

June 1, 1926.

E. P. HAINES

1,586,989

METHOD OF AND APPARATUS FOR DISTRIBUTING CARS

Filed March 31, 1922

5 Sheets-Sheet 1

Fig. 1.

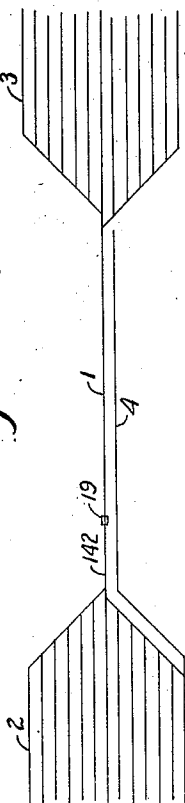


Fig. 2.

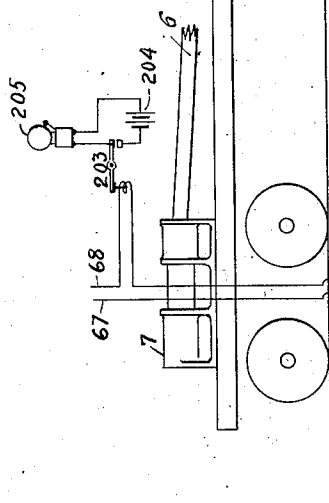
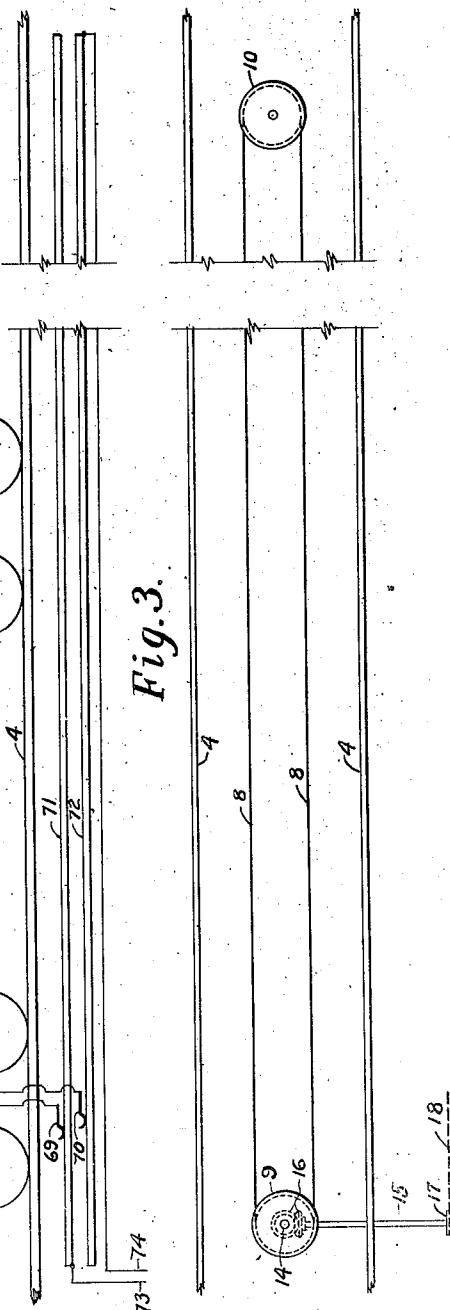


Fig. 3.



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Fig. 6.

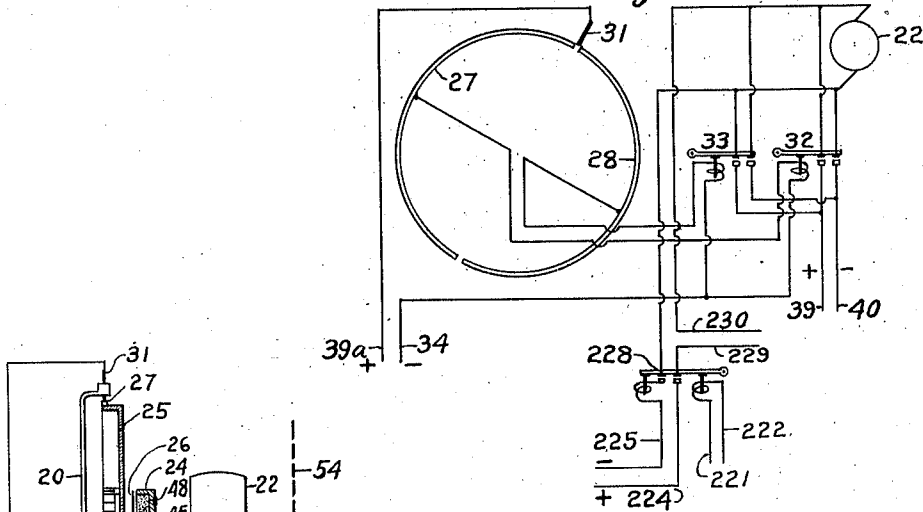


Fig. 5.

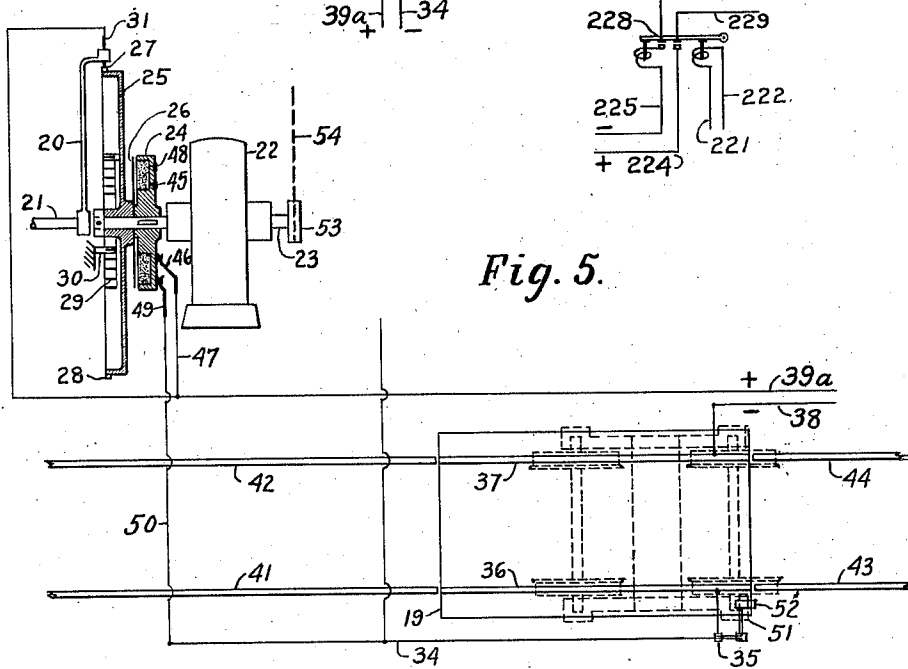
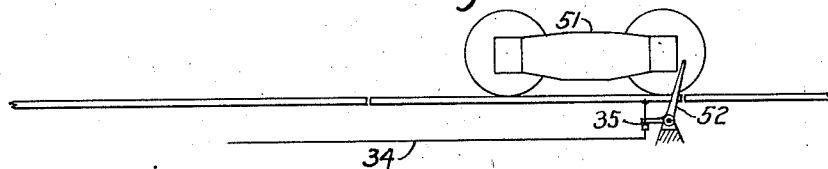


Fig. 7.



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METHOD OF AND APPARATUS FOR DISTRIBUTING CARS

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5 Sheets-Sheet 3

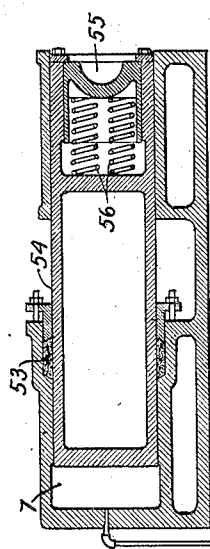
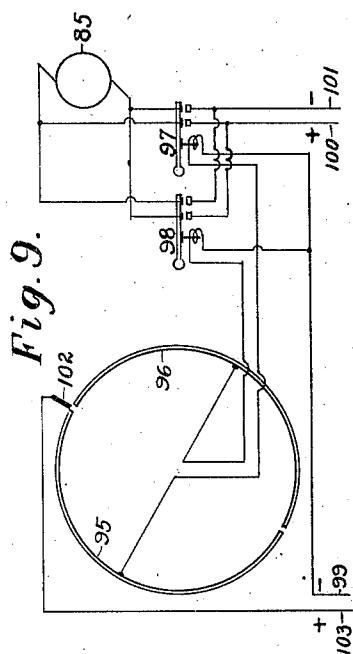
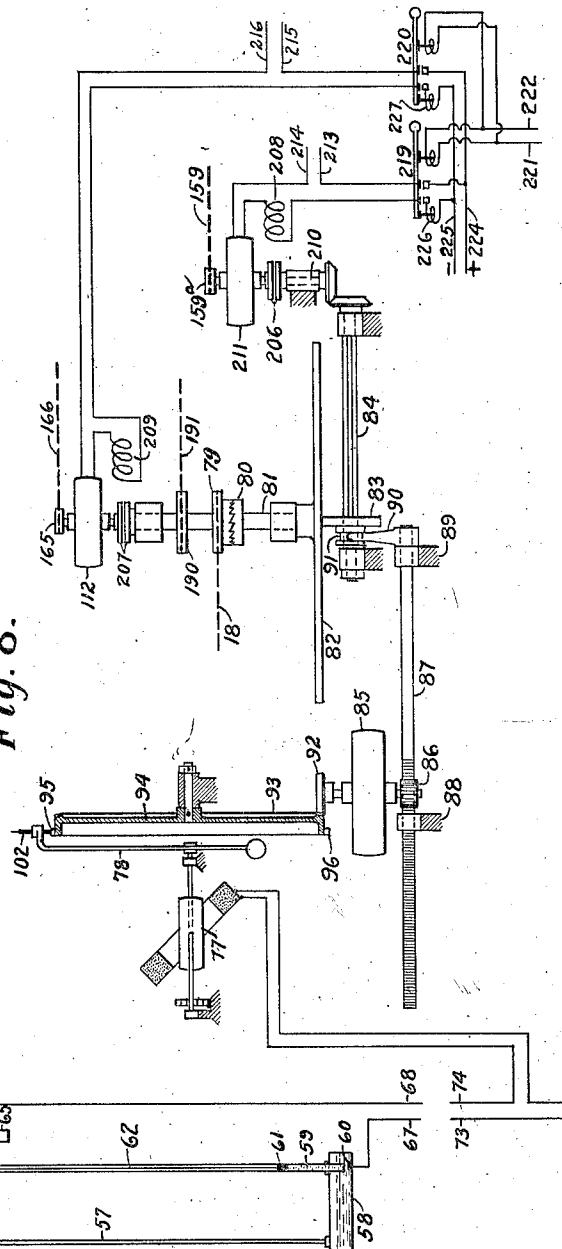


Fig. 8.



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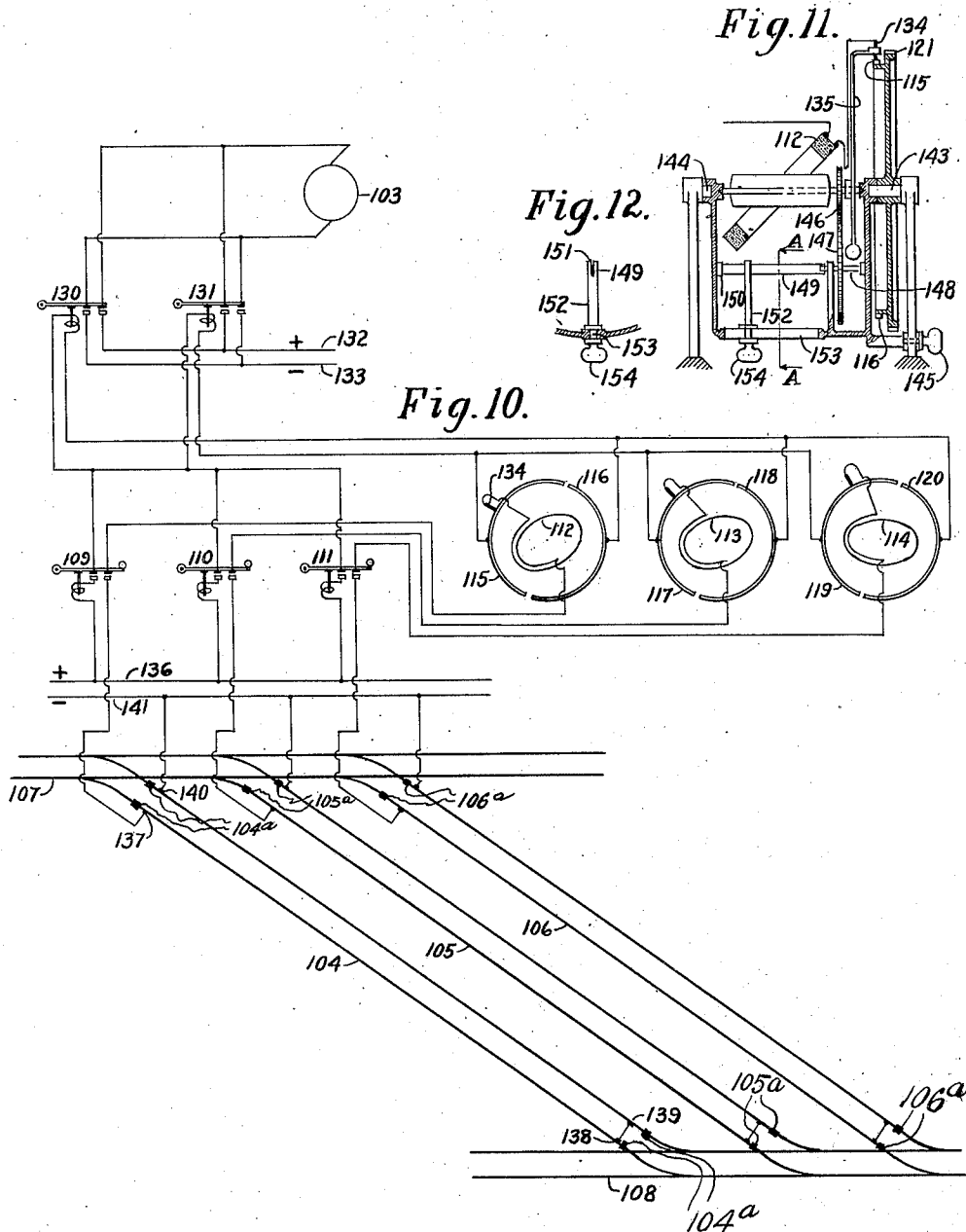
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METHOD OF AND APPARATUS FOR DISTRIBUTING CARS

Filed March 31, 1922

5 Sheets-Sheet 4



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METHOD OF AND APPARATUS FOR DISTRIBUTING CARS

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5 Sheets-Sheet 5

Fig. 14.

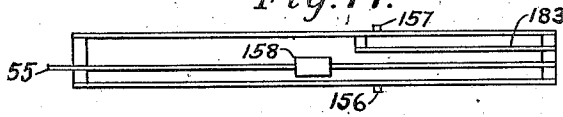
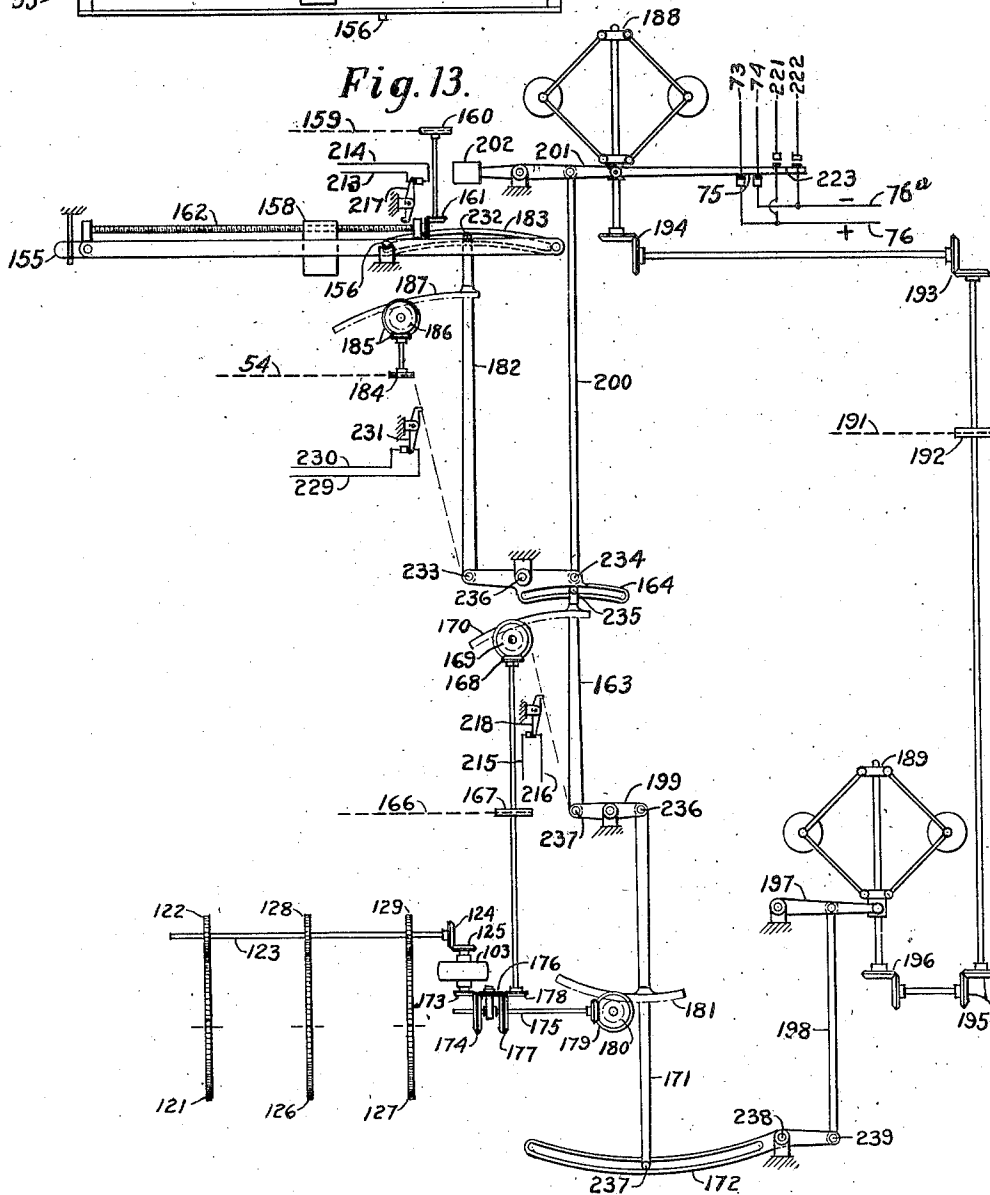


Fig. 13.



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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR DISTRIBUTING CARS.

Application filed March 31, 1922. Serial No. 548,307.

My invention relates to a method of and apparatus for use in connection with the trackage system of a freight yard of such design that a car or group of cars being moved by means of a pusher or accelerator over a length of track, will have imparted to it a certain definite speed whereby it is caused to travel to the ends or other desired portions of the various branch tracks onto which it is switched, and one object of the present invention is to provide a system whereby a definite and predetermined speed may be imparted by any suitable motive power device to a car or a number of cars, which speed shall be dependent upon and variable with the various forces opposing said movement, and the distance which it is desired the car or cars shall travel after separation from such device.

Another object of my invention is to provide automatic means for obtaining the total weight of a car or group of cars during continuous movement over a track scale.

Another object of my invention is to provide automatic means for determining the force applied to a car or number of cars being moved by accelerating means and so combining this force with the distance moved and the acceleration produced to automatically determine the frictional resistances encountered during the application of the force.

Another object of my invention is to provide automatic means, with or without hand controlled means, for determining the speed at which each car must travel to reach an automatically determined point on any one of the branch tracks in accordance with the distance of said point from the starting point.

Another object of my invention is to provide means for indicating the instant a predetermined speed has been reached by a car or group of cars, said indicating means to be used either to signal the operator or to automatically cut off the source of power. To this end I have devised apparatus of the character hereinafter described.

For an illustration of some of the various forms of my apparatus may take, reference is to be had to the accompanying drawings, in which:—

Fig. 1 is a plan of portions of freight re-

ceiving and classification yards, the exact arrangement of which forms no part of my invention, but is shown, to more clearly illustrate its application.

Figs. 2, 3 and 4 are respectively fragmentary elevation, plan and section of a portion of a track, with portions of the apparatus associated therewith;

Fig. 5 illustrates a portion of the apparatus used for obtaining the weight of one or more cars consecutively.

Fig. 6 is a wiring diagram of part of Fig. 5.

Fig. 7 is an elevation of a detail of Fig. 6.

Fig. 8 is a diagrammatic illustration of apparatus for measuring the force applied to a car and means of combining this with the distance through which the force is applied.

Fig. 9 is a wiring diagram of a portion of Fig. 8.

Fig. 10 is a wiring diagram of a portion of the branch tracks of a freight yard and the apparatus used for distance control.

Fig. 11 is an enlarged view of a portion of this apparatus.

Fig. 12 is a sectional view on the line AA of Fig. 11.

Fig. 13 shows the part of the apparatus which determines the friction of the cars and the speed at which they shall be dispatched in order to reach the desired destination.

Fig. 14 is a plan view of the scale beam of Fig. 13.

In Fig. 1 of the above drawings, 1 represents a railroad track connecting a freight receiving yard 2 and a classification yard 3, and parallel thereto is a track 4 such as is commonly used by a poling engine for accelerating cars to the classification yard. I do not limit my invention to this form of accelerator but show this commonly used arrangement in order to more clearly illustrate its application.

Fig. 2 shows track 4 more in detail with a poling car 5, the locomotive or other source of power not being shown, with a portion of a pole 6 used to push a car or group of cars on track 1 (Fig. 1). 7 is the pressure cylinder portion of the force measuring apparatus which I shall describe later.

Referring to Figs. 3 and 4 illustrating means for transmission of the motion of car 5 to other apparatus, 8 is a continuous rope or belt suitably protected by enclosures 8^a and 8^b, passing around sheave 9 located near one end of track 4 and an idler sheave 10 located at the other end or suitable point of said track. The motion of said car 5 may be transmitted to rope 8 by a suitable grip 11 attached to the car frame as at 12 and provided with a hand lever 13 for either releasing or regripping the rope. The motion of sheave 9, caused to rotate by said rope, according to the movement of car 5, is transmitted to other apparatus by means of shafts 14 and 15 and pair of bevel gears 16, sprocket 17 and link belt 18 or other positive driving means.

For obtaining the weight of a car or group of cars, I locate a scale 19, Figs. 1 and 5 near the receiving end of track 1. Referring to Figs. 5, 6 and 7; the scale 19 is of such length as to weigh only one truck of one or more cars at one time, the customary levers supporting the platform and mechanism operating the weight indicating arm 20 mounted on the rotating shaft 21, forming no part of my invention are not shown. As a means for obtaining the total weight of a series of car trucks, or a movement of other apparatus in direct proportion thereto, I provide a motor, 22, the shaft 23 of which is in line with shaft 21, and has an electromagnet 24 secured to it, and a wheel 25 rotatably mounted thereon. Attached to the hub of wheel 25 is a disk 26 which, when magnet 24 is excited forms a magnetic clutch so that wheel 25 will rotate in unison with said motor. Attached to the rim of wheel 25 are conductive segments 27 and 28. A spiral spring 29 is attached at one end to wheel 25 and the other end to a fixed pin 30.

The scale arm 20 carries an electric contact 31 which is connected to one terminal of a source of current by the conductor 39^a and when either the arm 20 or wheel 25 moves from the position shown in Fig. 6 contact is made with either one or the other of the segments 27 and 28 which are connected to the controlling windings of double-pole electro-magnetic switches 32 and 33, the second terminals of said windings connecting through the conductor 34 and switch 35, which is normally closed, to one of the rails 36 of the scale 19 and the opposite rail section 37 is connected to the second terminal of the source of electricity through the conductor 38. The rails 36 and 37 are electrically insulated from all other parts of the apparatus. Each of the switches 32 and 33 has one pair of its terminals respectively connected to the terminals of the armature of motor 22 and the other pair of said terminals respectively connected to the positive and negative conductors 39 and 40. 41 and

42 are the rails of the approach track and 43 and 44 of the departure track of said scale.

When the forward pair of wheels of a car truck make contact with rails 36 and 37 this part of the circuit is closed through the wheels and axle and said rails, the electromagnet 24 being connected to the positive conductor 39^a through contact ring 45, brush 46 and conductor 47, and to switch 35 and the negative conductor 38 through a similar ring 48, brush 49 and conductor 50, is immediately energized so that the ring segments 27 and 28 will move in unison with motor 22.

The weight of the car wheels will cause the scale arm 20 to move say to the left (Fig. 6) and close the circuit through contactor 31 and segment 27 causing switch 32 to close and start motor 22 which will rotate the segments 27 and 28 in the same direction as arm 20 is rotated. After the full weight of the truck has come onto the scale and arm 20 has come to rest in a position corresponding to the weight of said truck, the gap between the motor-driven segments 27 and 28 following closely the movement of the arm will be brought into registry with the contact 31 thereby breaking the circuit of the magnet of switch 32 thus opening the switch and causing the motor to stop after having moved an amount proportional to the weight of said car truck. After the above function has been performed, but shortly before the forward wheels leave the scale, the portion of the car truck 51 which projects beyond the rails will engage the lever 52 opening the switch 35 and the circuit through the magnet 24, releasing wheel 25 which will be returned to the zero position, against a suitable stop, not shown, by spring 29, the motor remaining in the advanced position, as the operating magnet circuit of the switches 32 and 33 is likewise opened by switch 35.

When the truck has left the scale and is clear of the lever 52 the switch is closed by a spring not shown, and the apparatus will repeat the cycle each time a car truck passes over the scale so that the total advance of the motor is in direct proportion to the total weight of the several trucks.

I transmit the movement of the motor 22 positively to another part of the apparatus, and for convenience of illustration, employ the sprocket 53 and link belt 54 for this purpose.

I provide means for returning the motor to its zero position, after weighing a car or group of cars, which will be described later.

Referring to Fig. 8, 7 is a pressure cylinder here shown in section having a stuffing box 53 and a piston 54 which carries at its outer end a socket 55, for the pushing pole 6 (Fig. 2), with springs 56 to absorb shock. Cylinder 7 is filled with oil or other liquid the pressure of which varies as the force ex-

erted on the pole. I employ novel electrical means for recording this pressure on other apparatus not located on the car consisting of a pressure gauge used to vary the resistance of an electric circuit.

The pressure in cylinder 7 is transmitted through a tube 57 to the well 58 of a mercury gauge the column 59 of which is used as a conductor in an electric circuit one terminal of which 60 is in the well 58 and the other 61 provided by a suitable float on the top of the column so that variations in pressure cause a change in the height of the column and the resistance and current in said circuit. The terminal 61 is connected by a flexible conductor 62 passing over a pulley 63 and under pulley 64, which is provided with a counter weight 65, to a fixed point 66. This arrangement is provided on account of the rise and fall of float 61 to prevent the conductor 62 from fouling said float. The above described cylinder and pressure gauge being preferably mounted on car 5 the conductors 67 and 68 lead respectively to brushes 69 and 70, Fig. 2 making contact with rails or conductors 71 and 72 parallel with track 4. In order to have a circuit of uniform length and resistance independent of the position of the car 5, I connect the conductors 73 and 74 to opposite ends of the rails 71 and 72. It is obvious that I may use the track rails 4, if bonded, in lieu of either of the rails 71 or 72 provided I use a material for the other rail of equal resistance to the combined rails 4 and make the connections in a similar manner.

The conductor 73 connects through one pole of the switch 75 Fig. 13 to the positive conductor 76. The conductor 74 connects through an ammeter 77 (Fig. 8) through the second pole of said switch to the negative conductor 76 of the same circuit.

It is evident, with a constant voltage impressed on the terminals of the conductors 73 and 74, that any variation in pressure in cylinder 7 will cause a change in the height of the mercury in the column 59 and the resistance and thereby the current in said circuit and through the ammeter 77 causing a corresponding movement of the arm 78 of said ammeter, the position of which will therefore represent a certain pressure, exerted on the pushing pole 6, used to accelerate a car or cars. In order to obtain a movement which shall vary directly as the product of the force applied to pole 6 multiplied by the distance through which said car moves, I drive, with the link belt 18, (Figs. 3 and 8) the sprocket 79, the unidirectional clutch or ratchet 80, shaft 81 and the disk 82 engaging which is a friction wheel 83 mounted on a spline shaft 84 whose axis intersects the axis of shaft 81. It is evident that if the wheel 83 is moved radially from the centre of disk 82 in proportion to the

force applied to said pole, the revolutions of wheel 83 caused by contact with disk 82 will be in proportion to the product of said force multiplied by the movement of said car during the application of said force.

For moving the wheel 83 on shaft 84 I provide a motor 85 having a pinion 86 engaging the rack 87 which slides through the guides 88 and 89 and has secured to it an arm 90 engaging the groove 91 on the hub of wheel 83. Referring to Figs. 8 and 9; for controlling the motor 85 the pinion 92 engages a gear 93 on wheel 94 attached to which are conductive segments 95 and 96 which are connected to the controlling windings of double pole electro-magnetic switches 97 and 98 whose second terminals are connected to the negative conductor 99. Each of these switches 97 and 98 has one pair of its terminals respectively connected to the armature terminals of the motor 85 and the other pair of said terminals connected to the positive and negative terminals 100 and 101.

The ammeter arm 78 carries a contact brush 102 which is connected to the positive conductor 103. When the ammeter arm 78 moves in either direction from the position shown contact is made with one or the other of the segments 95 or 96, for instance say 95, then current would be free to flow from the conductor 103 contact brush 102, segment 95, windings of switch 97 to the negative main 99, closing said switch, and starting the motor 85 which will rotate the wheel 94 until the gap between the segments 95 and 96 comes opposite the contact 102, opening the circuit through said switch winding thereby causing switch 97 to open and stop said motor. It is evident that the reverse movement may be similarly made so that the motor will shift the friction wheel 83, through the mechanism previously described, to a position dependent upon the location of contact 102 which depends on the pressure exerted on pole 6 thus securing the desired result.

Referring to Fig. 10: 103 is a motor which is caused to rotate and adjust other apparatus in accordance with the distance the car shall travel. 104—106 are some of the branch tracks of a classification yard, 107 part of the track over which cars travel to said branch tracks, 108 the outbound track, the latter having no special connection with my invention. Each of said branch tracks is respectively wired to manually operated switches 109—111, ammeter coils 112—114, ring segments 115—120. Since the said tracks all operate in a similar manner I shall describe the cycle for track 104 only.

Fig. 11 is a sectional view of one of the ammeters controlling the movement of motor 103 in a similar manner to that described for motor 85. The ring segments 115 and 116

are carried on a spur gear 121, which meshes with a pinion 122, Fig. 13, rotated by motor 103 by means of shaft 123 and bevel gears 124 and 125. Other spur gears 126 and 127 and pinions 128 and 129 are provided for ammeters 113 and 114. Each of the double pole electro-magnetic switches 130 and 131 (Fig. 10) has one pair of its terminals respectively connected to the armature of motor 103 and the other pair of said terminals connected to the positive and negative conductors 132 and 133. I have shown the contactor 134 (Figs. 10 and 11), carried by ammeter arm 135, touching the segment 115; if then, switch 109 is manually closed current will flow from the positive conductor 136, through the holding magnet and one of the poles of said switch, the operating magnet of switch 131 (closing the latter) to segment 115, contactor 134, ammeter coil 112, the second pole of switch 109, to one rail of track 104 at 137, this rail being bonded the circuit is continuous to the other end, 138, of same, where connection is made to the opposite rail at 139, which is also bonded and connected at 140 to the negative conductor 141 completing the circuit. The circuit remains closed until the motor 103 rotates the gear 121 until the gap between the segments 115 and 116 is opposite contactor 134 when both switches 109 and 131 open, stopping the motor after the completion of the required distance adjustment. Adjustment in the reverse direction is similarly accomplished.

As the branch tracks 104—106 are unequal distances from the starting point, 142 (Fig. 1), where power is first applied, I provide means for adjusting each ammeter, by rotation on the trunnions 143 and 144, Fig. 11, and after setting for the distance corresponding to the most distant part of said branch track, such as 138 of track 104, it is held in place by the thumb screw 145. Having made the above adjustment, it will be noted that as the branch track 104 fills with cars the resistance of the rail portion of the circuit between the points 137 and 140 will decrease, being short circuited by said cars, in direct proportion to the remaining length thereof. Having a constant voltage between the conductors 136 and 141 the above change in resistance will cause a change in the amperes flowing in said circuit and a consequent change in the displacement of the ammeter arm 135. In order that this displacement may be adjusted to represent the change in distance which the succeeding cars are required to travel, and in accordance with the condition of said branch track, I provide a means for changing the scale of the spring opposing the torque of the field element of said ammeter. The said field torque is transmitted through the spur gears 146 and 147 (Fig. 11) shaft 148 to the torsion spring 149 the opposite end of which is attached

to the ammeter frame at 150. I preferably employ a spring of rectangular section as shown more clearly in Fig. 12, which is a section on A A of Fig. 11, the spring fits neatly in a slot 151 of the stud 152 which is slidable in a slot 153 of the ammeter frame and provided with a clamping screw 154. It is evident that by moving the stud 152 to the right (Fig. 11) that the torsional stiffness or scale of the spring is increased and vice versa, so that the required movement of the ammeter arm 135 may readily be obtained.

The rails of tracks 104, 105, and 106, adjacent to their ends, are insulated from the tracks 107 and 108 by sections of insulating material, as indicated at 104^a, 105^a and 106^a, respectively, and said rails are insulated from their cross-ties (not shown) by any suitable means, such as plates of insulating material (not shown) interposed between the rails and ties.

Referring to Figs. 13 and 14, 155 is a scale beam, supported on the fulcrum 156 and 157 and provided with a weight 158 whose position is a measure of the total revolutions of the friction wheel 83, Fig. 8, whose motion is transmitted to the weight through mechanism to be described later, and sprocket 159^a, link belt 159, sprocket 160, (Fig. 13) bevel gears 161, and screw 162. The position of link 163 with relation to the fulcrum of lever 164 is dependent upon the distance the car 5 (Fig. 2) moves while accelerating force is being applied to the car or cars being shifted as motion is transmitted from shaft 81, through mechanism and sprocket 165 (Fig. 8) link belt 166, sprocket 167, bevel gears 168, pinion 169 and gear segment 170.

The location of link 171, with respect to the fulcrum of lever 172, is dependent upon the total distance the car or cars shall travel less the distance traveled during acceleration. The movement of motor 103, the position of which, has been shown to bear a direct relation to the total distance a car or group of cars shall travel to reach the predetermined destination is transmitted through the bevel pinion 173, double faced bevel gear 174, which is rotatably mounted on shaft 175, to the bevel pinion 176, which is rotatable on a stud which is keyed to shaft 175. The double faced bevel gear 177, also rotatably mounted on said shaft and engaging bevel pinion 176, is rotated by the bevel pinion 178 and sprocket 167, in proportion to the distance traversed during acceleration, so that the shaft 175 is given the required differential motion, which is transmitted to the bevel gears 179, pinion 180 and gear segment 181 attached to link 171, causing proper adjustment of said link.

The location of link 182 with relation to lever 183 which is rigidly connected to the scale beam 155 is dependent upon the total

weight of the car or cars, since the movement of motor 22 (Fig. 5) is transmitted to it through the sprocket 53, link belt 54, sprocket 184, bevel gears 185, pinion 186 and gear segment 187 attached to said link. It is obvious that link 182 may be provided with an indicator and lever 183 may be graduated in such manner that the weight of a car or group of cars may be read from said graduations.

I provide two centrifugal governors 188 and 189 which are rotated at a speed in direct proportion to the speed of car or cars being accelerated, by means of the shaft 81, sprocket 190, (Fig. 8) link belt 191, sprocket 192 and pairs of bevel gears 193—196. The centrifugal members of said governors are exact duplicates so that each exerts a force directly proportional to the square of the velocity of the car or cars being accelerated. Governor 189 is connected through lever 197, link 198, lever 172, link 171, lever 199, link 163 to lever 164, which is connected to governor 188 by link 200 and lever 201, and at the opposite end by link 182 to the scale beam 155.

It can be demonstrated that with the parts of this weighing mechanism adjusted, as described, in accordance with the various elements entering into the case, that I have so measured the resistances of the car or cars being accelerated, that they will have the required speed to carry them to the desired destination at the instant that the force exerted by the governors 188 and 189 counter balances the force exerted by the weight 158.

I have provided a counterbalance 202 for lever 201 which has been extended to control two two-pole switches 75 and 223. When the required speed has been attained, governor 188 will lift the lever 201 and open the circuit 73, 74 which will permit the relay 203, (Fig. 2) to close the circuit of the battery 204 and ring the bell 205 as a signal to the engineer to shut off power. It is obvious that this relay 203 may be arranged to set in operation means for automatically shutting of the source of power without departing from my invention.

Having completed the forward cycle it is necessary to provide means for returning weight 158 and links 163 and 182 to their zero positions. For this purpose I have provided similar apparatus for weight 158 and link 163. Referring to Fig. 8 the clutches 206 and 207, the details of which not forming a part of my invention are not shown, are set for transmission by springs and provided with solenoids 208 and 209 for releasing. One part of each of said clutches is attached to the shafts 210 and 81 and the other to the shafts of motors 211 and 212 to the opposite ends of whose shafts are attached the sprockets 159^a and

165. During the forward movement these motors were open circuited and had no influence on the transmission.

The said motors are connected through conductors 213—216 to limit switches 217 and 218 (Fig. 13) and to the two pole electro-magnetic switches 219 and 220. When the governor 188 raises lever 201 the conductors 221 and 222 are connected through a two-pole switch 223 (Fig. 13) to the positive and negative conductors 76 and 76^a causing the two-pole electro-magnetic switches 219 and 220 to close, and, connecting to the positive and negative conductors 224 and 225, energize the solenoids 208 and 209 releasing the clutches 206 and 207, leaving the motors 211 and 212, likewise energized, free to return respectively the weight 158 and link 163 to their zero positions, upon reaching which the said weight and link open their respective limit switches and stop said motors. The switches 219 and 220 are provided with holding-in magnets 226 and 227 so that a subsequent change in the position of governor 188 will not interfere with the completion of this function.

Referring to Fig. 6, switch 228 is provided to return motor 22 and link 182 (Fig. 13) to their zero positions. The said switch is similar in construction and operation and starts to function at the same time and from the same cause as switches 219 and 220, just described. The conductors 229 and 230 connect to the limit switch 231 (Fig. 13). Upon the link 182 reaching its zero position in line with the fulcrum 156 and 157 said limit switch is opened by said link stopping motor 22. With these members re-set in their zero positions the apparatus is ready to repeat its functions as soon as the poling car 5, (Fig. 2) has returned to the starting point for the next cut of cars.

In order to demonstrate that the part of the apparatus illustrated in Fig. 13 will indicate when the required speed has been attained by a car or cars, in order that said car or cars shall reach the desired destination, reference is had to the following equations:

$$(1) \quad Fd = \frac{S^2 W}{2g} + d f w.$$

$$(2) \quad \frac{Fd}{W} - \frac{S^2}{2g} = d f$$

$$(3) \quad \frac{S^2 W}{2g} = f W (D - d)$$

$$(4) \quad \frac{S^2}{2g} = f (D - d)$$

In which:

D=total distance from starting point to final destination of car.

d=distance car is moved during acceleration.

F=accelerating force.

f=coefficient of friction.

W=weight of car being accelerated.

g=acceleration produced by gravity;

32.16.

S=velocity of car.

Equation 1 is fundamental; that is, the work performed on the car is equal to the resulting kinetic energy of the car plus the work lost in friction.

Equation 2 is a more convenient form of equation 1.

Equation 3 may be stated as: The kinetic energy at final speed of acceleration must equal the frictional losses between the points of final acceleration and final destination in order that the car shall travel to the said destination as required.

Equation 4 is a more convenient form of equation 3.

Referring to Fig. 13, the moment of weight 158 about the fulcrum of the beam 155 is a measure of Fd and the distance of the pin 232 engaging the lever 183 from the same fulcrum is proportional to the weight of the car, so that the upward force exerted by link 182 on pin 233 is a measure of

$$\frac{Fd}{W}$$

and this force is transmitted through lever 164 to pin 234 where it is opposed by the upward force of the governor 188 which is a measure, in the same units, of

$$\frac{S^2}{2g},$$

but, from equation 2,

$$\frac{Fd}{W} - \frac{S^2}{2g} = df.$$

Therefore the unbalanced force at pin 234 is a measure of df . The distance of pin 235 which engages lever 164 from the centre line through the fulcrum 236 of said lever and pin 237 is a measure of d , so that the force exerted by link 163 on pin 237 is inversely proportional to d multiplied by df , and is therefore a measure of the friction, f , of the car or cars being accelerated. The lever 199 is interposed to change the direction of this force which is transmitted by pin 236, link 171 and pin 237 upwardly to lever 172, but the distance of pin 237 from the fulcrum 238 of said lever is a measure of $D-d$ so that the force at pin 239 is a measure of $f(D-d)$ which from equation 4 is equal and opposite, at the critical speed, to the measure of

$$\frac{S^2}{2g}$$

exerted by governor 189; therefore when the said mechanism is in equilibrium the re-

quired speed for the car or cars to reach the predetermined destination has been attained. Since the said governors can be designed to be unstable in this condition, an infinitesimal increase of speed will cause a movement of the mechanism and allow governor 188 to perform its functions as previously described.

From the foregoing description it will be seen that means have been provided:

For the automatic determination of the frictional resistance of a car or cars during a period of acceleration by a source of power.

For the determination of the speed required to carry said car or cars to a predetermined destination, and either for the setting of a signal or the cutting off of power from said car when said speed has been attained.

For automatically determining the work performed on a car or cars.

For automatically obtaining the total weight of a car or group of cars in motion.

For a combined manual and automatic determination of the distance a car is required to travel to reach a predetermined destination.

Although certain specific embodiments of the invention have been illustrated and described I do not intend to be limited to the particular devices shown and it should be understood that further changes in the construction and arrangement of the various cooperating parts may be made without departing from the spirit or scope of the invention as set forth in the following claims. It is to be understood that the expression "car" when used in the appended claims may designate either a single car or a group of cars.

I claim:—

1. A method of determination of the force applied to a car or cars by a source of power; consisting of hydrostatically varying the resistance of an electric circuit in proportion to the force exerted on said car or cars.

2. A method for automatically determining the coefficient of friction of a car or group of cars per unit of distance and weight comprising the determination of the work performed, on said car or group of cars by a source of power, ascertaining the second power of the speed produced by said work, obtaining the total weight of said car or cars, and combining the aforesaid determinations and eliminating the distance traversed during the performance of said work so that the unbalanced force is a measure of the coefficient of friction of said car or cars.

3. A method of automatically pre-determining the speed required in order that a car or group of cars may reach a predetermined destination; comprising the step of indicating when said speed has been attained

and the further step of automatically predetermining the distance said cars shall travel in order to reach said destination.

4. In a car distributing system, the combination with a car, of car accelerating means, actuated by a source of power, means for automatically indicating, when the car accelerating means in actuating said car attains a predetermined speed, means for determining said speed in accordance with the condition under which said car is actuated, and means for automatically predetermining said condition.

5. In the art of car distribution, the method which comprises accelerating a car, determining the frictional resistances opposing the acceleration of said car, and continuing the acceleration for a period of time dependent upon the magnitude of the frictional resistances.

6. The combination with car propelling means and a car, of a device for automatically determining the velocity of said means necessary to overcome a co-determined frictional resistance to movement of said car.

7. In a car distributing system a device for automatically determining the total weight of a group of cars passing consecutively over said device, and means varying partly with the weight for determining the highest speed during distribution.

8. In a car accelerating system; an accelerator and the combination of centrifugal governors differentially connected to weighing mechanism for the automatic determination and indication of the speed required in order that said car may travel a predetermined distance after leaving said accelerator.

9. In a car accelerator; the combination of centrifugal governors, whose speed is dependent upon the speed of said accelerator, automatic mechanism for the determination of the frictional resistance of car or cars and means for effecting an indication at an automatically determined speed when the equilibrium of said governors and mechanism becomes unstable.

10. The combination in a car controlling system, of a car, car propelling means, a device for automatically indicating the point at which the power shall be cut off from said propelling means, and mechanism manually and automatically adjustable in accordance with any predetermined distance which it is desired said car shall travel for determining the speed acquired by it before said device operates.

11. Apparatus for distributing cars, comprising means for determining the weight of a car, means for automatically determining the distance which said car is to be moved, and means controlled by both of said means for indicating when the force applied to the car has attained the magnitude required to move it to its destination.

12. Apparatus for distributing cars, comprising an accelerating means, a control device actuated by said means in accordance with the force exerted on a car, a second control device actuated in accordance with the speed of the car during acceleration, a third control device automatically operative in accordance with the distance through which said car is to be moved, and means operated by all of said control devices, for indicating the degree of acceleration required to propel said car to its destination.

13. Apparatus for distributing cars, comprising means for imparting momentum to a car at the beginning of its path of travel, a control device actuated in accordance with the work required to produce acceleration of the car, a control device, automatically operative in accordance with the distance to be traveled by said car, and means operated by said control devices to indicate when said car has been given a momentum sufficient to carry it to its destination.

14. Apparatus for distributing cars, comprising accelerating means, means for indicating the acceleration required to carry a car to its destination, governing means controlling said indicating means, a device actuated in accordance with the weight of the car, a device actuated by the force exerted by said accelerating means, and a device operative in accordance with the distance to be traveled by said car, the said devices cooperating to control said governing means.

15. Apparatus for distributing cars, comprising accelerating means, means for indicating the acceleration required to carry a car to its destination, a governor controlling said indicating means, a device actuated in accordance with the weight of the car, a device actuated by the force exerted by said accelerating means, and means for effecting cooperation of said devices, to control said governor.

16. The method of distributing cars, which comprises automatically determining the resistance to movement of a car and the distance to which the car is to be moved, and applying a propelling force sufficient to overcome said resistance and to move said car to its destination.

17. The method of distributing cars, which comprises determining the distance a car is to be moved, determining the weight of the car, determining the coefficient of friction per unit of distance and weight, and applying an accelerating force to said car sufficient to carry it to its destination.

18. The method of distributing cars, which comprises determining the resistance to movement of a car and the distance to which the car is to be moved, determining the coefficient of friction per unit of distance and weight, and applying a propelling force

sufficient to overcome said resistance and to move said car to its destination, the said force being applied only during the initial movement of the car.

19. The method of distributing cars, which comprises determining the distance a car is to be moved, determining the weight of the car, determining the coefficient of friction per unit of distance and weight, and applying an accelerating force whose magnitude is governed by said determinations to said car during a portion of its travel, sufficient to carry it to its destination.

20. In a car distributing system, means manually and automatically adjustable in accordance with the distance a car shall travel on a predetermined route, and means for temporarily accelerating the car to cause its movement through said distance, the magnitude of the acceleration depending on the distance to be travelled.

21. In a car distributing system, means for weighing a car, and means for temporarily applying a force to move such car a predetermined distance, the magnitude of the force depending on the weight of the car.

22. In a system as described, an accelerating agent, an object to be accelerated, and means for determining in accordance with the coefficient of friction per unit of weight and distance of said object the kinetic energy necessary to move such object a predetermined distance.

23. In the distribution of cars, the method which comprises accelerating a car, weighing the car during the acceleration period, and thereafter continuing the acceleration for a period of time dependent upon the weight of the car.

24. In the distribution of cars, the method which comprises accelerating a car, during the acceleration period determining the weight of the car, its frictional resistances, and the distance to be travelled by the car, and thereafter continuing the acceleration for a period of time depending upon said factors.

25. In the distribution of cars, the method which comprises accelerating a car, during

the acceleration period determining the distance the car shall travel after the acceleration period, and thereafter continuing the acceleration for a period of time dependent upon the distance to be travelled.

26. In the art of car distribution, the method of determining the amount of acceleration necessary to shift a car a given distance, which comprises during acceleration determining the weight of the car and the frictional resistances and simultaneously applying an accelerating force to the car.

27. In a system as described, an accelerating agent, an object to be accelerated, means for determining the energy necessary to move the object a predetermined distance in accordance with the coefficient of resistance to movement per unit of weight and distance, and means for automatically resetting the energy-determining means.

28. In a system as described, an accelerating agent, an object to be accelerated in order to reach a predetermined point, and speed responsive devices co-ordinated with said accelerating agent, said speed-responsive devices indicating the speed required for said accelerated object to reach said predetermined point.

29. In a system as described, an accelerating agent, an object to be accelerated, and means for determining the energy necessary to move the object a predetermined distance in accordance with the coefficient of resistance to movement per unit of weight and distance, said means including speed-responsive devices for indicating the speed required for said accelerated object to reach the predetermined point.

30. The method of distributing cars which comprises determining the distance a car is to be moved, determining the coefficient of friction per unit of weight and distance of said car, and simultaneously accelerating the car, the magnitude of acceleration depending upon the distance and the coefficient of friction.

In testimony whereof I have hereunto affixed my signature this 30th day of March, 1922.

EDWARD P. HAINES.