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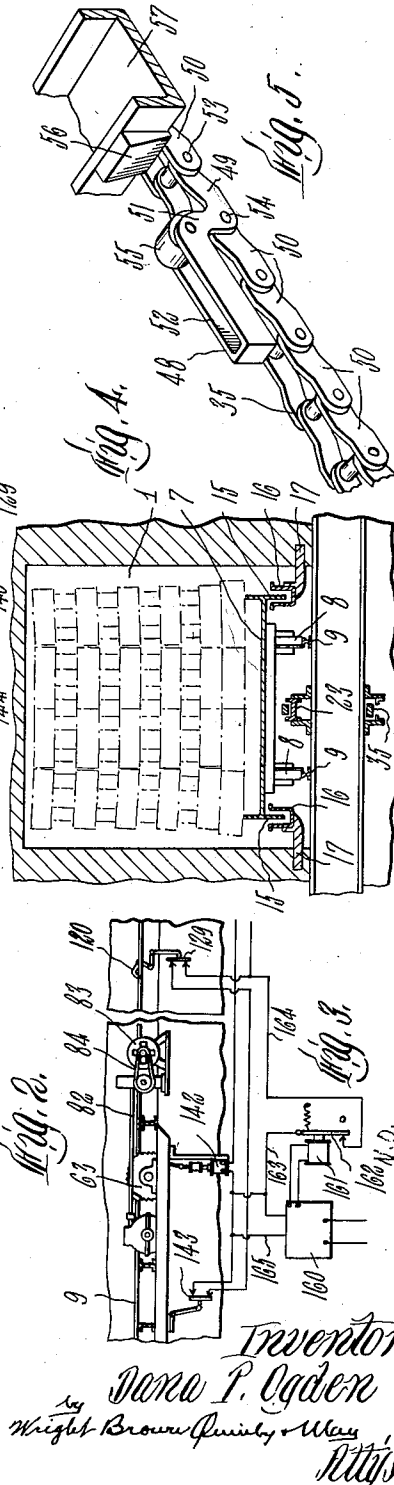
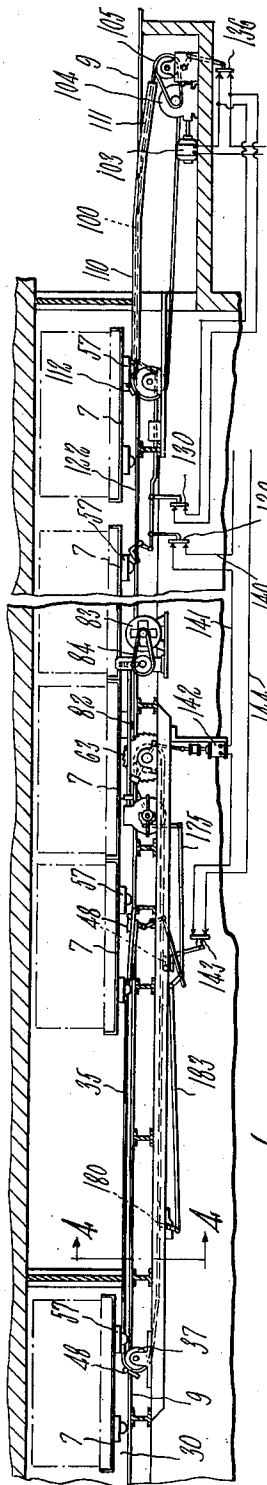
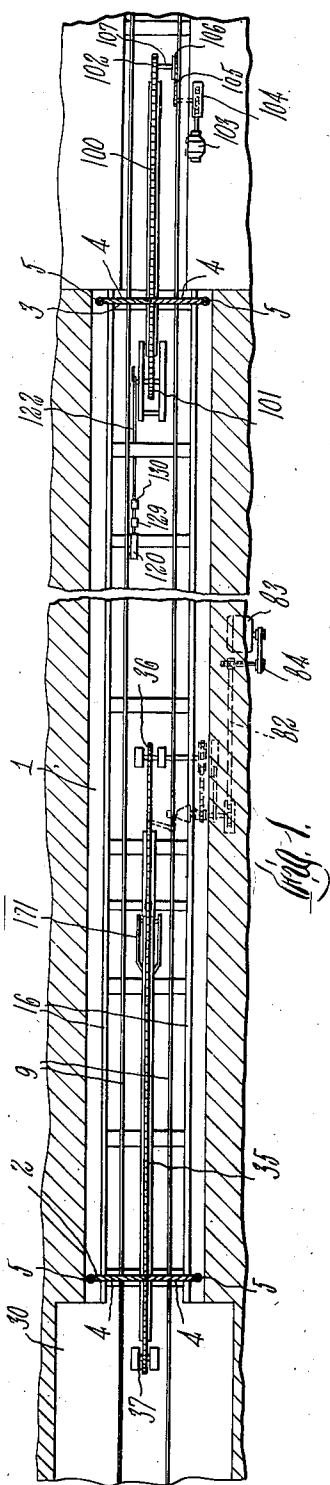
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2,292,284

CAR MOVING MECHANISM

Filed Jan. 9, 1940

4 Sheets--Sheet 1



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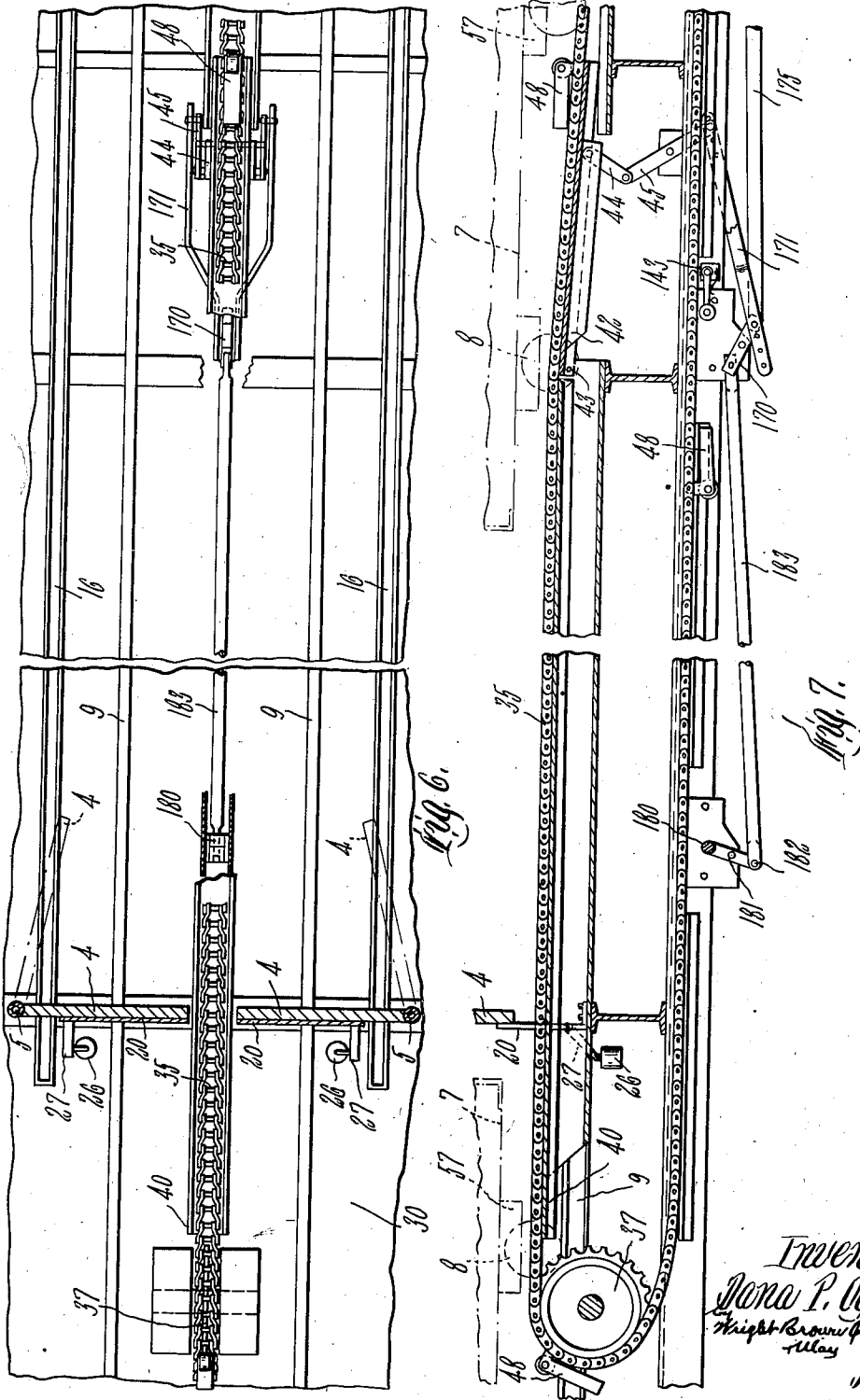
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CAR MOVING MECHANISM

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4 Sheets-Sheet 2



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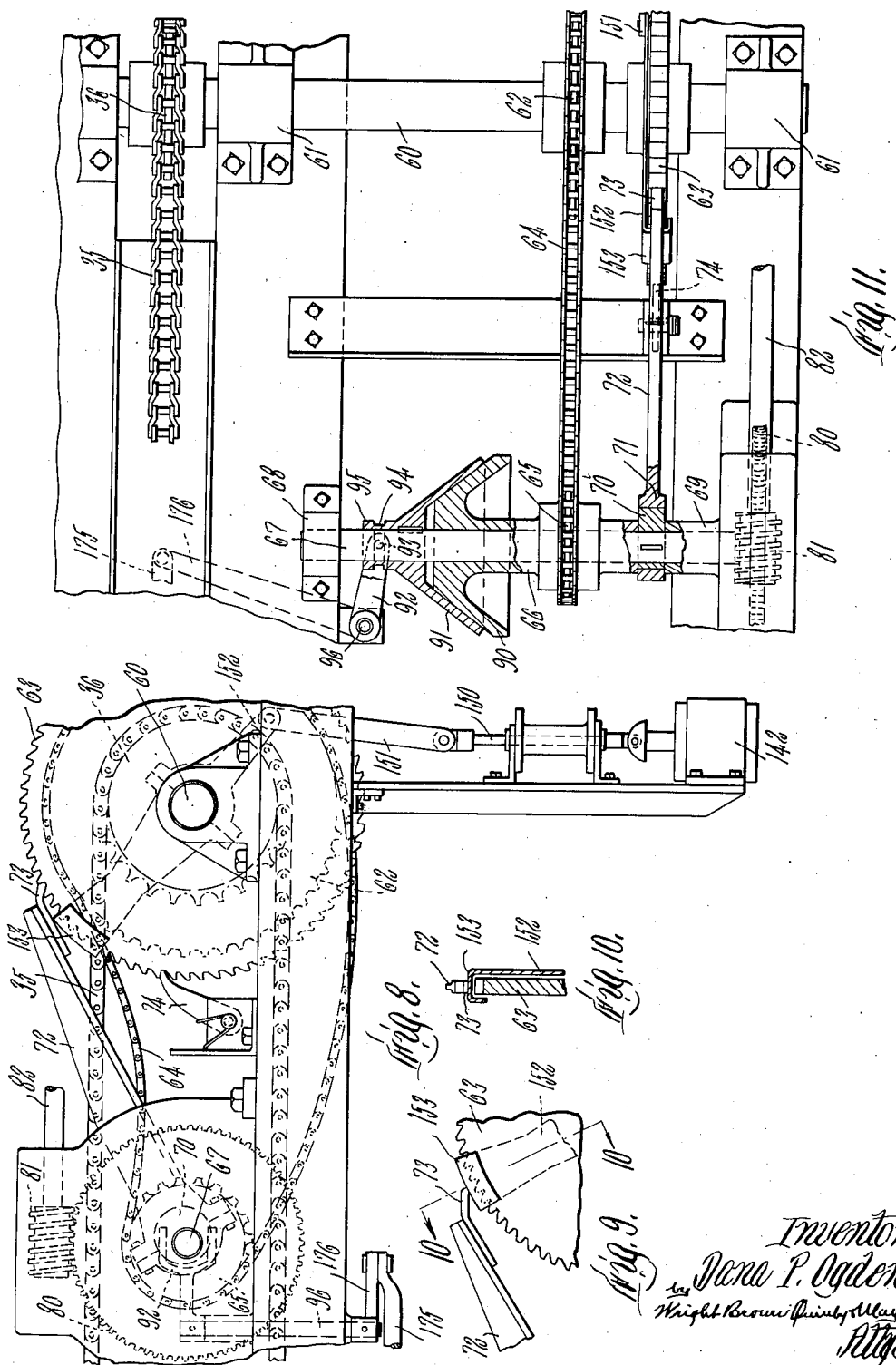
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CAR MOVING MECHANISM

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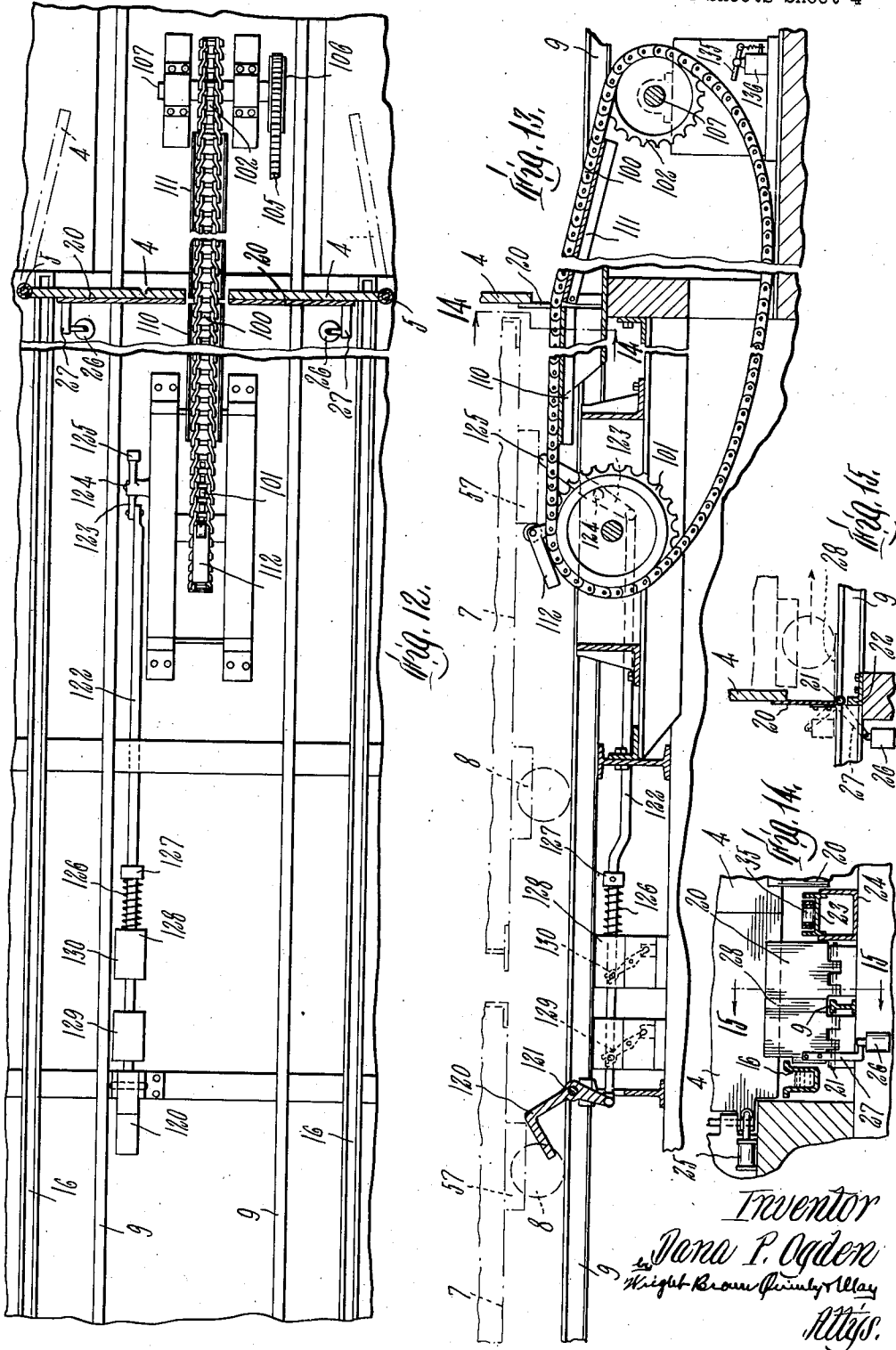
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CAR MOVING MECHANISM

Filed Jan. 9, 1940

4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,292,284

CAR MOVING MECHANISM

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Application January 9, 1940, Serial No. 313,033

22 Claims. (Cl. 104—172)

This invention relates to mechanism for moving a string of cars in a manner particularly suitable for a continuous car tunnel furnace which may be of the general type illustrated in my Patent No. 1,768,486 granted June 24, 1930, for Continuous car tunnel furnace. In the tunnel furnace illustrated herein, however, its exit end is not fully open to the atmosphere, as is shown in my patent, but is normally closed by suitable doors.

An object of this invention is to provide means for moving the cars individually quickly into the tunnel and then in a string adjacent to the door or doors at the exit end of the tunnel at a sufficiently low speed for the desired treatment of the car contents to be effected, and then to remove the front car of the string when it reaches a predetermined point through the exit doorway rapidly. Thus the entrance and exit doors may remain closed for a considerable proportion of the time and effect a seal of the ends of the furnace from the passage of air or gases therethrough.

A further object is to move the cars through the tunnel at such a carefully controlled speed that the treating or cycle time for the material on the cars may be accurately predetermined.

Another object is to provide for a wide variation in such controlled speed to suit the requirements of different types and qualities of product.

A further object is to provide means by which the car moving element may be disengaged readily from the car while under heavy load.

Another object is to provide a friction drive in the high speed drive mechanism for entering the individual cars into the tunnel furnace which will slip under heavy load and permit the low speed drive to overcome such heavy load and start the motion of the cars, thereby permitting the use of a small drive motor without danger of stalling it.

For a more complete understanding of this invention, reference may be had to the accompanying drawings in which

Figure 1 is a fragmentary horizontal section through the end portions of a tunnel furnace to which mechanism embodying this invention has been applied.

Figure 2 is a vertical sectional view of the same.

Figure 3 is a fragmentary detail somewhat similar to a portion of Figure 2, but showing a modified construction.

Figure 4 is a detail section to a larger scale on line 6—4 of Figure 2.

Figure 5 is a fragmentary perspective view

showing cooperating parts of a driving chain and a tunnel car.

Figure 6 is a view similar to a portion of Figure 1, but to a larger scale and showing the moving means for the string of cars.

Figure 7 is a side elevation of the mechanism shown in Figure 5.

Figure 8 is a fragmentary side elevation to a larger scale of the forward end of the driving mechanism, the other parts of which are shown in Figures 6 and 7.

Figure 9 is a detail elevation of cooperating parts of a ratchet feed mechanism.

Figure 10 is a detail section on line 10—10 of Figure 9.

Figure 11 is a top plan of the part shown in Figure 8.

Figure 12 is a view similar to a portion of Figure 1, but to a larger scale and showing the mechanism for removing the forward car from the furnace.

Figure 13 is a side elevation of the part shown in Figure 12.

Figure 14 is a fragmentary section on line 14—14 of Figure 13.

Figure 15 is a detail section on line 15—15 of Figure 14.

As shown best in Figures 1 and 2, the furnace comprises an elongated tunnel 1 having at opposite ends closure members for normally closing off substantially wholly the cross sectional area of the tunnel. These closures, shown at 2 and 3, each comprise a pair of doors 4 hinged adjacent to the side walls of the tunnel as at 5 and closing together substantially midway of the width of the tunnel.

The tunnel is closed off at the bottom by means of the floors 7 of cars which are intended to be arranged in a string throughout the major portion of the length of the tunnel with their floor portions 7 in substantial contact as is shown best in Figure 2. Each car is supported on suitable wheels 8, which, in turn, are supported by a pair of rails 9 which extend throughout the length of the tunnel and past the doors 4, so that a car placed thereon outside of one set of doors may be moved past these doors into the tunnel and against the rear end of the string of cars already in the tunnel, and then with this string of cars, be moved toward the exit end of the tunnel, where at a predetermined point, the forward car of the string may be separated from the remaining cars of the string and moved quickly past the exit doors out from the tunnel.

As shown in Figure 4, the car bottoms 7 are

preferably provided with depending flanges 15 which may ride in channels 16 supported on floor pieces 17 secured in the side walls of the tunnel. These channels 16 may be sufficiently filled with water so that the flanges 15 depend thereinto, thus substantially completing the sealing off of the bottom of the tunnel throughout that extent where the string of cars is continuous. It is intended that the cars support work to be treated in the tunnel furnace, as, for example, in substantially the manner set out in my Patent No. 1,768,486, to which reference has previously been made.

The present invention is not concerned with the particular cycle of operations within the tunnel, but relates particularly to the mechanism for moving the cars into, through, and out of the tunnel in the desired manner.

Referring to Figures 14 and 15, it will be noted that the lower edges of the doors 4 are spaced somewhat above the rails 9, and in order to more fully complete the closure of the cross sectional area of the tunnel at these doors, closure flaps such as 20 may be employed. These flaps are hinged on horizontal pintles 21 on either side of each rail 9 to supporting angle brackets 22, and they extend upwardly into engagement with the outer face of the door 4 immediately thereabove. They substantially fill the space between the brackets 22 and the lower edges of the doors and the channels 16, and they also approach a portion of the car moving means comprising a horizontal channel member 23 supported at the upper portion of a U-shaped support 24. The doors 4 are normally held closed by ordinary door checks 25 and each flap 20 is normally held closed as by a counterweight 26 at the outer end of a lever 27 secured to each flap 20. These flaps 20 may, however, be pushed down with a central portion 28 engaging the tread of the rail by pressure of a car thereagainst, which also is effective to open the doors 4 against which the cars may strike. As soon as a car has passed these doors and flaps, however, they return automatically to closed position.

A car with its load in condition to be treated in the tunnel furnace is spotted on the rails 9 in the entrance way 30 of the tunnel in position for a car-moving mechanism to engage it and move it quickly into the tunnel past the entrance doors and flaps and into contact with the last car of the string of cars in the tunnel. Thereafter the entire string of cars, including the one just passed through the entrance, are moved forwardly through the tunnel at a relatively slow rate predetermined in accordance with the time of treating cycle desired, and whenever a car at the forward end of the string arrives at a predetermined point adjacent to the exit doors, it is engaged by another fast motion car-moving means which pulls it away from the remaining cars of the string, the next adjacent car being held back and the slow moving means for the string rendered for the time being inoperative, and this forward car is then moved rapidly out of the tunnel past the exit doors and flaps.

The means by which the cars are thus moved will now be explained in detail. Referring first to Figures 6 and 7, which show the portion of the car-moving mechanism which moves the cars individually past the entrance doors, and Figures 8 to 11 which show the forward driving portion of this mechanism, it will be seen that the car-moving means comprises an endless moving member shown in the form of a roller chain at

35. This chain passes about a driving sprocket pulley 36 at its forward end, and at its rear end, positioned in the entrance way 30, it passes about an idler sprocket pulley 37, which may be adjusted by any suitable means to maintain the chain 35 at the desired degree of tightness. The upper stretch of this chain rests upon the guiding channel 23 which extends between the rails 9 and parallel thereto from a point 40 adjacent to the pulley 37 beneath the entrance doors 4 and into the tunnel. The forward portion of this support for the upper stretch of the chain comprises a hinged supporting section 42. This section 42 is hinged at 43 adjacent to the forward end of the fixed section and its opposite end portion is supported as by a pair of toggle links 44 and 45, so that when the toggle links are straightened the chain remains at substantially the same level as where it is supported on the fixed support, but by breaking the toggle, the chain is guided out of alignment with the rear portion of the top stretch for a purpose which will later appear. This chain 35 may have secured thereto car-engaging elements which also operate a switch and certain trips as will later appear. Three such elements 48 are shown arranged in equally spaced relation throughout the length of the chain 35.

In Figure 5 a preferred form of such element is shown in detail. As shown it comprises a special form of chain link having side walls 49 similar to the chain links 50, but provided with an upwardly extended portion 51 at the rear merging with a U-shaped tail member 52. The forward ends of the side members 49 are pivoted to the chain links 50 forwardly thereof as by means of the pivot 53, and the rear portions beneath the extensions 51 are likewise pivoted as at 54 to the forward ends of the chain links 50 immediately back thereof. At the upper portion of the extensions 51 a roller 55 is pivoted on a horizontal axis. This roller 55 is so positioned that when it is carried by the straight top stretch of the chain, it is in position to engage an abutment block 56 secured to the rear face of a channel member 57 which is a portion of the car frame and which supports a pair of wheel bearings for the car wheels 8. The tail portion 52 rests upon the chain rearwardly of the roller 55 and acts to support the roller 55 in the proper position, the reaction pressure of the abutment 56 on the roller 55 pushing the tail 52 downwardly against the top surface of the chain, the lower face of which engages the top face of the chain support. This mounting, however, permits the car-engaging element to pass around the pulleys 36 and 37, the tail portion then being spaced from the chain surface as is illustrated in Figure 7, where one of these elements is shown as passing about the pulley 37.

The abutment 56 is beveled off at such an angle that when the toggle 44-45 is broken, the lowering of the chain as it passes down the inclined support 42 causes the roller to roll down this face of the abutment and to become disengaged therefrom readily, even though considerable pressure may be exerted by the roller 55 in pushing the car forwardly. This lowering of the car-driving element is accomplished periodically and at about the same time a car at the forward end of the string is detached therefrom and is moved out of the tunnel as will later more fully appear.

In Figures 8 to 11 is illustrated a combined slow and high speed drive for the chain 35, the high speed drive being used to move a single

car from the entrance way past the doors and into the tunnel, while the slow speed drive is employed for the normal forward movement of the entire string of cars in the tunnel, those ahead of the last car being moved ahead by the driving effort applied to the last car. The driven sprocket wheel 36 is secured to a shaft 60 journaled in suitable spaced bearings 61. Between the bearings 61, the shaft 60 has secured thereto a sprocket wheel 62 and a ratchet wheel 63. The sprocket wheel 62 has a drive chain 64 passing thereabout, this drive chain also passing about a sprocket wheel 65 carried by a sleeve 66. The sleeve 66 is journaled on a shaft 67 which is supported in spaced bearings 68 and 69. Between the sleeve 66 and the bearing 69, the shaft 67 has keyed thereto an eccentric 70 which rides in a bearing 71 in a ratchet arm 72. This ratchet arm 72 carries a ratchet dog 73 in its outer end which may engage the teeth of the ratchet wheel 63, so that on rotation of the shaft 67, the arm 72 is reciprocated and produces an intermittent rotation of the ratchet wheel 63 and the shaft 60. A spring pressed pawl 74 engaging the teeth of the ratchet wheel 63 prevents backward motion of the ratchet wheel 63. This ratchet drive provides for the slow motion to which reference has been made.

The shaft 67 is rotated, for this purpose it being shown as provided with a worm wheel 80 engaged by a worm 81 carried by shaft 82. This shaft 82, in turn, may be driven from a small constant speed motor 83 through any suitable type of reduction gearing indicated as a whole at 84. This slow drive, it will be noted, is a high torque drive and exerts ample power at the slow speed to move the entire string of cars within the tunnel. The ratchet mechanism also provides an overrunning connection since it is clear that the ratchet wheel 63 may be driven more rapidly than is done through the arm 72, if desired, without the slow speed drive interfering in any way, the member 73 then riding idly on the ratchet teeth of the ratchet wheel 63.

This high speed drive which is employed to move a car through the entrance to the tunnel and toward or into engagement with the last car of the string, is afforded by a high speed drive of the sleeve 66 which may be imparted thereto through a friction clutch mechanism. To this end one end of the sleeve 66 is provided with one member 90 of a friction clutch, the other member comprising the friction cone 91 splined to the shaft 67 and movable axially into and out of frictional engagement with the member 90. This movement may be produced by rocking a shift yoke 92, which has pins 93 engaging in a peripheral groove 94 in a hub portion 95 of the cone 91. This shift yoke is shown as secured to a rock shaft 96 which may be actuated by means which will later appear.

The employment of the friction drive in the high speed mechanism permits the use of a relatively small driving motor, since if the resistance to the start of the single car is sufficiently great, this friction drive will slip, allowing the starting of the car through the slow speed high torque drive mechanism including the ratchet drive, whereupon the friction of rest being thus overcome, the high speed drive may then be effective to move the car. Thus the friction drive may slip before a load sufficient to stall the small motor is applied thereto.

Means are provided for detaching the forward car from the remainder of the string when the

first car 2 of the string reaches a predetermined point adjacent to the exit doors and feeding it out rapidly through the exit doorway. This means comprises a second endless car-moving member comprising a roller chain 100 (see Figures 1, 2, 12 and 13) which passes about the end sprocket wheels 101 and 102. The sprocket wheel 102 may be power driven as from a motor 103 through a suitable worm reduction gear 104 and a chain drive 105 to a pulley 106 fixed to the shaft 107 of the sprocket wheel 102. The top stretch of the chain 100 passes over a horizontal guide member 110 which extends to the exit doors 4 and flaps 20 and outwardly of the doors and flaps over a downwardly inclined support 111.

A single car-moving element at 112, the construction of which may be identical with that shown in Figure 5, is secured to the chain 100 and is arranged to cooperate with the forward channel frame member 57 of the forward car of the string, so that when the forward car is positioned to be engaged by its roller 55 and this roller is brought around into contact therewith, further motion of the chain 100 will serve to move the first car in the string rapidly forwardly.

It may happen, however, that in the process within the tunnel furnace, the first car in the string and the one immediately in back thereof may become stuck together. In order that separation of these cars may be insured, means are provided as shown herein for holding the second car in the string against motion and at the same time to render inoperative the feed of the cars in the string toward the exit doors.

The means for holding the second car of the string comprises a car stop cam 120 fulcrumed at 121 between the rails 9, and which is thrown up into position to engage with the forward channel 57 of the second car to stop its progress. This stop cam is shown as connected at its lower end to an actuating rod 122 pivoted at its forward end to the lower end of an actuating lever 123. This lever 123 is fulcrumed at 124 and its upper end at 125 is struck by the forward beam 57 of the front car and depressed before the car-moving element 112 reaches car-moving position. This depression of the lever end 125 forces the stop cam 120 into operative position. As soon as the forward car has been moved forwardly sufficiently for the beam 57 to clear the lever 123, these parts are returned to their normal position, with the car stop cam 120 depressed, by a spring 126 surrounding the rod 122 and reacting between a collar 127 secured thereto and a stationary switch casing 128. The motion of the rod 122 also acts to throw a pair of switches 129 and 130, the switch 130 being shown as housed within the casing 128. The throwing of this switch 130, when the forward car of the string reaches the position shown in dotted lines in Figure 13, closes this normally open switch, energizing the motor 103 and starting the car-moving member 100 in operation. At the time of start of the motor 103, the element 112 is somewhat below the shaft 107 in position to impinge on a lever actuator 135 and hold open a normally closed switch 136 arranged in parallel with the switch 130. The starting of the motor 103 by the switch 130, however, moves the element 112 out of engagement with the arm 135, permitting the switch 136 to close, thus maintaining the circuit to the motor 103 closed, even when the switch 130 thereafter opens, thus energizing this motor 103 until such time as the

element 112 has contacted with the frame member 57 of the forward car in the string, has moved this car out through the exit end of the tunnel, has become disengaged from the car as it moves down the inclination 111 and has again contacted the switch arm 135 and opened the switch 136.

The motion of the rod 122 to the left also closes the switch 129, which is arranged in series through the leads 140 and 141 with a solenoid 142, and a normally open switch 143 through the lead 144 to a source of power. The switch 143 is adjustably secured in position along the track to be contacted by one of the three elements 48 carried by the feed chain 35 on its lower or return stretch and while this feed chain is being moved in slow motion by the ratchet mechanism heretofore described. This switch 143 is so adjusted as to close at approximately the same time as the switch 129 so as to energize the solenoid 142.

As shown best in Figures 8, 9, and 10, energization of this solenoid pulls downwardly on a rod 150 which is connected through a link 151 with one end of a rock arm 152 journaled on the shaft 60. The opposite end of this arm 152 has an extension 153 overlying a portion of the periphery of the ratchet wheel 63 so that when this solenoid 142 is energized, this portion 153 is swung up beneath the ratchet member 73 and lifting it so that it can no longer engage with the ratchet teeth of the wheel 63. Oscillation of the arm 72 is then ineffective to move the ratchet wheel 63, the member 73 riding idly back and forth on the outer face of the portion 153. Thus as the stop dog 120 is moved into stopping relation to the next to the forward car of the string, the slow motion feed mechanism employed to move the cars of the string through the tunnel becomes inoperative. It remains in this condition as long as the lever 123 is held depressed by its engagement with the frame member 57 of the forward car of the string, so that this forward car may be pulled away from the remainder of the string and removed from the tunnel. As soon as the lever 123 is permitted to return by the action of the spring 126, the stop dog 120 is retracted and the switch 129 is opened, deenergizing the solenoid 142 and allowing the portion 153 to move out from under the ratchet dog 73, thus permitting the slow feed to again be operative to move the car-driving chain 35.

By the use of a constant speed alternating current motor as the motor 83, an accurate timing of the cycle during which the cars are in the tunnel may be obtained, but should it be desired to provide an even more accurate timing, a modification illustrated in Figure 3 may be employed. In this modification an electric clock 160 may be employed to energize the solenoid 161 of a normally open switch 162 after a suitable time interval after the solenoid 142 has been energized. This may be arranged in a holding circuit comprising the leads 163, 164, and 165 for the solenoid 142. Even though either of the switches 129 and 143 may have opened, the solenoid 142 will remain energized and thus hold the slow feed mechanism inoperative until such time as the normally closed switch 162 shall have opened as timed by the clock 160, the timing mechanism being set whenever the solenoid 142 closes.

Shortly after one of the members 48 has tripped the switch 143 into closed position, it

strikes upon a trip lever 170 (see Figure 7), rocking this to the position shown in Figure 7. This lever 170 is connected through a link 171 to the lower end of the toggle lever 45 so that the toggle 44 and 45 is broken, causing the forward end of the hinged section 42 to be lowered and removing the car-moving element 48 from engagement with the frame member 53 of the last car in the string. This stops the feed of this last car, though the driving motor 83 continues to run. This same motion of the trip 170 also acts through a long link 175 pivotally connected to an arm 176 secured to the rock shaft 96 to engage the high speed friction clutch member 91 with its mating element 90, so that the chain 35 is now driven by the high speed mechanism, at which time another of the elements 48 is approaching a position to engage the sill 57 of the car in the entrance 30 to the tunnel and move this car from the entrance into the treating portion of the tunnel. The element 48 which actuated the trip 170 thereafter engages a second trip 180. This trip 180 is fulcrumed at 181, and its lower end is pivoted as at 182 to a link 183 connected to the trip 170. The depression of the trip 180 acts to return the trip 170 to its former position, straightening the toggle links 44 and 45 and throwing out the fast motion clutch element 91, so that the car just introduced into the tunnel continues to be moved at slow speed further into the tunnel, and after it contacts with the last car of the string, acts to move the whole string of cars forwardly toward the exit opening.

It will be noted that except for the time during which the ratchet feed for the chain 35 is rendered inoperative, this chain is driven either by the ratchet feed mechanism at a relatively slow speed or through the friction clutch at a relatively fast speed.

From the foregoing description of an embodiment of this invention, it should be evident to those skilled in the art that various changes and modifications might be made without departing from the spirit or scope of this invention as defined by the appended claims.

I claim:

1. The combination with a track and a string of cars on said track, of means for moving the cars of said string relatively slowly in one direction toward a predetermined point, means effective only on the forward car of said string when it reaches said point to move said forward car beyond said point at a relatively rapid rate, and a control member for said slow moving means in the path of motion of said forward car when said forward car approaches said point and moved by said forward car to stop said slow moving means until said forward car has passed beyond said point.

2. The combination with a track and a string of cars on said track, of means for moving the cars of said string relatively slowly in one direction toward a predetermined point, and means effective only on the forward car of said string when it reaches said point to move said forward car beyond said point at a relatively rapid rate, a control member for said slow moving means in the path of motion of said forward car when said forward car approaches said point and moved by said forward car to stop said slow moving means until said forward car has passed beyond said point, a movable car stop positioned back of said point, and means under the control of said member for moving the stop into position

to positively stop the motion of the second car in the string when said first car is being moved by said fast moving means to hold back said second car from motion with said first car.

3. The combination with a track and a string of cars on said track, of means for moving the cars of said string relatively slowly in one direction toward a predetermined point, means controlled by the forward car of said string when it reaches said point to move said forward car beyond said point at a relatively rapid rate, means actuated by said controlled means when actuated by said forward car to render said slow moving means inoperative, a car stop, and means also actuated by said controlled means when so actuated to move said stop into position to hold back the car next to said forward car from being moved with said forward car at said relatively rapid rate.

4. Car-moving means comprising an endless driving member, a support for a portion of said member guiding said member in a normally straight stretch, said support having a hinged portion to permit lowering of one end thereof, a car-engaging element carried by said member in position while in said straight stretch to engage and move a car, and means supporting said hinged portion to permit its retention in alignment with said straight stretch or to lower it and cause disengagement of said element from said car when said car reaches a predetermined position over said hinged portion.

5. In combination, car-moving means comprising an endless driving member, spaced pulleys over which said member passes, a track having spaced rails between which said member is positioned to move longitudinally thereof, a support for the top stretch of said member having a hinged end portion, means supporting said hinged end portion in substantial alignment with the remainder of said support and substantially parallel to said rails, a driving element carried by said member and having a horizontally journaled roller therein, a car on said track, said car having an abutment block with which said roller may engage, and means for lowering said hinged portion to cause said roller to move downwardly and roll out of contact with said abutment when said car reaches a predetermined position over said hinged portion.

6. In combination, car-moving means comprising an endless driving member, spaced pulleys over which said member passes, a track having spaced rails between which said member is positioned to move longitudinally thereof, a support for the top stretch of said member having a hinged end portion, means supporting said hinged end portion in substantial alignment with the remainder of said support and substantially parallel to said rails, a driving element carried by said member and having a horizontally journaled roller therein, a car on said track, said car having an abutment block with which said roller may engage, and means for lowering said hinged portion to cause said roller to move downwardly and roll out of contact with said abutment when said car reaches a predetermined position over said hinged portion, said abutment having a roller engaging face sloping in a direction to facilitate the disengaging motion of said roller.

7. Car-moving means comprising an endless driving member, car-engaging means carried by said member, a shaft, means for rotating said shaft, a slow speed drive from said shaft to said member including an overrunning device, and a

fast speed friction drive from said shaft to said member, said moving means including means for selectively rendering said fast speed drive operative or inoperative whereby the slow speed drive is effective when said fast speed drive is inoperative.

8. Car-moving means comprising a drive member, car-engaging means carried by said member, a rotary shaft, means for rotating said shaft, a slow driving connection including an over-running device from said shaft to said drive member, a fast drive connection between said shaft and said drive member, and means for throwing said fast driving connection into and out of operative condition, said over-running device allowing drive of said driven member by said fast driving connection without interference from said slow driving connection.

9. Car-driving means comprising an endless driving member, car-engaging means carried by said member, a shaft, means for rotating said shaft, a sleeve journaled on said shaft, fast driving connections between said sleeve and driving member, a slow speed ratchet drive from said shaft to said driving member, a clutch between said shaft and sleeve, and means for actuating said clutch.

10. The combination with a track and a string of cars on said track, a two-speed car moving means, means for actuating said moving means to move the cars of a string at the slow speed in one direction away from a predetermined point and toward a second predetermined point, means actuated by the forward car of the string when said forward car reaches said second predetermined point to operatively disconnect said car-moving means from the cars of said string, and to cause said car-moving means to engage a car back of said first mentioned predetermined point and to move said engaged car at the higher speed forwardly of said first mentioned point toward position to form the last car of said string and thereafter to render said slow speed operative to move the string of cars including said last engaged car forwardly toward said second predetermined point.

11. The combination with a tunnel having entrance and exit doors, a track extending through said tunnel and outwardly of said doors, a car-moving means adjacent to each of said doors, the first car-moving means adjacent to said entrance doors including a selective two-speed drive mechanism and having car moving elements positioned to move a car from outside past said entrance door and toward said exit door on said track, the second car-moving means adjacent to said exit door having a car-moving element positioned to move a car from within said tunnel adjacent to said exit door past said exit door at a relatively rapid rate, car operated means adjacent to said exit door for rendering operative said second car-moving means to remove the car adjacent to said exit door past said exit door and for rendering said first car-moving means inoperative, means acting after a predetermined extent of actuation of said second car-moving means for stopping operation of said second car-moving means and rendering operative the high speed drive of said first car-moving means to move a car outside of said tunnel past said entrance door, and means effective after a predetermined extent of motion of said first car-moving means to render inoperative said high speed drive and to render operative said slow speed drive of said first car-moving means to thereby cause said car

last moved past said entrance door to be moved and push ahead of it a string of cars toward said exit door.

12. The combination with a tunnel having entrance and exit doors, a track extending through said tunnel and outwardly of said doors, a car-moving means adjacent to each of said doors, the first car moving means adjacent to said entrance door including a selective two-speed drive mechanism and having car moving elements positioned to move a car on said track from outside past said entrance door and toward said exit door, a second car moving means adjacent to said exit door having a car-moving element positioned to move a car on said track from within said tunnel adjacent to said exit door past said exit door at a relatively rapid rate, a movable car stop when in operative position being positioned to stop the motion of a car immediately preceding the car moved by said second car-moving means, car operated means adjacent to said exit door for rendering operative said second car moving means to remove a car adjacent to said exit door past said exit door, for rendering said first car moving means inoperative, and for moving said stop into operative position, means acting after a predetermined extent of actuation of said second car moving means for stopping operation of said second car moving means, removing said stop from operative position, and rendering operative the high speed drive of said first car moving means to move a car on said track out of said tunnel past said entrance door into said tunnel, and means effective after a predetermined extent of motion of said first car moving means to render inoperative said high speed drive and to render operative said slow speed drive of said first car moving means to thereby cause said car last moved past said entrance door to be moved along said tunnel and push ahead of it a string of cars toward said exit door.

13. The method of moving cars through a treating zone normally closed off at opposite ends, which comprises periodically moving a car quickly from outside into said zone at its entrance end toward a string of cars in said zone and then at a slower rate to push the cars ahead of it in said string toward the exit end of said zone, and when the forward car of said string reaches a predetermined point, separating said forward car from the remainder of the string while stopping the motion of the cars remaining in said string and moving said forward car quickly away from said string out of said zone at the exit end, and freeing the cars of said string for further motion by the pushing of a car newly added to the rear end of said string.

14. The combination with a tunnel having a pair of doorways spaced apart longitudinally therein, doors for normally closing said doorways, means actuable at relatively high speed to pass a car through one of said doorways past its doors into said space and then to move said car slowly toward the other of said doorways, and means controlled by a car when said car reaches a predetermined point in its passage toward said other doorway to move said last mentioned car quickly through said second doorway past its doors and out of said space.

15. The combination with a tunnel having a track extending therethrough, pairs of cooperating doors hinged at the opposite sides of said tunnel and spaced apart, the doors of one pair being arranged above said track and closing together, horizontally pivoted flaps beneath said

door, means yieldingly holding said flaps elevated in position so that when said doors are closed and said flaps are lifted the cross sectional area of said tunnel is substantially closed, cars on said track, means actuable to move a car on said track against and past one of said pairs of doors and its flaps and into said space, and for moving cars in said space toward the doors at the opposite ends of said space, and means for moving a car in said space against and past the doors and flaps at said opposite end to remove said car from said space.

16. In combination with a tunnel having closures adjacent to opposite ends thereof, means engageable with a car outside of one of said closures actuable to move said car through said closure and to cause said car so moved to engage and push a string of cars between said closures toward the other of said closures, means effective to engage the forward car of said string when it reaches a predetermined point to separate said forward car from the string and to move it through the other of said closures, and means controlled by said forward car for stopping the motion of the next adjacent car of the string until after said forward car has been separated from the other cars of the string.

17. In combination with a tunnel having closures adjacent to opposite ends thereof, means engageable with a car outside of one of said closures actuable to move said car at a relatively rapid rate past said closure and to cause said car so moved to engage and push at a slower rate a string of cars between said closures toward the other of said closures, and means actuated by the forward car of the string to engage said forward car when it reaches a predetermined point to separate said forward car from the string and to move it at a relatively rapid rate past the other of said closures.

18. The combination with a treating tunnel having entrance and exit openings and having a track therethrough, of means for moving cars through said entrance opening to form portions of a string of cars within said tunnel and for moving cars from the forward end of said string through said exit opening, means controlled by the forward car of the string when such car reaches a predetermined point to stop the motion of the other cars to cause said car moving means to separate such forward car from the string prior to moving such forward car through said exit opening, a timing device, and means controlled by said device for controlling said moving means to accurately determine the time during which said cars remain between said entrance and exit openings.

19. The combination with a tunnel having an entrance, a track extending through said tunnel including said entrance for supporting cars, car-moving mechanism comprising a continuous member having a top stretch extending through said entrance into said tunnel, means for moving said member selectively at a relatively fast speed or at a relatively slow speed, elements carried by said movable member and when at said top stretch in position to engage a car and move said car by motion of said member, and control mechanism actuated by one of said elements at another portion of the path of motion of said movable member to select one and then the other of said speeds.

20. The combination with a tunnel having an entrance, a track extending through said tunnel including said entrance for supporting cars,

car-moving mechanism comprising a continuous member having a top stretch extending through said entrance into said tunnel, means for moving said member selectively at a relatively fast speed or at a relatively slow speed, elements carried by said movable member and when at said top stretch in position to engage a car and move said car by motion of said member, and control mechanism actuated by one of said elements at another portion of the path of motion of said member to select one and then the other of said speeds and to change the path of motion of a portion of said stretch to release an element in said top stretch from a car in said tunnel.

21. The combination with a tunnel having an entrance and an exit, and a track extending through said tunnel including said entrance and exit, of a car-moving mechanism comprising a continuous member having a top stretch extending through said entrance into said tunnel, means for moving said member selectively at a relatively fast speed or at a relatively slow speed, elements carried by said movable member and when at said top stretch in position to engage and move a car by motion of said member, control mechanism actuated by one of said elements at another portion of said member to select one and then the other of said speeds, car-moving means at said exit for removing cars from said tunnel through said exit, and means actuated by a car nearing said exit to set into motion said exit car-moving means and to stop the actuation

of said car-moving mechanism for a period of time.

22. The combination with a tunnel having an entrance and an exit, and a track extending through said tunnel including said entrance and exit, of a car-moving mechanism comprising a continuous member having a top stretch extending through said entrance into said tunnel, means for moving said member selectively at a relatively fast speed or at a relatively slow speed, elements carried by said movable member and when at said top stretch in position to engage and move a car by motion of said member, control mechanism actuated by one of said elements at another portion of the path of motion of said member to select one and then the other of said speeds, car-moving means at said exit for removing cars from said tunnel through said exit, means actuated by one of said cars for stopping the motion of cars back of the forward car, for stopping the actuation of said car-moving mechanism, and for starting the actuation of said car-moving means actuated by motion of the car moving means to remove the forward car from the tunnel through said exit, and means for rendering said motion stopping means ineffective and for re-starting said car-moving mechanism when said forward car has been moved by said car-moving means a predetermined amount.

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