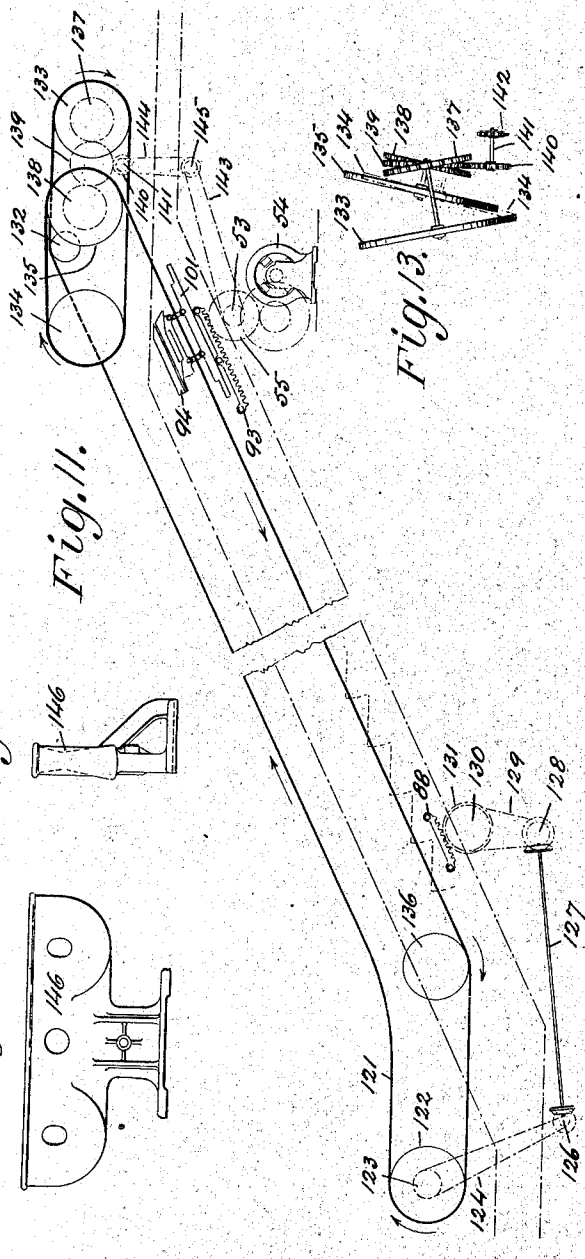


Fig. 11.

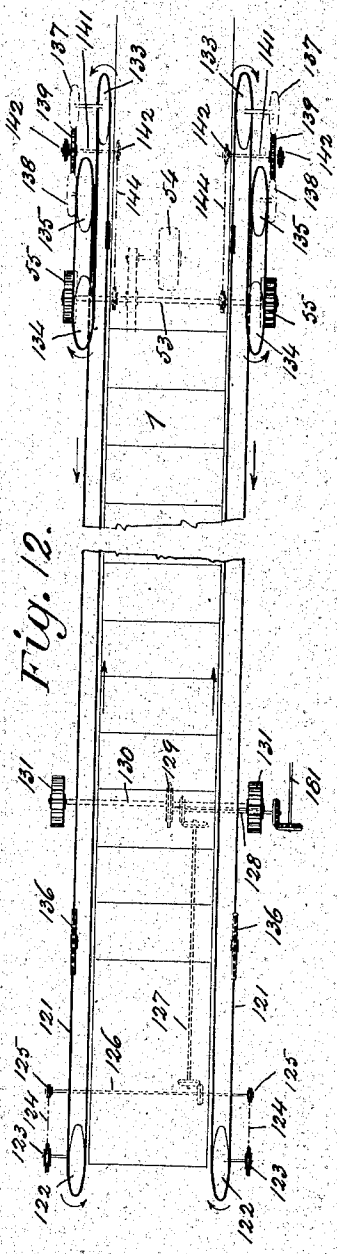


Fig. 12.

Fig. 13.

Fig. 15.

Fig. 14.

WITNESSES:

A. H. Walborn

Carl Strobirk.

INVENTOR

CHARLES D. SEEBERGER.

BY

Coburn & McRoberts

ATTORNEYS

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406.

Patented Jan. 23, 1912.

13 SHEETS—SHEET 7.

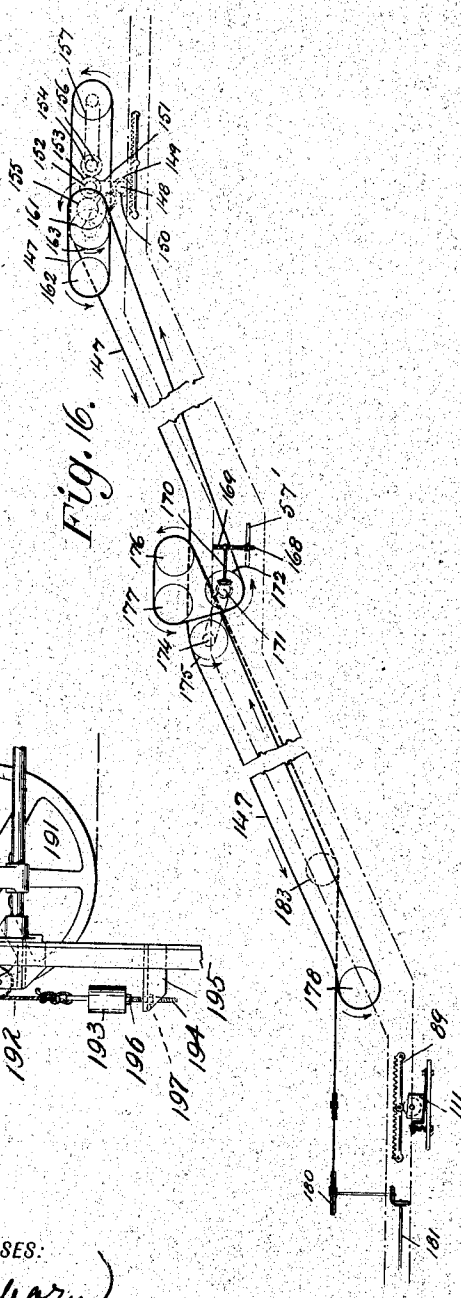


Fig. 16.

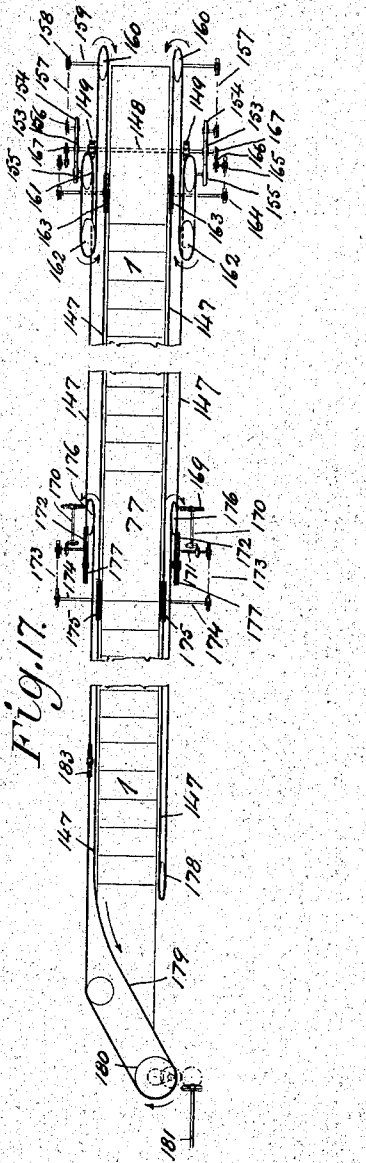


Fig. 17.

Fig. 17a

WITNESSES:

A. H. Colborn

Carl Strobach.

INVENTOR

CHARLES D. SEEBERGER.

BY Coburn & McRoberts

ATTORNEYS

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406.

Patented Jan. 23, 1912.

13 SHEETS—SHEET 8.

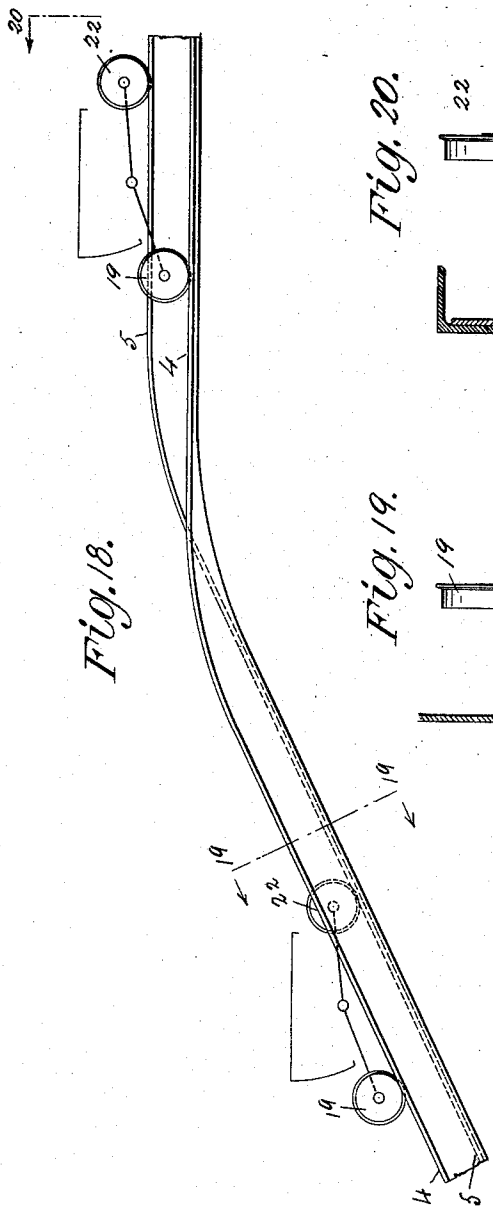


Fig. 18.

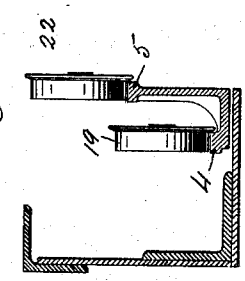


Fig. 20.

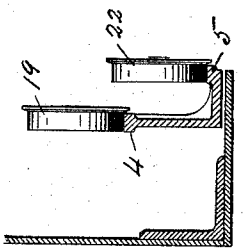


Fig. 19.

WITNESSES:

P. H. Elworth

Carl Stroker.

INVENTOR

CHARLES D. SEEBERGER.

BY

Coburn & McRoberts

ATTORNEYS

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406.

Patented Jan. 23, 1912.

13 SHEETS—SHEET 9.

Fig. 21.

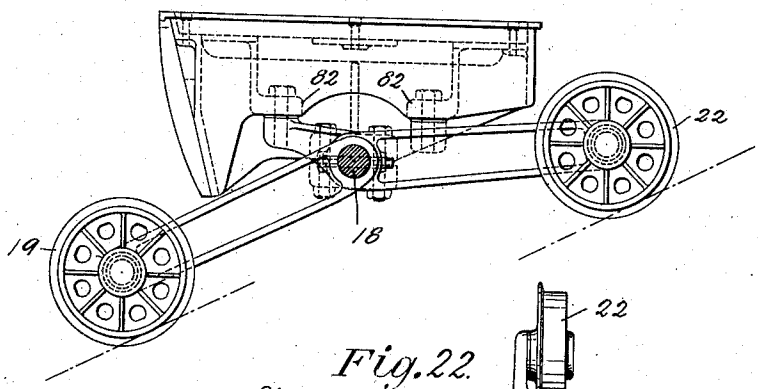


Fig. 22.

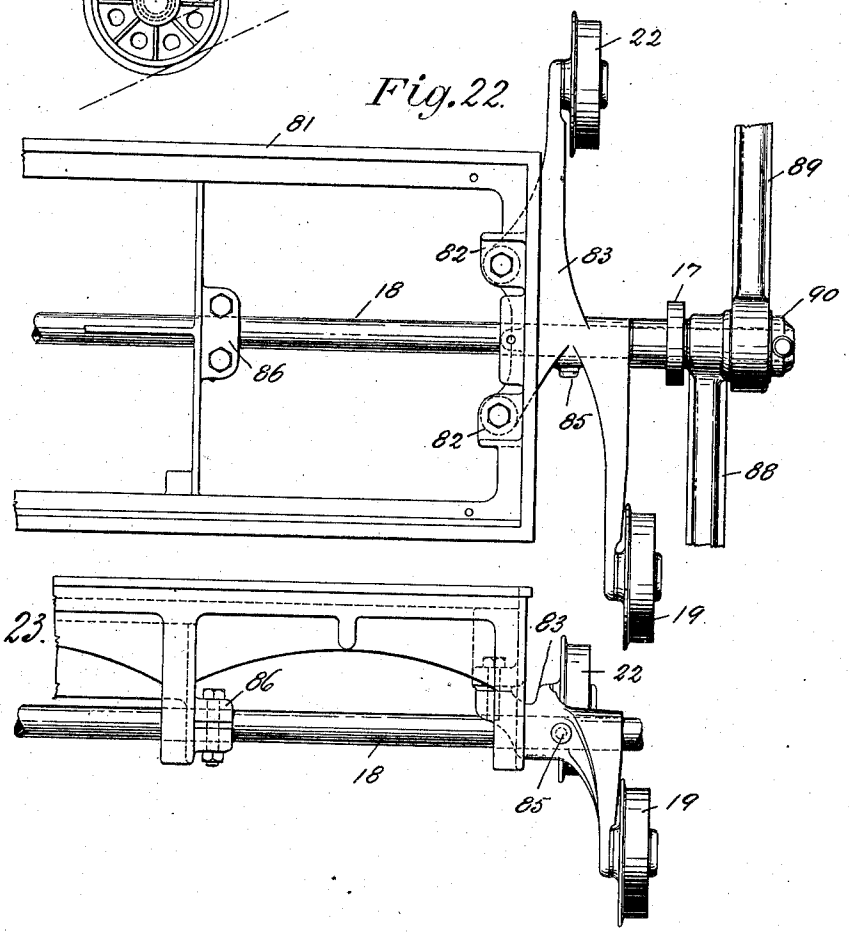


Fig. 23.

WITNESSES:

H. L. Reborn

Carl Strokirk.

INVENTOR

CHARLES D. SEEBERGER.

BY

Coburn & McRoberts

ATTORNEYS

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406. Patented Jan. 23, 1912.

13 SHEETS—SHEET 10.

Fig. 24.

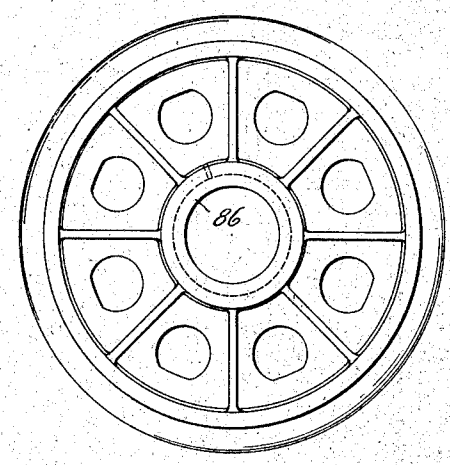


Fig. 25.

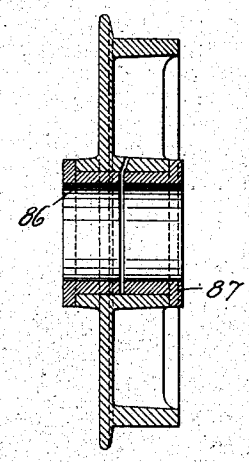


Fig. 26.

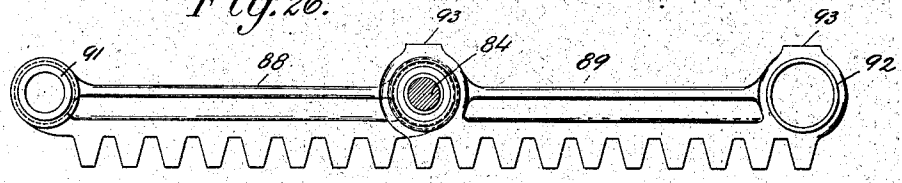


Fig. 27.

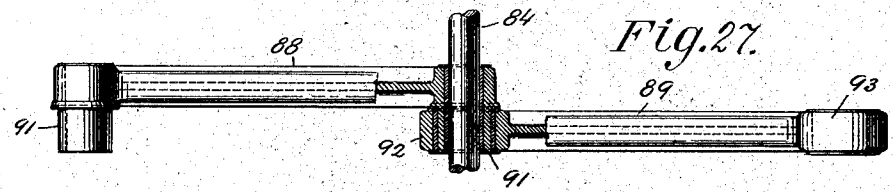
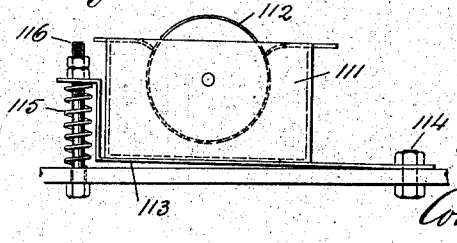


Fig. 28.



WITNESSES:

A. D. Osborn

Carl Strobick.

INVENTOR

CHARLES D. SEEBERGER.

BY

Coburn & McRoberts

ATTORNEYS

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406. Patented Jan. 23, 1912.

13 SHEETS—SHEET 11.

Fig. 29.

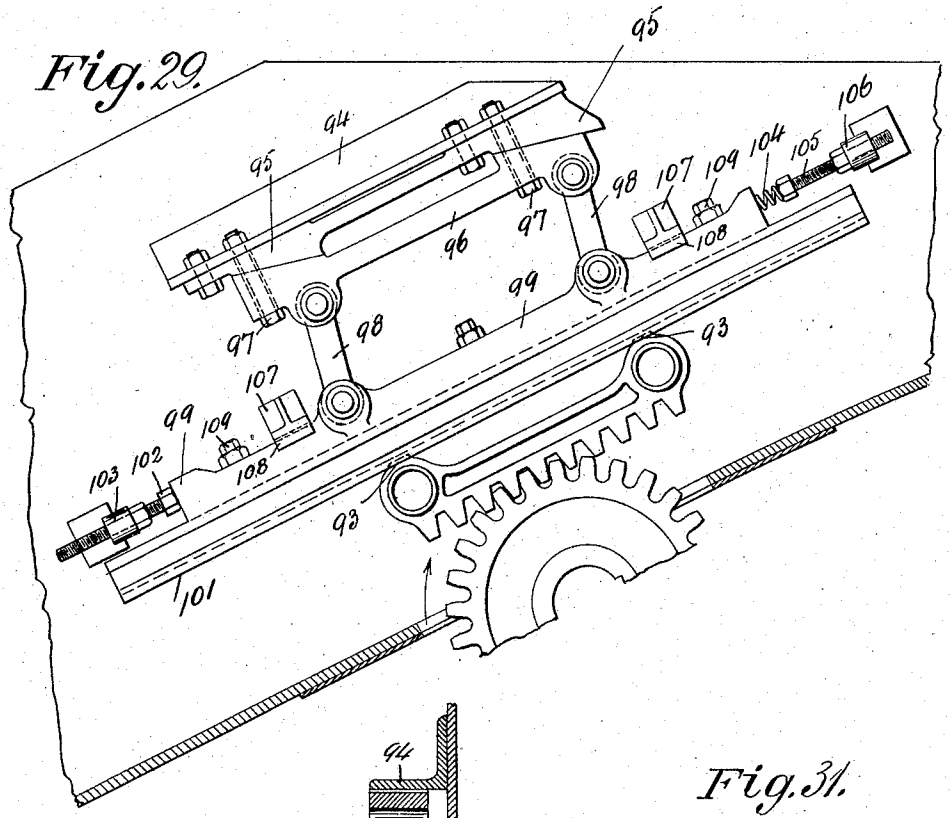


Fig. 30.

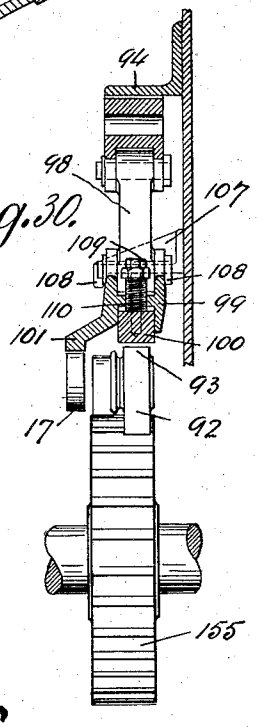
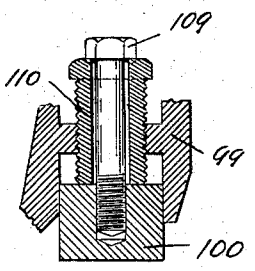


Fig. 31.



WITNESSES:

J. W. Arbor

Carl Strobirk.

INVENTOR

CHARLES D. SEEBERGER.

BY Coburn & McRoberts

ATTORNEYS.

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406.

Patented Jan. 23, 1912.

13 SHEETS—SHEET 12.

Fig. 32.

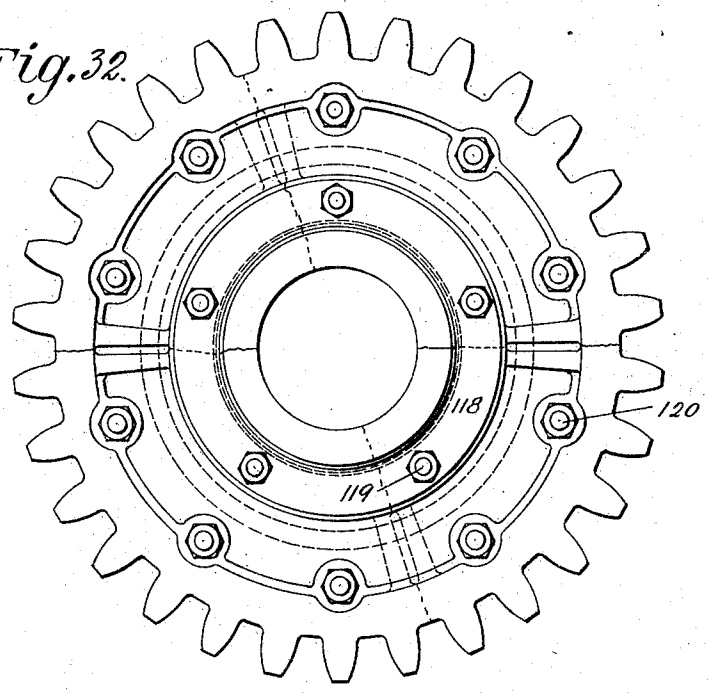
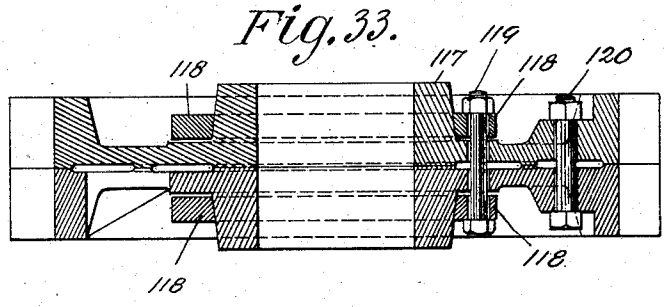


Fig. 33.



WITNESSES:

P. L. Gellhorn

Carl Strobirg.

INVENTOR

CHARLES D. SEEBERGER.

BY

Coburn & McRoberts

ATTORNEYS

C. D. SEEBERGER.

CONVEYER.

APPLICATION FILED FEB. 24, 1906. RENEWED MAR. 26, 1910.

1,015,406. Patented Jan. 23, 1912.

13 SHEETS—SHEET 13.

Fig. 35.

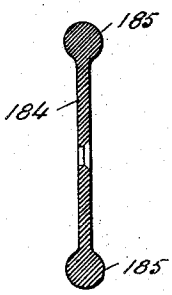


Fig. 34.

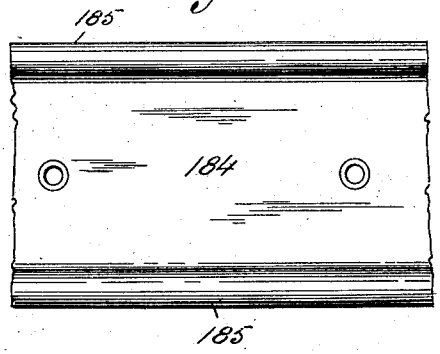


Fig. 36.

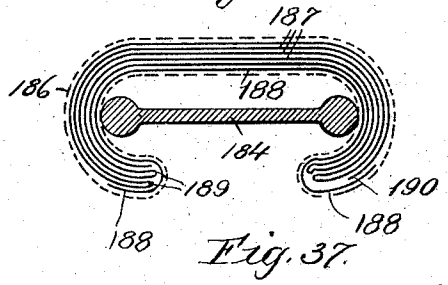
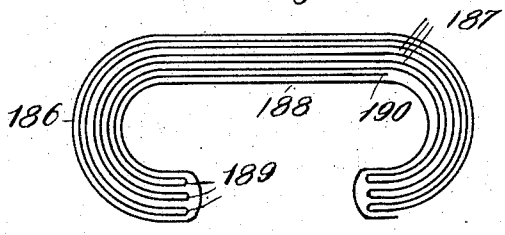


Fig. 37.



WITNESSES:

J. L. Welborn

Carl Strokirk

INVENTOR

CHARLES D. SEEBERGER.

BY

Coburn & McRoberts

ATTORNEYS

UNITED STATES PATENT OFFICE.

CHARLES D. SEEBERGER, OF NEW YORK, N. Y., ASSIGNOR TO OTIS ELEVATOR COMPANY, A CORPORATION OF NEW JERSEY.

CONVEYER.

1,015,406. Specification of Letters Patent. Patented Jan. 23, 1912.

Application filed February 24, 1906, Serial No. 302,760. Renewed March 26, 1910. Serial No. 551,774.

To all whom it may concern:

Be it known that I, CHARLES D. SEEBERGER, a citizen of the United States, residing at 17 Battery Place, New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Conveyers, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to conveyers, and especially to that class of conveyers wherein a traveling foot-way preferably in the form of a series of connected steps, extending between different levels, is adapted to carry or transport freight or passengers upon both its ascending and descending runs.

The object of the invention is to provide certain novel and useful features in this class or type of machines, which will be fully disclosed in the general description thereof, and the invention consists in the constructions and arrangements of parts hereinafter set forth and then pointed out in the appended claims.

In the accompanying drawings, which illustrate an embodiment of the several features of my present invention—Figure 1 is a diagrammatic view showing the general arrangement and disposition of a conveyer arranged in the form of a traveling footway and embodying my present invention; Fig. 2 is a top plan view of the drive of the upper level of Fig. 1; Fig. 3 is a detail view showing the arrangement of the tracks throughout the cycle of Fig. 1; Fig. 4 is a detail view, part in side elevation and part in section, of one of the drive shafts and its associated elements; Fig. 5 is a side elevation of the form of coupling shown in Fig. 4, the shaft being in section; Fig. 6 is a view in side elevation of one side of the lower carriage through which the carrier or foot-way passes at the lower end of the machine, one of the steps of the carrier being shown in side elevation; Fig. 7 is a view in side elevation of one side of the transfer employed at the top landing, one of the steps of the carrier being shown in position therein; Fig. 8 is a sectional view on the line 8—8 of Fig. 7; Fig. 9 is a view in side elevation of one side of the carriage through which the carrier or foot-way passes at the upper end of the machine, one of the steps being shown therein; Fig. 10 is a plan view showing the tread surface of one of the steps and a roller attached to the upper carriage; Fig. 11 is a view, partly in side elevation and partly diagrammatic, showing the arrangement of various parts associated with the ascending run or line of the carrier; Fig. 12 is a plan view of the parts shown in Fig. 11; Fig. 13 is a detail showing the arrangement of the pulleys for the hand-rail of Fig. 11; Fig. 14 is a side view of the gear case for the hand-rail pulleys at the upper end of Fig. 11; Fig. 15 is an end view of the gear case of Fig. 14; Fig. 16 is a view, partly in side elevation and partly diagrammatic, showing the arrangement of various parts associated with the descending line or run of the carrier; Fig. 17 is a plan view of Fig. 16; Fig. 17[a] is a detail view; Fig. 18 is a view showing the arrangement of the tracks at the upper end of the incline, the steps being also shown in two positions thereon; Fig. 19 is a sectional view on the line 19—19 of Fig 18; Fig. 20 is a sectional view on the line 20—20 of Fig. 18; Fig. 21 is a side view of one of the steps constituting the carrier or footway, the axle-bar beinb in section; Fig. 22 is a plan view of one end of the step frame and its associated parts; Fig. 23 is a back view of a portion of one of the steps; Fig. 24 is a side view of one of the step wheels; Fig. 25 is a central sectional view of the wheel of Fig. 24; Fig. 26 is a side view of a pair of the links employed to connect the step axles, one of which latter is shown in section; Fig. 27 is a top plan view of the parts of Fig. 26 with certain portions of the links in section; Fig. 28 is a side view of a form of lubricating box that may be employed; Fig. 29 is a side view of an upthrust device shown in association with one of the links and the drive wheel; Fig. 30 is an end view of the parts shown in Fig. 29; Fig. 31 is a detail view of one of the connecting and adjusting bolts shown in Fig. 29; Fig. 32 is a side view of the drive wheel; Fig. 33 is a sectional view of the same; Fig. 34 is a top plan view of a portion of the guide for the hand-rail on its return line; Fig. 35 is a cross-sectional view of the guide of Fig. 34; and Figs. 36 and 37 are sectional views of forms of hand-rails which may be employed.

In the form of machine shown in Fig. 1, the foot-way or carrier, preferably in the form of a connected series of steps 1, is adapted to travel on suitable tracks and to

transport or carry passengers or freight upon both its ascending and descending runs or lines between different levels. In this view the references 2 and 3 indicate a lower floor or level and an upper floor or level, respectively, with reference to which the machine is so arranged as to carry in both directions, and the foot-way or carrier is adapted to travel on tracks or ways 4 and 5 extending on inclines between the levels and in horizontal planes at the levels, the arrangement being such that the upper surfaces or treads of the steps lie in the same horizontal plane to form a lower get-on or entry landing 6, then break into step formation as they travel upwardly in the direction of the arrow upon the inclined portion of the tracks, and again run in a horizontal plane to form the upper get-off or exit landing 7. Beyond the upper landing the steps pass through a transfer 8 by which they are directed upwardly and from whence they extend forwardly to pass through the upper carriage 9 by which their direction of movement is reversed and they are presented at the level of the upper floor or landing 3 to form the upper get-on or entry landing 10. As the landing 10 is beneath the extension of the steps between the transfer 8 and the carriage 9, these two latter parts are made of sufficient size to carry the portions of the steps extending between them high enough above the landing 10 to provide proper clearance for the passengers or freight, as by extending the transfer and carriage upwardly above the level 3 in the manner shown. From the landing 10 the steps travel in step formation down the return inclined portion of the tracks until they reach the lower level 2, where they extend in the same horizontal plane to form the get-off or exit landing 11. The tracks are then extended downwardly below the level 2 and enter a lower carriage 12 which is so located and disposed as to return and present the steps at the lower get-on landing 6.

From a consideration of the above description it will be apparent that the construction provides a duplex elevator or one adapted for transportation upon both of its ascending and descending lines or runs which are located one below the other.

In Fig. 6, I illustrate the details of the lower carriage 12, which may be employed in a machine of the general type and arrangement shown in Fig. 1, it being understood of course that the construction shown in Fig. 6 is employed upon each side of the tracks or is duplicated for the supporting wheels which are arranged at each end of the steps in the customary manner. The corresponding parts upon each side of the machine forming the carriage are connected together in any suitable manner and are provided upon their outer faces with suitable flanges 13 which rest upon rollers 14 supported upon short tracks or ways 15. By this construction the carriage is free to move back and forth to keep the foot-way under sufficient tension to run smoothly and evenly. Each side of the carriage is provided with a channel guide 16 for the guide rollers 17 or their equivalent devices with which the ends of the axle bars 18 of the steps may be provided, although of course the axles themselves may coöperate directly with the channel guides if desired. The channel guides extend through the carriage in the general form of the letter **C**, as shown in Fig. 6, their ends or terminals facing or opening in the same direction and in alinement with the associated tracks as more fully hereinafter explained. Each side of the carriage is also provided with a way for the outside step-supporting wheels 19, which is formed by a track 20 extending below the channel guide at its inlet in a horizontal direction to substantially the rear part of the carriage where it is bent or directed upwardly and an associated track 21 which begins opposite the upwardly extending portion of the track 20 and continues in an upward and inward direction to and across the channel guide, on the opposite side of which it continues in a horizontal plane to the exit of the carriage below the channel guide, being cut-away where it crosses the channel guide to allow the projecting axles of the steps to pass. Each side of the carriage is also provided with a way for the inside step-supporting wheels 22, which is composed of the opposite tracks 23 and 24. The initial portion of the track 23 is on the same horizontal plane as the lower portion of the channel guide, and as the way for the wheels 22 crosses the channel guide before the latter bends upwardly the track 23 is cut-away at its point of crossing to allow the axles 18 to pass, and then extends upwardly in a curved path inside of the line of the channel guide as shown, terminating at about the line of the upper end of the track 20. The track 24 may begin at any point opposite the curve of the track 23, and then extends upwardly to the upper portion of the carriage where it is curved and extended forwardly in a horizontal path to the exit of the carriage in substantially the plane of the lower portion of the channel guide. At the exit portion of each side of the carriage a guard track 25 is arranged above the track 24 to coöperate therewith to form the way at the exit of the carriage for the inside wheels 22.

The lower portion of the track 21 receives the wheels 19 as the steps begin to pass through the curve between the horizontal and vertical paths of travel in the carriage, as at this portion of the track the connections between each step and its pre-

upright portion and oppositely directed portions conforming to the general contour of the transfer and arranged approximately central thereof, and adapted to receive the rollers 17 upon the axle bars of the steps. The transfer is also provided with guides or ways for the front and rear supporting wheels of the steps; the track 36 for the front wheels 22 is arranged upon substantially the same vertical planes as the lower portion of the central guide 35 at the top and bottom and its vertical portion is in front of the guide 35, and the track 37 for the rear wheels 19 enters the transfer below the guide 35 at its lower end, then crosses the guide and extends vertically upon the side opposite the track 36 until it reaches a point approximately opposite the exit of the transfer where it again crosses the guide and extends below the guide to the exit end of the transfer. The track 37 is of course cut away where it crosses the guide to allow the axles to pass.

At the lower end of the transfer, guard tracks 38 and 39 are arranged to coöperate with the wheels to prevent them from being withdrawn from contact with their tracks by the lifting action of preceding connected steps, and at the upper end a similar guard track 40 is provided.

The transfer is provided with a space 41 as shown in Fig. 8, to receive the links connecting the axles of the steps outside the supporting wheels. In this respect the view in Fig. 8 is typical also of the carriages, which are similarly provided with spaces for the links.

From the exit of the transfer the steps pass along the extension above the upper landing 10 to the upper carriage 9.

As shown in Fig. 9, the upper carriage is substantially a reversal of the lower carriage. It is provided with suitable flanges on its sides which rest upon rollers 42 supported upon ways or tracks 43. It is provided on each side with a central channel guide 44 for the guide rollers 17 of the steps. It is further provided upon each side with ways for the step-wheels. The way for the leading wheels 22 is composed of a track 45 whose horizontal portion is on the same level as the lower portion of the guide 44, and which crosses the guide, being cut away at its point of crossing to allow the axles to pass, and then extends in a curve downwardly beyond and outside of the guide, and a coöperating track 46 which extends vertically to the lower portion of the carriage where it curves outwardly and downwardly and then passes to the exit on a level with the lower portion of the guide 44. The way for the rear wheels 19 is composed of a track 47 which extends horizontally inward, and a vertical track 48 which crosses the guide 44, being cut-away at its point of crossing, and extends downwardly to the exit as shown. The upper carriage is also provided at its lower portion with a magnetized track 48^a, which is energized by means of a spool or coil 49, whose terminals lead to a suitable source of electrical energy. The track 48^a is arranged to contact with and hold the wheels 19 in predetermined relation while the wheels 22 are in engagement with the track 46 at its lower curve or bow. The wheels 22 engage a guard track 50 at this point, which holds the wheels upon the track 46, and which is provided with a spring 51 to form a cushion to receive the impact of the wheels as they descend upon the guard. When the steps are in the position shown at the lower portion of Fig. 9, the wheels 19 have a tendency to fall or drop on account of the fact that at this particular point these wheels do not have any appreciable traction on their tracks, and the track 48^a exerts a holding power on the wheels at that point to counteract this tendency and keep both sets of wheels in constant relation. Also, the spring 51 by pressing the wheels 22 against their track 46 prevents these wheels from working or moving up, and holds the wheel-frame or base from tilting with its axle as a center, thereby aiding in overcoming the tendency of wheels 19 to fall.

I make no claim herein broadly to means to automatically take up the increment of the stretch of the hand rail and to automatically hold the aggregate of the stretch, or broadly to means for increasing the traction of the truck wheels as the steps pass through the upper end carriage, as broad claims to each of these features are contained in and form part of the subject matter of my Patent No. 984,304 dated Feb. 14, 1911 for which said subject matters are hereby expressly reserved, but limit the claims in the present application to electrical or magnetic devices for increasing the traction of the truck wheels, and to the features herein disclosed to automatically take up and hold the stretch of the hand rail.

The upper carriage is provided at its top with a transverse roller 52 journaled in suitable bearings so as to engage the top of the treads while the forward wheels 22 are crossing the gap between their track sections 45. It will be observed that the relation and arrangement of parts is such that this guard roller engages the tread in the rear of the axle during the time the wheels 22 are moving across the gap, thereby holding the step against tilting, and as the step and axle-frame or base are rigid the wheels 22 are carried across the gap.

Power is applied to move the foot way, which in the present embodiment, is in the form of an endless series of connected steps, by the drive shaft 53, which is located at or near the head of the incline of the ascend-

ceding step exert a tendency to draw the step against the track, and as the track is more or less angular to the direction of the strain or pull, the steps would have a tendency to hook under or hitch or hang upon the track 21. In order to obviate this, I provide this track with a yielding section 26, located at the curve between its horizontal and vertical portions at the lower end thereof. In the present form this yielding section is pivoted at 27 at its upper end and at its lower or free end it is provided with a slot or opening 28 into which a stop pin 29 projects, the latter being fixed to the frame of the carriage. The section 26 normally hangs in position to form a continuation of the track 21 on the curve, and it is obvious that if the step-supporting wheels 19 for any reason hook under or hitch against the track in passing around the curve, the section 29 will yield in order to release the wheels and overcome and obviate any tendency of the steps to lag or hitch at this point. While gravity holds the yielding section of the track in normal position during the ordinary operation of the machine, the section is preferably controlled by a spring 30 which in the drawings is in the form of a coil spring engaging oppositely projecting studs 31 located on the frame and pivoted section as shown. In practice the pressure of the wheels 19 upon the pivoted section will not be sufficient to cause the same to move against the tension of its spring while the steps are moving through the carriage in the normal operation of the machine, but in the event any of the wheels 19 bind or catch upon the track 21 by reason of the fact that the latter overhangs the direction of the driving strain at this point in the path of the wheels, the pressure against the spring 30 will then be sufficient to cause the latter to yield so as to obviate the binding action of the wheels upon the track and the consequent lagging or hitching of the steps.

The track 24 is provided at its inner face with a leaf spring 32 which normally stands in position to somewhat restrict the area of the way for the wheels 22, as shown for example in Fig. 6. The spring 32 impinges upon the wheels 22 as the latter pass through the way and serves as a brake for the wheels in the event there is any tendency of the wheel-bases to turn with their axles as pivots in their links by reason of the binding or hitching of the wheels 19 against the track 21. It is obvious that if the wheels 19 bind or hitch upon the track 21, the frames carrying the wheels 19 and 22 will tend to turn with their axles as centers, thereby overcoming the center of gravity of the step, throwing the tread out of its horizontal position, and causing the wheels 22 to jump or slip through a portion of their ways; this tendency, when it occurs, is obviated by the spring 32 which acts as a brake upon the wheels 22.

It is obvious that anything which causes the steps to hitch or lag during their travel is objectionable as it causes the machine to move unevenly with more or less jerking action, and the function of the pivoted track to prevent this objectionable action is of value. The spring 32 holds the step to its outer limit so as to reduce its liability to hitch or hook, and retards the wheels 22 so as to tend to throw the wheels 19 up and to prevent the hooking action. The center of gravity of the step is slightly to the left of the center of the axle as it appears in Fig. 6, and as the tendency of the step is toward the left, the reduction of the track resistance on the wheels 19 and the retardation of the wheels 22 tend to preserve the center of gravity and prevent the turning of the steps out of normal position.

It is of course understood that the pivoted section 26 of the track and the spring 32 are provided merely to overcome any difficulties which may result from any variation in the curves in the tracks, and that in the normal and usual operation of the machine the curves are uniform so that the steps pass through the lower carriage at constant speed and without any tendency to lag or hitch therein.

In the operation of the machine the steps pass into the carriage 12 at its lower or inlet portion, the ends of the tracks 20 and 23 being in extension of corresponding tracks 4 and 5 for the respective wheels, and the guide rollers 17 passing into the channel guides 16. As the steps pass through the carriage their line of travel is reversed, and the steps themselves are reversed so that the wheels 19 which were the leading wheels upon the lower run become the rear wheels upon the upper run. The supporting wheels pass out upon the tracks 21 and 24 respectively, which are in alinement or continuation of tracks 4 and 5 at the entry landing 6. The steps are presented in horizontal position to form the entry landing, from whence they pass up the incline portion of the track or way to the upper exit landing 7, and thence to the transfer 8.

As shown in Fig. 1, the transfer receives the steps at its lower inlet from the tracks at the upper landing 7 and presents them from its upper outlet to an upper level of the tracks above the landing 10. For this purpose the transfer is in the form of an elongated vertical body 33 provided at its ends with oppositely extending lateral inlet and outlet portions 34, as shown in Fig. 7, it being understood, of course, that the details of the transfer are duplicated upon each side of the way or run. The transfer is provided with a central channel 35 consisting of an

ing run as shown in Fig. 1, this shaft being driven by a suitable motor 54. The drive shaft is provided with sprocket wheels 55, which mesh with the links connecting the step axles, as more fully hereinafter explained. In Fig. 2 the positions of the links are indicated by dotted lines, it being understood that the links extend throughout the circuit of the machine and are arranged with their teeth looking down on the ascending line or run and looking up on the descending run. The shaft 53 transmits motion by spiral gears 56 to longitudinal shafts 57 located on each side of the foot-way at the upper landing and extending back in the rear of the transfer 8 at or near where the foot-way enters the incline of the return or descending run, as shown in Fig. 1. At or near where the foot-way enters the transfer an intermediate cross-shaft 58 is located, which is driven from the shafts 57 by means of intermediate spiral gears 59, and which is provided with a pair of sprockets 60 adapted to engage the links of the steps to lift the steps through the transfer and prevent their buckling on the landing 7 which otherwise might occur owing to the resistance of the steps on the curves of the transfer. At the rear ends of the shafts 57 a pair of stub shafts 61 are located, which are provided at one end with spiral gears 62 to receive motion from the shafts 57, and on the other ends with sprockets 63 adapted to engage with the step links. The sprockets 63 are necessarily mounted on stub shafts at this point as they are located above the line of the links and therefore a shaft could not of course extend across the machine as it would interfere with the use of the foot-way.

In Figs. 4 and 5, I have illustrated in detail the construction of the longitudinal shafts 57 which I prefer to employ. In Fig. 4 the arrangement of the spiral gears 56 is shown, by which power is transmitted from the main drive shaft 53 to the longitudinal driving shafts 57. As the longitudinal shafts 57 are of considerable length it is necessary to keep the shaft lined up and for this purpose universal bearings 64 are employed at frequent intervals. Each of the universal bearings 64 is provided with a supporting case 65 having a seat 66 adapted to receive a correspondingly shaped enlargement on an elongated bearing sleeve 67, in which the shaft 57 is mounted, whereby the sleeve is free to move in its seat in order to keep the shaft in alinement. The sleeve is provided with a recess in its top portion to receive a projection 68 on the casing which limits the movement of the sleeve and prevents displacement of the parts.

I prefer to make the longitudinal shafts in sections, connected together by universal joints 69 between the spiral gears and bearings 64, and I also prefer to employ an adjustable coupling intermediate the points of application of power to links. This arrangement is illustrated in Fig. 4. The adjustable shaft couplings may be of any suitable form, and in the present embodiment, as shown in Figs. 4 and 5, consist of a pair of coöperating members 70 and 71 rigidly connected with the adjacent ends of their respective shaft sections, one of the members being provided with bolts 72 which pass through elongated slots 73 in the associated member, by which the members may be locked and rigidly secured together in their adjusted positions. The two members of the coupling are also provided with oppositely arranged ears 74, one of which is tapped to receive an adjusting bolt 75 which bears against the corresponding ear of the other member and which is held in position by means of set nuts 76. The adjustable couplings are important for the purpose of allowing the sections of the shaft to be set or adjusted so as to bring the sprocket wheels corresponding with the respective sections into mesh with the teeth of the links under a uniform degree of pressure. As the longitudinal shafts 57 coöperate with a plurality of driving sprockets engaging the links at different points, it is obvious that in assembling the machine some of the sprockets may not engage the teeth of the links with the same pressure or to the same degree as others, and therefore by the use of the adjustable coupling the sprockets may be adjusted, through the intermediate spiral gears, so as to set all the sprockets to the same relation or pressure upon the teeth of the links. They may likewise be employed in the future operation of the machine to compensate for uneven wear of the parts. It is obvious that where the longitudinal shafts 57 coöperate with sprockets driving on both runs or lines, this adjustment insures that both lines will be driven in unison. The range of movement of the coupling of Fig. 5 is such that the adjustment may be made even when the teeth of the sprockets and links are opposite, being equal in extent to a half pitch of the teeth.

At a suitable point in the descending line or run, and preferably at about its center, I prefer to run the foot-way in a horizontal plane in the form of an intermediate landing 77, as shown in Fig. 1, which provides an eye-rest so that the passenger at the upper entry landing will observe an apparent break in the continuity of the run and will not be so impressed with the height of the machine and the consequent length of the run as he would be if he looked from the upper landing to the lower landing instead of upon the traveling landing at an intermediate point. This is of importance in machines having long runs. The treads are in the same plane in the eye rest.

At about the middle of the runs I arrange a supplemental pair of longitudinal shafts 57′ (see Fig. 1) of the same construction as the shafts 57, one on each side of the footway, and by reason of the intermediate landing or eye-rest construction, these intermediate shafts may coöperate with the descending line or run at each end thereof, so as to take the strain off the steps throughout the entire run of the intermediate landing or eye-rest. The shafts 57′ are provided at their front ends below the ascending run with spiral gears (not shown) which mesh with corresponding spiral gears (not shown) on a cross-shaft 78, the arrangement in this respect being similar to the gears 56 of the shafts 57, and the cross-shaft 78 is provided with sprockets (not shown), similar to sprockets 55, which mesh with the teeth of the links, the teeth being on the underside of the links or looking down at this point. Stub axles (not shown), similar to stub axles 61, are provided at 79 and 80, and are driven by the shafts 57′ by spiral gears (not shown) similar to the gears 62, and these stub axles are also provided with sprockets which mesh with the teeth of the links on the descending run, the teeth being on the upperside of the links or looking up at these points. By this means the two lines or runs are tied together or connected, and power is applied from the main drive shaft 53 to the descending run through the ascending run and the intermediate shafts and connections, while on the other hand the power of the weight of the descending run is applied to the up-run at its center. The intermediate drive divides the machine at about its center, and each side of the machine is balanced, as the weight of each portion of the descending run tends to counterbalance a portion of the ascending run. The load of the steps below the eye-rest is also in effect placed upon the shafts 79, and as the shafts 80 apply power to the links at the other end of the eye-rest, all load is taken off the curves at both ends of the eye-rest. The shafts 79 and 80 being thus geared together, power is transmitted from the former to the latter through the longitudinal shafts, so that the link connections between the steps are free from tension throughout the eye-rest and as they pass the angles.

Each step comprises a rectangular frame 81, provided with the usual tread and riser as shown in Fig. 21, and having interior bosses 82, to which the ends of the wheel-base 83 are bolted. The wheel-base receives its associated axle 18, which is rigidly connected thereto by means of pins 85 and which also is clamped in a stirrup 86 depending from and rigid with the step-frame at about its center, which arrangement provides a truss construction, the axle being in effect the lower chord and the step-frame the upper chord, whereby the step-frame is supported at its center and the axle is strengthened. The wheel-base is provided with oppositely extending arms which project beyond the sides of the step so as to provide a wheel-base of greater area than the step itself. The arms are provided at their outer ends with outwardly facing studs upon which the wheels 19 and 22 are mounted in different vertical planes with their flanges toward the interior of the machine. Each wheel is provided with outer and inner flanged graphite bushings 87, as shown in Fig. 25, thus giving a lubricating flange on each face of the wheel. The bushings are so proportioned as to leave a slight clearance between them as a convenient receptacle for a small quantity of oil which may be provided through an oil hole in the hub of the wheel.

The inclination of the two arms of the wheel-base to each other is such that the angle of the incline to the horizontal is divided by a line extending through the centers of the wheels of the steps, and as a consequence the tracks 4 and 5 are at the same difference in levels on the inclined as on the horizontal runs, but on the incline the tracks 4 for the outside wheels 19 are above the tracks 5, and on the horizontal runs the tracks 5 are above the tracks 4, as shown in Figs. 18, 19 and 20. This gives the same distance between the upper and lower tracks measured perpendicularly to the direction of travel on both the inclined and horizontal runs, reduces the vertical overall dimensions of the step to a minimum, and also brings the intersection or crossing point of the tracks at substantially the center of their curved portions, as shown in Fig. 18. The axles extend beyond or outside of the wheel-base where they receive the links 88 and 89, which are held upon the axles by means of collars 90 provided with locating pins, as shown in Fig. 22. The links 88 and 89 are in male and female form, respectively, the sleeves 91 of the former receiving the axles and extending within the collars 92 of the latter, these several parts being provided with interposed bushings, all as shown in Fig. 27. The male links are provided with eight teeth arranged intermediate the sleeves, and the female links have ten teeth extending from beneath the collars; as the presence of teeth beneath the collars of the links tends to tip or tilt the links on their axles when the drive sprockets engage these extreme teeth, the female links may be provided with bosses 93 to coöperate with suitable up-thrusts to obviate this action, one form of which will be hereinafter described.

The guide rollers 17 are located upon the axles between the wheel bases and the links, as shown in Fig. 22. As before stated, the

guide rollers are not essential and may be omitted; if retained they may serve the further function of coöperating with upthrusts.

The action of the driving sprockets causes the steps to rise, and also tends to turn the female links upon the axles when the sprockets engage the extreme teeth thereon, and to overcome this action I provide a suitable upthrust. In the form of upthrust illustrated in Figs. 29 and 30 a block or plate 94 is rigidly secured to the frame or structural part of the machine, and is provided with wedge-shaped faces 95, with which corresponding wedge-shaped faces on a second block or plate 96 coöperate. The blocks are secured together in adjusted positions by means of bolts 97 passing through the blocks, one of which is provided with suitable elongated slots to admit of the adjustment or regulation of the blocks to vary the height of the upthrust. Suitable toggles 98 depend from the block 96 and carry a swinging frame 99, which is provided with a shoe 100 forming an upthrust for the bosses 93 of the female driving-links. The frame may also be provided with a laterally extending flange 101 arranged in the path of travel of the guide rollers 17, as shown in Fig. 30, to provide an upthrust for both the links and the guide rollers. It is obvious of course that the upthrust may be employed in conjunction with either of these elements or both as desired. In practice the upthrust is located over the drive-sprockets of the ascending line, as for example, on shafts 78 and 53, its position with reference to the latter at the top of the incline where the foot-way changes from the inclined to the horizontal run being shown in Fig. 29. When the upthrust is in position the toggles 98 normally tend to hang in vertical position or at less than a right angle to the drive links, as shown in Fig. 29, and the frame 99 rests against a set screw 102 in a projecting bracket 103, which acts to limit its motion in one direction and against which it is pressed by a spring 104 located upon a set screw 105 in a projecting bracket 106 at its opposite end. In the normal position of the parts the toggles 98 hang in substantially the relation shown in Fig. 29, and the arrangement and relation of the parts is such that the shoe 100 is in position to press lightly upon or just clear the bosses 93 of the drive-links as the latter are subjected to the lifting and turning action of the drive wheels, as shown in Fig. 30. As the service becomes heavier by reason of the greater load upon the machine by the increase in the weight carried, the increased friction due to the lifting action of the drive-links incident to the increased duty of driving the foot-way causes the frame 99 to move from a position in which the toggles are more or less vertical to a position in which they are at right angles to the line of the driving links, which latter position is shown in Fig. 11. This slight movement causes the shoe to drop slightly toward the bosses of the drive-links, and consequently interposes more resistance to the increased tendency of the drive-links to lift or turn incident to the greater load, and thereby overcomes the tendency of the links in these respects. By adjusting the wedge-block 96 the resistance of the upthrust may be regulated. By thus regulating the pressure between the boss and upthrust I avoid an excessive pressure during times when there is small load, and consequently reduce the wear of the parts as well as increase the efficiency of driving.

The frame is held against lateral displacement by means of the guides 107, which are in the form of laterally projecting brackets secured to the frame or structural part of the machine and provided with depending ears 108 embracing the frame. The shoe is adapted to take up wear by means of screw bolts 109 which are threaded into the shoe, and pass through and serve to locate or fix sleeves 110 which are provided with external screw threads adapted to take into tapped openings in the frame 99.

When an upthrust is employed to coöperate with the bosses 93 of the female links, it is desirable to provide a device for supplying oil for the purpose of lubricating the bosses. In Fig. 28 I have shown one form of lubricating device for this purpose, which may be supported upon the frame or structure at any suitable point where it will contact with the bosses, as for example, as shown at the lower left hand end of Fig. 16. As shown in Fig. 28, the oiling device consists of an oil receptacle 111 in which a wheel 112 revolves, the parts being so arranged that the exposed surface of the wheel will lie in the path of travel of the bosses of the links to impart the requisite amount of oil to the bosses as they engage the wheel. The receptacle is preferably spring mounted, as by attaching it to a spring-plate 113 which is screwed by a bolt 114 at one end to the structure and is carried at its other end by a spring 115 preferably arranged in the form of a coil spring surrounding a guide post 116. By this arrangement the wheel 112 is maintained in normal position slightly above the line in which the bosses travel, and the spring construction allows it to be pressed down as the bosses pass from it, thus insuring oiling contact. The surface of the wheel may be of felt, leather, or other suitable material, adapted to take up a quantity of oil, the action of the bosses upon it causing it to revolve in the receptacle so that all parts of the periphery are oiled.

The driving sprockets are preferably split longitudinally and transversely, thus mak-

ing four pieces which are bolted together in a manner to break joints. The two lateral parts of the sprocket are split upon a longitudinal line, and each part is then split upon a transverse line, as indicated in Fig. 32 by the irregular dotted lines, all of the parts being provided with a suitable key seat for connection with the associated shaft. In order to draw the parts of the wheel tight upon the shaft and true to each other, I bevel the hub 117 of the wheel upon each of its faces or sides, and provide a steel ring 118 for each side with a corresponding bevel, and then draw the rings together by means of tightening bolts 119 whereby a heavy pressure is exerted upon the hub to force the parts together upon the shaft. The parts of the wheel are further joined and secured together by supplemental bolts 120.

The ascending line or run of the foot-way is preferably provided on each side with a hand-rail 121 moving at the same speed as the foot-way. Each hand-rail passes around a drive-pulley 122 at the lower entry landing, whose shaft has a sprocket wheel 123 which is driven by a sprocket chain 124 from sprockets 125 on a common shaft 126 to which motion is imparted by bevel gears from a longitudinal shaft 127, which in turn takes its motion by bevel gears from a short shaft 128 driven by a sprocket chain 129 from a through shaft 130 which carries at each end a gear-wheel 131 meshing with the upwardly ascending line of drive-links. The hand-rails pass from the pulleys 122 along the lower entry landing and up the incline to idlers 132, thence in horizontal direction along the upper exit landing to upper drive pulleys 133, which are tipped or set at an angle to the horizontal, thence to tightening idlers 134, which are oppositely tipped or set at an angle and so that their lowest points are in the same horizontal planes as the lowest points of their associated drive pulleys 133, as shown in Fig. 13, and thence around an intermediate pulley 135, also set at an angle or tipped, and thence down the incline to the idlers 136 where they change direction to return to the pulleys 122, which are tipped or set at an angle so as to bring their lowest points in line with the idlers 136 and with the lowest points of idlers 135. The intermediate pulleys 135 are slightly above the associated pulleys 133 and 134, so as to clear the stretch of rail between pulleys 133 and 134, and so disposed that their lowest points are substantially in alinement with the lowest points of pulleys 133, and their highest points are substantially in alinement with the highest points of pulleys 134, as shown in Fig. 13. By this arrangement of the parts the upper or operative stretch or line of the rail is adjacent the foot-way, and clearance is provided for the various stretches or lines of the rail where they pass or cross. Also, the rail is thus supported by the pulleys at the places where it is twisted, and the runs are in substantially straight lines.

The shafts of the pulleys 133 and 135 are out of alinement, and as a convenient means of driving these disalined shafts, I provide them with spiral gears 137 and 138, respectively, which mesh with an intermediate spiral gear 139, which is driven by a spiral pinion 140 on one end of a short shaft 141 whose other end is provided with a sprocket 142, which is driven from the shaft 53 of the driving sprockets 55. Any suitable means may be employed for imparting motion from the main driving shaft 53 to the sprockets 142, and, as shown in Fig. 11, this is conveniently done by means of sprocket chains 143 and 144 connecting the shafts 53 and 141, respectively, with an intermediate sprocket shaft 145.

The train of spiral gears is preferably inclosed in a gear case 146, such as shown in Figs. 14 and 15, and which is adapted to contain oil. The gear case is widened out at each end in order to accommodate the angular positions of the wheels 138 and 139.

A suitable hand-rail 147 is also provided at each side of the descending line or run of the foot-way, and driven at the same speed as the foot-way. These hand-rails and their operating parts of the same in construction and operation from the upper entry landing to the lower exit landing, and therefore a description of one of them will suffice for both between these points, after which I will describe the lower extension of the right-hand rail. Power to drive these hand-rails is preferably taken from the step-linkage at the upper landing, and at the right hand end of Figs. 16 and 17 I have illustrated an arrangement of parts for this purpose. As shown in these figures, a cross-shaft 148 is provided with sprockets 149 which mesh with the upturned teeth of the step-links, as shown in Fig. 16, by which motion is imparted to the cross-shaft. Sprockets 150 are located on the cross-shaft outside the sprockets 149, and by means of sprocket-chains 151 communicate motion to sprockets 152 arranged each upon one end of a short stub-shaft, located above and substantially in the same vertical plane as the cross-shaft 148. The other end of each stub-shaft is provided with a spiral-gear 153, which in turn meshes with sprocket-gears 154 and 155 which are supported each upon one end of oppositely directed stub-shafts located one upon each side of the first stub-shaft. A sprocket 156 is located on the other end of each of the stub-shafts of the sprocket 154, and transmits motion by a sprocket chain 157 to a sprocket 158 located on one end of a stub-shaft 159, which is ar-

ranged at or near the outer end of the upper entry landing, one at each side thereof, and carrying at its opposite end a drive pulley 160. Upon the inner end of each of the stub-shafts of the sprocket-gears 155, a drive pulley 161 is located, preferably in a plane outside of or beyond the pulley 160 with reference to the foot-way. A tightener-pulley 162 is also preferably provided for each line of the hand-rail, and in the construction shown it is arranged beyond its associated drive pulley 161, being regulated or adjusted by any suitable means to take up the slack of the hand-rail. Pulleys 163 are located close to each side of the foot-way at or near the point where it changes direction of travel from the upper entry landing to the downward incline, and these pulleys are preferably driven from the cross-shaft 148 by means of interposed sprockets and chains, as shown in Figs. 16 and 17. For this purpose, the shafts of the pulleys 163 carry sprockets 164, driven by chains from sprockets 165 whose shafts are in turn driven by cross-chains 166 from sprockets 167 on the shaft 148.

In the operation of the parts at the upper entry landing, the lower strand of the hand-rail passes to the lower portion of the pulley 161, about which it makes a half turn to pass to the upper portion of the associated idler 162 from whose lower portion it passes to the lower portion of the associated pulley 160, about which it then makes a half turn and runs in a horizontal plane to the pulley 163, the stretch between the pulley 160 and the pulley 163 forming the operative portion of the hand-rail along the length of the upper entry landing. The pulleys 162 are tipped or arranged at an angle to the vertical so that the rail may clear in passing to the pulley 160, the inclination of the pulleys 162 being such that the strands passing from them to the pulleys 160 will have the proper clearance with respect to the up-running portions or strands of the rail going to the undersides of the pulleys 161. The upper points of the pulleys 161 and 162 are substantially in line, and the lower points of the pulleys 162 are substantially in line with the lower points of the pulleys 160. While the pulley 162 may be set at such inclination as to bring the hand-rail close up to the sides of the foot-way, I prefer to set it at a less inclination so that the strand running from it to the pulley 160 will not interfere with the idlers 163, and then oppositely tilt the pulleys 160 to the necessary inclination to bring the operative line or strand of the rail into substantial alinement with the sides of the foot-way. The angle of the pulleys 162 is obtuse to the foot-way, while the angle of the pulleys 160 is acute thereto.

When a middle landing or eye-rest is employed it has been found in practice to be desirable to introduce means for driving the hand-rails at this point. Power to drive the hand-rails at the middle landing or eye-rest is preferably taken from the longitudinal shafts 57', which for this purpose are provided with gears 168 meshing with corresponding gears 169, each on one end of a longitudinal stub-shaft 170, whose opposite ends are provided with bevel-gears meshing with corresponding bevel-gears on transverse stub-shafts 171, whose inner ends carry pulleys 172 from which the up-running strand of the rail leads to the pulleys 161. The outer ends of the stub-shafts 171 are provided with sprocket-wheels from which sprocket chains 173 extend to corresponding sprocket wheels on one end of each of the stub shafts 174 of the pulleys 175 located at a point where the foot-way changes its direction of movement from the middle landing or eye-rest to the lower portion of the incline. Above the pulleys 172 idle pulleys 176 and 177 are located, the arrangement and disposition of the parts being such that the lower or up-going strand of the hand-rail is received upon the pulley 176, which is tipped or set at an angle so as to bring its upper point in line with associated idler 177 which in turn is in the same vertical plane as the idler 172, so that the rail in passing around these pulleys receives proper direction and is provided with the necessary clearance.

The hand-rail of the left hand side of the descending line or run of the foot-way passes around a lower idler 178 which is located at or near the point where the foot-way changes its direction of movement from the incline to the horizontal run of the lower exit landing, and which is set at an angle or tipped so as to have its upper point substantially in line with the upper portion of the associated pulley 175 and its lower point in substantial alinement with the lower portion of the associated tipped idler 176.

The hand-rail for the right-hand side of the descending line of the foot-way preferably does not terminate at the lower end of the incline but is extended across the lower exit landing to form a shunt-run, as at 179 in Fig. 17. At the end of this shunt-run the right-hand rail passes around a horizontally disposed drive pulley 180 which is driven by suitable intermediate connections from a longitudinal shaft 181 by which power is transmitted from the shaft 128, the connections being shown in Figs. 11 and 16, respectively. The shaft 128 is driven from the step-links as heretofore described, and as the exit-landing 11 where the drive-pulley 180 is located is below the line of the ascending run of the carrier, the connection to the shaft 128 is conveniently accomplished. The rail passes from the pulley 180 to a horizontal idle pulley 182 and then

under an idle pulley 183 in line with the lower point of the tipped pulley 176.

It is obvious that the return or idle stretches or portions of the hand-rails of both runs are turned over or upside down, and in order to reduce the wear on the rails I provide a guide for these portions of such construction as to afford a minimum of contact therewith. For example, as shown in Fig. 35, the guide 184 is provided with end or terminal enlargements 185 forming tracks upon which the hand-rails run in such manner that they do not engage the guides throughout their area or surface. This reduces the friction and wear.

The hand-rails 186 are preferably made by uniting a plurality of plies or thicknesses of suitable material, such as canvas, or by folding a strip of such material back and forth upon itself in a number of layers 187, as shown in Figs. 36 and 37, and is provided with a protecting or wear strip 188 which covers its surface exposed to the guides. The rails are preferably C-shape in cross-sectional outline or contour, and the wear strip covers or envelops the inner face and also the bights of the folds 189 and the selvage edges 190, as shown. In the arrangement illustrated in Fig. 36, the wear strip is a separate strip. It may, however, be formed of a continuation of one of the layers or plies, as shown in Fig. 37. As there shown the outer layer is continued and folded across the folded edges of the plies at one side of the hand-rail, then after following the internal contour of the rail is extended across the folded edges at the other side. The inner faces of the flat or body portion of the rails rest or bear upon the guides upon the operative portions or stretches, and the inner faces of the inturned ends rest on the guides on the return or idle stretches, thereby dividing the wear and distributing it upon different portions of the rails. By this construction of hand-rail, the bights of the folds and the selvage edges are concealed and the presence of raw edges is avoided, thus preventing raveling of the canvas. The canvas or other fabric of the hand-rail may be coated with, cemented together by, or embedded in suitable material, such as rubber, as indicated by dotted lines in Fig. 36, as is usual in this class of devices.

The tightener-pulleys 162 are mounted in sliding-frames 191, which are provided with cables 192 having weights 193 and screws 194, as shown in Fig. 17a. The screw passes freely through a bracket on the frame 195 and is provided with upper and lower regulating nuts 196 and 197. By turning up the nut 197, the tightener is drawn to increase the tension on the rail. The weight takes up the increment of the stretch of the rail, and the screw forms a lock to positively hold the aggregate of the stretch and prevents the tightener from jumping back if any sudden and excessive strain comes upon the rail.

By reason of the arrangement of the driving pulleys, it is obvious that in the descending run (Figs. 16 and 17) the portions of both rails from the upper driving pulleys to the eye-rest are slack, that is relaxed and not under tension. The driven pulleys 175 at the exit end of the eye-rest serve each to put its associated hand-rail under tension along the eye-rest. In the left hand rail, owing to the idler 178, the rail is again slack between the pulley 175 and the bottom of the incline. The same conditions exist at the opposite side of the machine between the top and bottom of the lower incline, but by reason of the driven pulley 180 the portion of the hand-rail crossing the lower landing to form the shunt 179 is again under tension. Each hand-rail is therefore tensionless or slack at the inclines, while at the horizontal portions, viz., the eye-rest and the lower landing, it is under tension.

What I claim is:

1. In an elevator, a series of sections, and a way forming a plurality of conveyer-runs having inclined portions on which the sections travel in ascending and descending lines, the inclined portion of the run for the descending line having an angular portion between adjacent levels.

2. In an elevator, a series of sections, a way having upper and lower inclined runs upon which the sections travel, the lower run having a horizontal portion between adjacent levels.

3. In an elevator, a way extending between two landings at different levels, and having an intermediate horizontal portion, tracks on the way, a carrier consisting of a series of steps traveling on the way, each step having front and rear supporting wheels, the tracks for the front wheels being above those for the rear wheels on the way adjacent the intermediate portion and below the rear-wheel tracks in the intermediate portion.

4. In an elevator, an inclined way extending between levels and having an angular portion therebetween, an endless carrier traveling down the way, and drive mechanism for the carrier at the angular portion of the way.

5. In an elevator, an inclined way extending between adjacent levels and having an angular portion therebetween, an endless carrier traveling down the way, and drive mechanism engaging the carrier at the ends of the angular portion of the way.

6. In an elevator, an inclined track or way having a horizontal portion between adjacent levels, an endless series of steps traveling down the way, links connecting the

steps, and drive mechanism engaging the links where the steps change direction of travel at the horizontal portion of the run.

7. In an elevator, an inclined way having a horizontal portion between adjacent levels, a series of connected steps traveling down the way, driving means for the steps at or near each end of the horizontal portion, and connections between the drives.

8. In an elevator, an inclined way extending between adjacent levels and having an intermediate horizontal portion, a series of connected steps traveling down the way, drive sprockets for the steps at or near the two ends of the horizontal portion, and means to operate the sprockets from a common source of power.

9. In an elevator, an inclined way extending between adjacent levels and having an intermediate horizontal portion, a series of connected steps traveling down the way, drive sprockets for the steps beyond the ends of the horizontal portion, and longitudinal drive shafts connecting with the sprockets.

10. In an elevator, a way extending in inclined ascending and descending runs between adjacent levels, the descending run having an intermediate horizontal portion, an endless series of steps traveling on the way, means to drive the steps of the ascending run, sprockets for the steps at the horizontal portion of the descending run, and longitudinal shafts driven by the steps of the ascending run and driving the sprockets at the intermediate portion.

11. In an elevator, a way extending in inclined ascending and descending runs between adjacent levels, the descending run having an intermediate horizontal portion, an endless series of steps traveling on the way, means to drive the steps of the ascending run, a pair of sprockets at each end of the horizontal portion of the descending run, and a longitudinal shaft at each side of the horizontal portion connecting the corresponding sprockets of each pair, and connections between said shafts and the steps of the ascending run.

12. In a conveyer, a series of connected wheeled sections, upper and lower runs upon which the steps travel, a carriage connecting the runs at their lower ends and having tracks for the wheels, one of the tracks having a lower yielding section.

13. In a conveyer, a series of steps each provided with carrying wheels, a way providing upper and lower runs for the wheels, and a carriage connecting the runs at their lower ends and having tracks with which the wheels coöperate as the steps pass through the carriage, one of such tracks having a lower yielding portion.

14. In a conveyer, a series of connected wheeled steps, ascending and descending inclined runs, a carriage connecting the runs at their lower ends and having tracks for the step-wheels, one of the tracks provided with a lower yielding section.

15. In a traveling stairway, a series of connected wheeled steps, inclined ascending and descending runs, an end carriage having tracks for the wheels of the steps, the tracks for the front wheels provided with inner spring pressed yielding sections where the wheels change their direction of travel.

16. In a traveling stairway, steps provided with front and rear carrying wheels, tracks forming upper and lower ways for the steps, and a carriage connecting the ways at their lower ends and having tracks curved to carry the steps from the line of the lower way to that of the upper way, the tracks for the front wheels in the carriage having a yielding section at the initial portion of the curve.

17. In a traveling stairway, the combination with tracks for ascending and descending runs, of connected steps provided with leading and following wheels running on the tracks, curved ways for the wheels as the steps pass from one run to the other, the way for the leading wheel on the descending run having a yielding section at the curve, and means to restrict the way for the associated following wheel.

18. In a traveling stairway, the combination with tracks for ascending and descending runs, of a set of steps provided with leading and following wheels adapted to the tracks, ways for the wheels as the steps pass from one run to the other, the way for the leading wheel on the descending run having a yielding section at the curve, and a brake in the way for the following wheel to prevent slippage of the latter.

19. In a traveling stairway, the combination with tracks for ascedning and descending runs, of steps provided with axle bars carrying leading and following wheels, guide ways for the wheels as the steps pass from the descending to the ascending run, the guide way for the following wheel having a spring restricting its area.

20. In a traveling stairway, the combination with tracks for ascending and descending runs, of steps provided with axle bars having leading and following wheels, a carriage connecting the runs at each end and having curved tracks providing guides for the wheels, the inner track of the guide for the following wheel of the descending run having a leaf spring in the line of the wheels.

21. In a conveyer, the combination with tracks for the ascending and descending runs of a traveling stairway, of steps provided with axle bars, yokes fixed to the axles and provided with leading and following wheels, a carriage for leading the steps

from the descending to the ascending run, such carriage having a channel guide for the step-axles and tracks having curved portions and providing guides for the wheels, the inner track for the guide for the following wheel having a leaf spring providing a brake for such wheel to overcome the tendency of the step to turn on its axle as a pivot as the leading wheel turns the curve in its guide.

22. In a traveling stairway, a series of connected steps, each having a wheel-base rigid therewith, front and rear supporting wheels on each base, tracks providing upper and lower runs for the wheels, means to move the steps on the tracks, and a carriage between the runs having curved tracks for the wheels, the carriage tracks for the front wheels each having a yielding section and those for the back wheels each having a spring located at the initial portions of the curves.

23. In a traveling stairway, a series of connected steps, each having an axle and wheel-base rigid therewith, front and rear wheels in each base, upper and lower runs for the steps, means to move the steps, and a carriage between the runs, a curved guide in the carriage for the axles, tracks in the carriage for the front and rear wheels, the front wheel track having a yielding section and the rear-wheel track having a spring whose stress is in the direction of the front-wheel track, the spring and yielding section being so located and arranged as to contact simultaneously with their associated wheels on each step.

24. In a conveyer, upper and lower transporting runs connecting adjacent levels and providing a landing for each run at the upper level, and a transfer between the landings at the upper level having a body and oppositely disposed inlet and outlet in different planes.

25. In a conveyer, upper and lower transporting runs connecting adjacent levels and providing exit and entry landings in alinement at the upper level, and a transfer between the landings at the upper level having a body and oppositely disposed inlet and outlet in different planes and a continuous step-axle guide.

26. In a conveyer, upper and lower transporting runs connecting adjacent levels and providing a landing for each run at the upper level, a vertical transfer between the said landings, and a vertical carriage at the end of the landings, the arrangement being such that the line of travel from the transfer to the associated carriage provides necessary clearance for the entry landing.

27. In a conveyer, a transfer having a body and oppositely disposed inlet and outlet in different horizontal planes, and an axle guide extending from end to end thereof.

28. In a conveyer, a way extending in different horizontal planes, a transfer intermediate adjacent portions of the way, a series of connected steps moving on the way, each step having an axle, and a continuous guide in the transfer for the axles as they pass therethrough.

29. In a conveyer, a way extending in different horizontal planes, a transfer intermediate adjacent portions of the way, a series of connected steps moving on the way, each step having an axle and supporting wheels thereon, a continuous guide for the axles and tracks for the wheels in the transfer.

30. In a conveyer, a continuous way comprising upper and lower inclined runs between adjacent levels, a pair of horizontal runs at each level, a carriage extending below the lower level, a carriage extending above the upper level, a transfer extending above the upper level, and an endless conveyer traveling over said way and forming entry and exit landings on the horizontal runs at each level and ascending and descending transporting portions between the landings.

31. In a traveling stairway, upper and lower transporting portions connecting different levels and providing exit and entrance landings at the upper level, an upwardly extending transfer having tracks for the step wheels, and guard rails.

32. In a traveling stairway having upper and lower transporting runs, steps having carrying-wheels, a carriage connecting the runs and having tracks for the wheels, one of such tracks having a gap, and means engaging the step body to prevent tilting of the step as the wheel associated with such track passes the gap.

33. In a device of the class described, a way having upper and lower runs, a series of moving steps having wheels, a carriage provided with tracks for said wheels in extension of said runs, and means engaging the step body for maintaining the equilibrium of the steps as they pass through the carriage.

34. In a traveling stairway having upper and lower transporting runs, steps each of which is provided with an extended axle-bar and carrying wheels, a carriage connecting the runs and having a guide for the extended ends of the axle-bar and tracks for the wheels, one of such tracks having a gap to permit of the passage of the axle-bar, and means to engage the step body to prevent tilting of the same as the wheel passes the gap.

35. In a traveling stairway having ascending and descending runs, a connected series

of steps each of which is provided with an extended axle-bar and leading and following carrying wheels, a carriage connecting the runs and having a guide for the extended end of the axle-bar and tracks for the wheels, the track for the leading wheel crossing the guide and having a gap to permit of the passage of the axle-bar, and a roller engaging the step tread in the rear of the axle as the leading wheel crosses the gap to prevent tilting of the step.

36. The combination with upper and lower tracks for ascending and descending runs of a traveling stairway, a series of connected steps each of which is provided with an axle-bar having extended ends, a wheel-base fixed to the axle-bar and provided with leading and following carrying-wheels, a carriage connecting the runs and having a guide for the extended ends of the axle-bars and tracks connecting the tracks of the ascending and descending runs, the track for the leading-wheel crossing the guide and having a gap to permit of the passage of the end of the axle-bar, and a roller journaled on the carriage and engaging the tread of the step at the rear of the axle-bar to prevent tilting of the step.

37. In a device of the class described, a series of moving steps having front and rear wheels, an end carriage having tracks for the wheels, and electrical means to increase the traction of the wheels on the said tracks.

38. In a device of the class described, the combination with an endless carrier having upper and lower runs, a carriage connecting the runs and having reversing tracks for the carrier, one of said tracks having a magnetized section.

39. In a device of the class described, a series of moving steps, and magnetic track for maintaining the steps in predetermined position.

40. In a device of the class described, a way having tracks, a series of moving steps, and electrical means to control the relation of the steps and the tracks.

41. In a device of the class described, a way providing upper and lower inclined runs, a reverser between the runs, a series of steps moving on the runs, and electrical means to control the relation of the steps at the reverser.

42. In a device of the class described, a way providing upper and lower inclined runs, a reverser between the runs, tracks on the runs and in the reverser, a series of steps having wheels running on the tracks, and a magnetized track in the reverser to increase the traction of the wheels.

43. In a device of the class described, a way providing upper and lower inclined runs, a reverser between the runs, tracks on the runs and in the reverser, a series of steps having wheels running on the tracks, and a magnetized track in the reverser with which the wheels coöperate.

44. In a device of the class described, a way providing upper and lower inclined runs, a reverser between the runs at the upper end of the incline, a series of steps moving on the runs, and electrical means to maintain the steps in predetermined position in the reverser.

45. In a device of the class described, a way providing upper and lower inclined runs, a reverser between the runs at the upper end of the incline, tracks on the runs and in the reverser, a series of moving steps having bearings moving on the tracks, and a magnetized track in the reverser coöperating with the bearings.

46. In a moving stairway, a way having a track, a series of steps having wheels running on the tracks, and electrical means to control the relation of the wheels and tracks.

47. In a conveyer, a series of wheeled steps moving in oppositely directed runs, a carriage connecting the runs, and tracks for the wheels in the carriage changing the direction of travel of the steps, one of the tracks being magnetized where the relation of associated front and back wheels is reversed.

48. In a device of the class described, a carriage having tracks for the leading and following wheels of the steps of a traveling stairway, the track for the leading wheel having angular portions connected by an outwardly bowed portion, and a guard track within and facing the bow.

49. In a device of the class described, a carriage having tracks for the leading and following wheels of the steps of a traveling stairway, the track for the leading wheel having angular portions connected by an outwardly bowed portion, and a curved guard track having a cushion to receive the impact of the wheels as they descend against the guard track.

50. In a device of the class described, a traveling footway providing straight ascending and descending inclined runs connecting different levels, a single source of power, and synchronously operated shafts at the same level driven thereby for transmitting motion to the footway at the top of both inclined runs.

51. In a device of the class described, a traveling footway providing straight ascending and descending inclined runs connecting different levels, a transverse shaft for transmitting motion to each run at the top of its incline, and a driving shaft connecting the transverse shafts at the same level.

52. In a device of the class described, a traveling footway providing ascending and

descending inclined runs connecting different levels and forming moving landings at the upper levels, a transfer beyond the landing at the upper level, and means for applying power to the footway as it enters the transfer.

53. In a device of the class described, a traveling footway consisting of connected steps forming an inclined run and a horizontal landing, a transfer beyond the landing, a transverse drive shaft at the top of the incline for moving the steps, and a connection from such shaft for applying power to the steps at the entrance to the transfer.

54. In a device of the class described, a traveling footway consisting of connected steps forming upper and lower inclined runs, each of which is provided with a horizontal landing at the top of the runs, a transfer at the end of the landing of the upper run, a transverse drive shaft at the top of such run, a second drive shaft adjacent the entrance to the transfer, and connections between such shafts.

55. In a device of the class described, a traveling footway consisting of a series of connected steps forming upper and lower inclined runs, each of which is provided with a horizontal landing at the top, a transfer between the landings, sprocket wheels engaging the step-connections at the top of the runs and at the entrance to the transfer, a longitudinal shaft adjacent the sprockets, and spiral gear connections between the longitudinal shaft and the sprocket-shafts.

56. In a device of the class described, a traveling footway, driven members for imparting motion to the footway at different points, and a sectional longitudinal shaft for driving such members, such shaft having universal joints, and universal bearings for the shaft.

57. In a device of the class described, a traveling footway, a longitudinal sectional shaft for transmitting motion to the footway at different points, such shaft having universal joints, and a bearing for each section of the shaft comprising an annular concaved bearing seat, and a bearing sleeve in the shaft coöperating with the seat.

58. In a conveyer, a way, a carrier moving on the way, teeth on the carrier, driving sprockets engaging the teeth at a plurality of points in the line of the carrier, a sectional shaft coöperating with the sprockets, and means to axially adjust the sections.

59. In a conveyer, a way, a carrier moving on the way, teeth on the carrier, driving sprockets engaging the teeth at a plurality of points in the line of the carrier, connections from a suitable source of power to one of said sprockets, a sectional shaft extending from the last named sprocket to the other sprockets, and means to true up the engagement of the sprockets with the teeth.

60. In a conveyer, a way, a carrier moving on the way, teeth on the carrier, driving sprockets arranged in pairs and engaging the teeth at a plurality of points in the line of the carrier, connections from a source of power to one pair of said sprockets, sectional longitudinal shafts driven by said last named sprockets and driving said other sprockets, and adjustable couplings for the sections to secure uniform engagement of the sprockets and teeth.

61. In a device of the class described, the combination with a footway provided with connecting linkage, and a shaft for transmitting motion to the linkage at different points and consisting of axially adjustable sections, and a coupling for securing the sections in their adjusted positions.

62. In a device of the class described, the combination with a footway consisting of a series of steps, rack links connecting the steps, and a shaft for transmitting motion to the links at different points and consisting of a pair of members rigid with the ends of the shaft and axially adjustable and means for securing the members in their adjusted position.

63. In a device of the class described, the combination with a footway consisting of a series of steps providing ascending and descending runs, rack links connecting the steps, sprockets engaging the links on both runs, and a sectional connecting shaft between such sprockets, a pair of coöperating members rigidly connected to the abutting ends of the sections and adapted to be adjusted axially with relation to each other so as to bring the sprocket wheels corresponding with the respective sections into mesh with the teeth of the linkage under a uniform degree of pressure.

64. In a device of the class described, a sectional footway, rack-links connecting the sections, sprocket wheels engaging the links at different points, and a sectional shaft for transmitting motion to the sprockets, such shaft being adjustable so as to set all the sprockets in the same relation to the teeth of the linkage.

65. In a device of the class described, a series of sections, rack-links connecting the sections, sprocket-wheels engaging the links at two different points in their line, means to drive one of the sprockets, a shaft for transmitting motion from said last named sprocket to the other sprockets and having an axially adjustable section, and a coupling therefor.

66. In a device of the class described, a way providing ascending and descending inclined runs, a carrier traveling on the way, sprockets engaging the carrier on each run, a sectional shaft connecting the sprockets, and a coupling to adjust the sections.

67. In a device of the class described, a

way providing ascending and descending inclined runs, a carrier traveling on the way, sprockets engaging the carrier at the top of each run, means to drive one of the sprockets, a shaft connecting the sprockets and having an adjustable section.

68. In a device of the class described, the combination with a footway consisting of a series of steps providing ascending and descending runs, rack links connecting the steps, sprockets engaging the links of both runs, a sectional transmission shaft between the sprockets and having one of the sections thereof adjustable axially so as to set the sprockets associated therewith in the same relation to the links as the sprocket associated with the other section.

69. In a device of the class described, the combination with a driven footway having upper and lower ascending and descending inclined runs, the descending run having a horizontal portion between its ends, and means for applying power from the ascending run to the other run at each end of the horizontal portion.

70. In a device of the class described, the combination with a footway consisting of an endless series of connected steps providing upper and lower ascending and descending inclined runs, the latter having a horizontal portion between its ends, means for driving the footway, and a connection between the ascending run and the descending run at both ends of the horizontal portion.

71. In a device of the class described, the combination with a footway consisting of an endless series of link-connected steps providing upper ascending and lower descending inclined runs, the descending run having an intermediate horizontal portion, synchronously driven sprockets engaging the links of both runs at the top of each incline, sprockets engaging the links between the ends of the ascending incline, sprockets engaging the links at opposite ends of the horizontal portion, and connections between the two latter sprockets.

72. In a device of the class described, a supporting wheel provided with outer and inner lubricating bushings provided with flanges located at the ends of the wheel-hub.

73. In a device of the class described, a wheel the hub of which is provided with inner and outer bushings spaced apart to provide an oil chamber between the same and having flanges to provide a lubricating flange on each face of the wheel.

74. In a device of the class described, an inclined way consisting of upper and lower tracks, and a step having a wheel-base, an axle-bar, and angular wheel-carrying arms thereon, the inclination of the arms being such that the axle-bar is above the line of the tracks.

75. In a device of the class described, upper and lower tracks providing a way having inclined and horizontal portions and crossing at the curve between the horizontal and inclined portions of the way, and a step having a wheel-base, and an axle-bar provided with angularly disposed wheel-carrying arms, the inclination of the arms being such that the axle-bar is above the line of the upper track on the incline.

76. In a device of the class described, a way having inclined and horizontal portions, upper and lower tracks in different vertical planes on the way, the tracks crossing at the curve between the inclined and horizontal portions so that the upper track on the incline becomes the lower track on the horizontal, a series of moving steps, each having an axle-bar, an angular wheel-base on the axle-bar provided with front and rear wheels, the angle of the base being such that the axle-bars are above the upper tracks at all points.

77. In a device of the class described, a way having inclined and horizontal portions, upper and lower tracks in different vertical planes on the way, the tracks crossing at the curve between the inclined and horizontal portions, a series of moving steps having angular wheel-bases provided with front and rear wheels, the relation of the tracks and wheel-bases being such that the steps remain with their treads substantially horizontal on all portions of the tracks.

78. In a device of the class described, a way having inclined and horizontal portions, upper and lower tracks in different vertical planes on the way, the tracks being the same distance apart on the inclined and horizontal portions and crossing at the curve between such portions, a series of moving steps each having an angular wheel-base provided with front and rear wheels whose axes are in a line dividing the angle of the incline.

79. In a device of the class described, a series of moving steps, tracks therefor located in different vertical planes, and in inclined and horizontal parallel planes, and in intersecting planes connecting the inclined and horizontal planes.

80. In a device of the class described, a series of moving steps having front and rear wheels, tracks therefor located in inclined and horizontal planes, the tracks for the front and rear wheels being in intersecting planes between the horizontal and inclined planes.

81. In a device of the class described, a series of moving steps, tracks therefor located in different vertical planes, and in inclined and horizontal parallel planes, and in planes which intersect at a middle point.

82. In a device of the class described, a series of moving steps having front and rear wheels, and tracks therefor forming inclined and horizontal ways, the distance between

the tracks being uniform on the inclined and horizontal ways.

83. In a device of the class described, a series of moving steps having front and rear wheels, and tracks therefor forming inclined and horizontal ways, and located in different vertical planes and in different parallel planes, the distance between the planes being uniform on the inclined and horizontal ways.

84. In a device of the class described, tracks arranged in different planes on inclined and horizontal ways, a series of steps each having a yoke, front and rear wheels on the yokes so disposed that the angle of the inclination of the way is bi-sected by a line drawn through the axes of the wheels.

85. In a device of the class described, an inclined way having tracks in parallel planes, and steps having front and rear wheels so disposed that the angle of the inclination of the way is divided by a line passing through the axes of the wheels.

86. In a device of the class described, upper and lower tracks providing a way having inclined and horizontal portions, and a step provided with a wheel-base, the wheels being in a line dividing the angle of the way, and the tracks being reversed at the same distance apart on the inclined and horizontal portions.

87. In a device of the class described, a way having inclined and horizontal portions, and a series of moving steps, each provided with a wheel-base having front and rear carrying wheels in different vertical planes, the wheels being upon a line dividing the angle of the inclined portion of the run, the track for the outer wheel being above the track for the inner wheel on the incline and below the same on the horizontal portion.

88. In a device of the class described, a way having inclined and horizontal portions, tracks the same distance apart and reversed on the two portions, a series of moving steps provided with inner and outer carrying wheels so disposed that on the incline the outer wheel runs upon the upper track and the inner wheel upon the lower track and reversely on the horizontal portion, such tracks crossing at the curve between the horizontal and inclined portions.

89. In a device of the class described, a way providing inclined and horizontal portions connected by a curve, upper and lower tracks on the way arranged the same distance apart on the inclined and horizontal portions and crossing at the curve, whereby the height of the tracks is reversed, a series of steps having front and rear wheels running on the tracks, and arranged upon a line dividing the angle of the incline.

90. In a device of the class described, a conveyer, and an upthrust therefor thrown into action thereby.

91. An endless conveyer, a driving member therefor, and an upthrust thrown into action by the conveyer under the action of the driving member.

92. In a device of the class described, a series of link-connected steps, a pinion engaging the links to drive the steps, a gravity controlled upthrust which is thrown into action by the links under the lifting and tilting action of the pinion.

93. In a device of the class described, a series of steps, rack-links connecting the steps, a pinion engaging the links to move the steps, and an upthrust to resist the lifting and tilting action of the pinion and consisting of a hanging shoe located over the links and moved into operative position thereby.

94. In a device of the class described, a series of link-connected steps, bosses on the links, a pinion engaging the links to drive the steps, and an upthrust shoe located above the links and normally out of engagement with the bosses thereof and thrown into action by the engagement therewith of the bosses to prevent tilting and lifting of the links under the action of the pinion.

95. In a device of the class described, a series of link connected steps, a pinion engaging the links, and an upthrust shoe located over and parallel with the line of movement of the links and moved toward the pinion by the links under the tilting and lifting action of the pinion.

96. In a device of the class described, a series of link-connected steps on an inclined way, a pinion engaging the links, an upthrust shoe parallel with the line of movement of the links, toggles supporting the shoe and normally approaching a perpendicular position, but moved to a position at a right angle to the line of movement of the links under the action of the latter due to the tilting and lifting action of the pinion.

97. In a device of the class described, an inclined way, a series of steps traveling thereon, rack-links connecting the step, a pinion engaging the links to move the steps, a toggle-supported upthrust shoe located over the links parallel with the line of movement thereof, means to adjust the shoe to compensate for wear, a stop to limit the movement of the shoe as the toggles approach perpendicular position, and a spring to resist the movement of the shoe in the opposite direction under the action of the links when lifted and tilted by the pinion.

98. In a device of the class described, an inclined way, a series of steps traveling thereon, rack-links connecting the steps and having bosses adjacent the ends and at the tops of the same, a pinion engaging the links to move the steps, an upthrust shoe coöperating with the bosses to resist the lifting and tilting action of the pinion, toggles pivoted to the shoe, a stationary block hav-

ing inclined faces, and an adjustable block having similarly inclined faces and to which the toggles are pivoted.

99. In a device of the class described, an inclined way, a series of connected steps traveling thereon, rack-links connecting the steps and having upper bosses adjacent the ends, a pinion engaging the links to move the steps, an upthrust shoe coöperating with the bosses to resist the lifting and tilting action of the pinion, toggles pivoted to the shoe, a stationary block having inclined faces, a second block having coöperating inclined faces and adjustable longitudinally of the stationary shoe and to which the toggles are connected, and bolts for securing the second block in adjusted position.

100. In a device of the class described, the combination with a moving stairway consisting of a series of wheeled steps provided with extended axle bars having rollers, rack-links connecting the steps, a pinion engaging the links to move the steps, and an upthrust device brought into action by the links to coöperate with the links and the axle rollers to resist the lifting and tilting action of the pinions.

101. In a device of the class described, the combination with a moving stairway consisting of a series of steps provided with extended axle-bars having rollers, rack-links having bosses and connecting the axle-bars, a pinion engaging the links to move the steps, a toggle-supported upthrust shoe with which the link bosses are thrown into engagement under the action of the pinion and having a flange with which the axle roller coöperates at such time.

102. In a device of the class described, a sectional traveling carrier, and an up-thrust thrown into action by the carrier and engaging two members of the carrier at the same time.

103. In a device of the class described, a sectional traveling carrier, and an up-thrust thrown into the action by the carrier and engaging two members of the carrier alternately.

104. In a device of the class described, a series of moving steps provided with axle-bars, links connecting the axle-bars, and an up-thrust thrown into action by the links and engaging the links and axle-bars simultaneously.

105. In a device of the class described, a series of steps having axle-bars, rack-links connecting the axle-bars, a pinion engaging the links to move the steps, and an upthrust engaging the axle-bars and alternate links.

106. In a device of the class described, a series of link-connected steps, bosses on the links, a pinion engaging the links to move the steps, an upthrust shoe with which the bosses of the links coöperate under the lifting and tilting action of the pinion, and a lubricator for the bosses.

107. In a device of the class described, a series of link-connected steps, bosses on the links, a pinion engaging the links to move the steps, an upthrust shoe with which the bosses of the links coöperate under the lifting and tilting action of the pinion, and a lubricating wheel with which the bosses contact before passing under the shoe.

108. In a device of the class described, a series of link-connected steps, bosses on the links, a pinion engaging the links to move the steps, an upthrust shoe with which the bosses of the links coöperate under the action of the pinion, a spring supported lubricant receptacle provided with a lubricating wheel to apply the lubricant to the bosses.

109. In a device of the class described, a series of link-connected steps, bosses on the links, a pinion engaging the links to move the steps, an upthrust shoe with which the bosses of the links coöperate under the action of the pinion, a spring supported lubricant receptacle provided with an automatic lubricating device for the bosses.

110. In a device of the class described, a series of link-connected steps, bosses on the links, a pinion engaging the links to move the steps, an upthrust shoe with which the bosses of the links coöperate under the lifting and tilting action of the pinion, a lubricant tank, a wheel mounted therein, and a spring for thrusting the tank toward the bosses so that the latter will engage the wheel and be lubricated thereby, the wheel being rotated by the engagement of the bosses.

111. A guide for the return of an endless hand-rail, having terminal enlargements extending above and below the rail and forming tracks to support the rail out of contact with the other portions of the guide.

112. A traveling hand-rail substantially C-shape in cross-section, and a guide for the return run thereof, such guide having terminal enlargements forming tracks upon which the hand-rail runs and is supported out of engagement with the body of the guide throughout its area or surface.

113. A guide for a hand-rail having terminal enlargements, and a hand-rail supported upon the enlargements out of contact with the other portions of the guide.

114. A guide having a hand-rail having lateral enlargements forming external tracks and a hand-rail supported upon the tracks out of contact with the other portions of the guide.

115. In a device of the class described, a moving footway consisting of an endless series of steps having their treads uppermost on opposite runs, links connecting the steps, and means engaging the links to move the

steps, a traveling hand-rail for each run, and connections driven by the links to drive the hand-rails.

116. In a device of the class described, a conveyer, a hand-rail therefor, a plurality of vertical pulleys angularly disposed with reference to each other and one of which is driven, and an idler leading the rail from each pulley to the succeeding one.

117. In a device of the class described, a conveyer, a hand-rail therefor, and a drive for the hand-rail consisting of two vertical pulleys placed angularly to each other, and an idler leading the rail from one of said pulleys to the other.

118. In a device of the class described, a conveyer, a hand-rail therefor, and a drive for the hand-rail consisting of two pulleys set obliquely to the vertical, and an idler leading the rail from one pulley to the other.

119. In a device of the class described, a conveyer, a hand-rail therefor, means to drive the hand-rail, a tightener-pulley for the hand-rail, and a locking device for positively controlling the tightener.

120. In a device of the class described, an inclined moving footway consisting of a series of steps connected by rack-links, pinions engaging the links to drive the steps, an endless hand-rail at each side of the footway, a transverse shaft having sprocket wheels engaging the links, hand-rail driving wheels at the bottom of the incline, a second transverse shaft, connections between the second shaft and the hand-rail driving wheels, and a longitudinal shaft with bevel gear connections between the transverse shafts.

121. In a device of the class described, the combination with a moving footway, a traveling hand-rail therefor, pulleys at the ends of the footway correspondingly inclined to bring the active run of the hand-rail adjacent the side of the footway, a take-up pulley disposed at an opposite angle, an intermediate pulley over which the hand-rail passes from the take-up pulley and from which the return run of the hand-rail passes, such pulley and the adjacent end pulley being inclined at opposite angles, and a gear for transmitting motion to the intermediate and end pulleys.

122. In a device of the class described, the combination with a moving footway, a traveling hand-rail therefor, and pulleys at the ends of the footway for the rail, a take-up pulley, an intermediate pulley, the latter pulley and the adjacent end pulley being oppositely inclined and having shafts provided with spiral gears, and a spiral driving gear common to both of the shaft-gears.

123. In a device of the class described, the combination with a moving footway, a traveling hand-rail therefor, oppositely inclined pulleys located adjacent one end of the footway and over which the hand-rail passes, disalined shafts for the pulleys and having spiral gears, and a driven gear engaging both spiral gears for driving the pulleys.

124. In a device of the class described, the combination with a moving footway, a traveling hand-rail therefor, oppositely inclined pulleys located adjacent one end of the footway and in contact with which the hand-rail passes, disalined shafts on which such pulleys are mounted and provided with spiral gears, a spiral driving gear engaging such gears, and a connection with the footway for turning the spiral driving gear.

125. In a device of the class described, the combination with a moving inclined stairway consisting of a series of steps, drive links connecting the steps, a traveling hand-rail therefor, a pulley located at each end of the stairway, such pulleys being set at corresponding angles, a take-up pulley adjacent the top of the incline and set at an opposite angle, a pulley intermediate the take-up pulley and the adjacent end pulley and standing at an angle corresponding to such end pulley, the shafts of the intermediate and end pulleys being disalined and provided with spiral gears, a spiral driving-gear common to the spiral gears, and chain and sprocket connections between the links of the stairway for turning the spiral driving-gear.

126. In a device of the class described, the combination with a moving stairway consisting of a series of steps, drive links connecting the steps, a traveling hand-rail therefor, a pulley located at each end of the stairway, such pulleys being set at corresponding angles, a take-up pulley adjacent the top of the incline and set at an opposite angle, a pulley intermediate the take-up pulley and the adjacent end pulley and standing at an angle corresponding to the adjacent end pulley and extending slightly above the take-up and end pulleys so as to clear the stretch of the hand-rail between such pulleys.

127. In a device of the class described, the combination with a moving inclined footway having a horizontal portion between its ends, a moving hand-rail for the footway, and means for applying power to the hand-rail at the said horizontal portion.

128. In a device of the class described, the combination with a moving inclined footway having a horizontal portion between its ends, a moving hand-rail for the footway, and means for applying power to the hand-rail at the said horizontal portion and comprising a pair of driven pulleys, each engaging one run of the hand-rail.

129. In a device of the class described, the combination with a moving inclined footway having a horizontal portion between its ends, a moving hand-rail for the footway, and

means for applying power to the hand-rail at the said horizontal portion and comprising a pair of driven pulleys, driving connections between the pulleys, and a connection from the footway for imparting motion to the pulleys.

130. In a device of the class described, the combination with a moving inclined footway having a horizontal portion between its ends, a moving hand-rail for the footway, carrying pulleys therefor at the ends of the footway, a driven pulley engaging each run of the hand-rail at the horizontal portion, and a pair of idlers over which the return run of the hand-rail passes to the driven pulley engaging such run, the pulleys engaging the return run being located outside the active run.

131. In a device of the class described, the combination with a moving inclined footway having a horizontal portion between its ends, a moving hand-rail for the footway, drive pulleys engaging both runs of the hand-rail at the horizontal portion.

132. In a device of the class described, the combination with a moving footway consisting of inclined portions connected by a horizontal portion, a hand-rail for the footway, and a driving pulley engaging the hand-rail at the top of each inclined portion.

133. In a device of the class described, the combination with a moving descending footway consisting of inclined portions connected by a horizontal portion and having a landing portion at each end, a moving hand-rail at each side of the footway one of which crosses the lower landing to provide a shunt thereat, and the other of which terminates adjacent the lower landing, driven pulleys engaging both runs of the hand-rails at the horizontal connecting portion, and driven pulleys engaging the hand-rails at the upper landing.

134. In a device of the class described, a moving stairway consisting of link-connected steps providing upper ascending and lower descending transporting inclined runs, traveling hand-rails at the sides of each run, driven pulleys for the hand-rails of the ascending run at the ends thereof, and driven pulleys for the hand-rails of the descending run located at the upper end of the incline.

135. In a device of the class described, a moving stairway consisting of link-connected steps providing upper ascending and lower descending inclined transporting runs, a main drive shaft for the stairway, traveling hand-rails at the sides of each run, driven pulleys for the hand-rails of the ascending run at the ends thereof, connections between the main drive shaft and the pulleys at the upper end of such run and connections between the links and the pulleys at the lower end of the run, driven pulleys for the hand-rails of the descending run located at the upper end of the incline, and connections between the links and the latter pulleys.

136. A traveling hand-rail for moving inclined footways having a horizontal portion under tension and an inclined portion relaxed on its service-run.

137. A traveling hand-rail having on its operative or service run an inclined slack or relaxed portion and a horizontal portion under tension.

138. A traveling footway, having an inclined and a horizontal portion, and a traveling hand-rail having its operative or service run relaxed along the incline and under tension at the horizontal.

139. A traveling footway consisting of inclined portions connected by a horizontal eye-rest, and a traveling hand-rail having its operative or service-run relaxed along the incline and under tension at the eye-rest.

140. A traveling footway consisting of inclined portions connected by a horizontal eye-rest and having a horizontal landing at the bottom of the lower incline, a traveling hand-rail, and driving pulleys at the ends of the footway and at the exit end of the eye-rest, whereby the hand-rail is put under tension at the eye-rest and horizontal landing and is relaxed along the incline.

141. In a device of the class described, an endless traveling hand-rail, a slidably mounted pulley for the rail, a weight for sliding the pulley to maintain the rail under tension, and an adjustable abutment for limiting the movement of the weight under abnormal strain of the hand-rail.

142. In a device of the class described, an endless traveling hand-rail, a slidably mounted pulley for the rail, a cable supported weight for moving the pulley to take up slack in the rail, a bracket, a stem depending from the weight and passing through the bracket, and an adjustable abutment on the stem coöperating with the bracket to define the normal tension of the rail and to limit the movement of the weight when the hand-rail is subjected to abnormal strain.

143. In an upthrust, a frame, a shoe in the frame, headed screw bolts connecting the frame and shoe, and externally threaded sleeves secured in the frame and through which the bolts pass and upon which their heads rest.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES D. SEEBERGER.

Witnesses:

W. H. BRADY,

H. L. GILLESPIE.