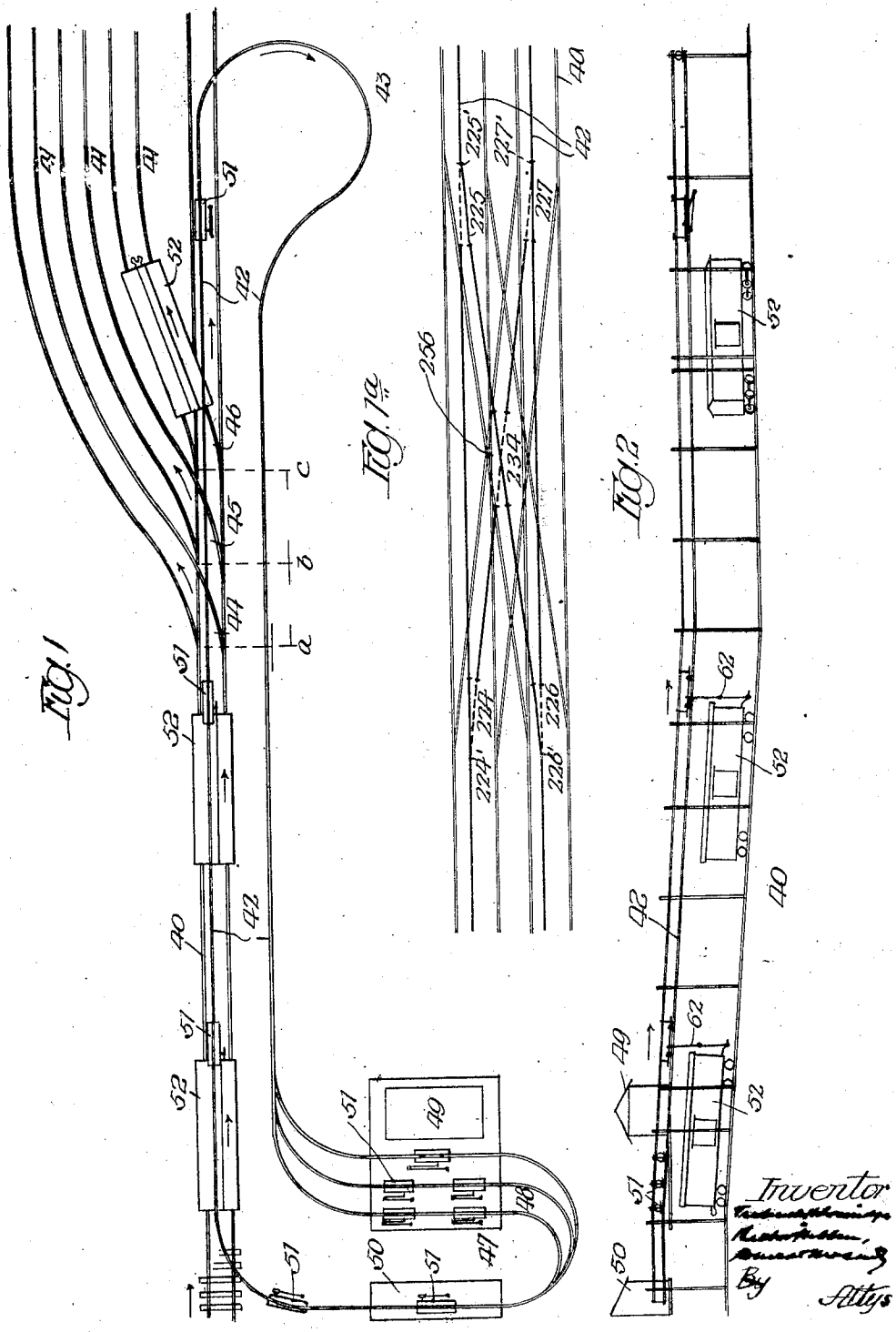
Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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F. H. LOVERIDGE

RAILWAY CAR CONTROL

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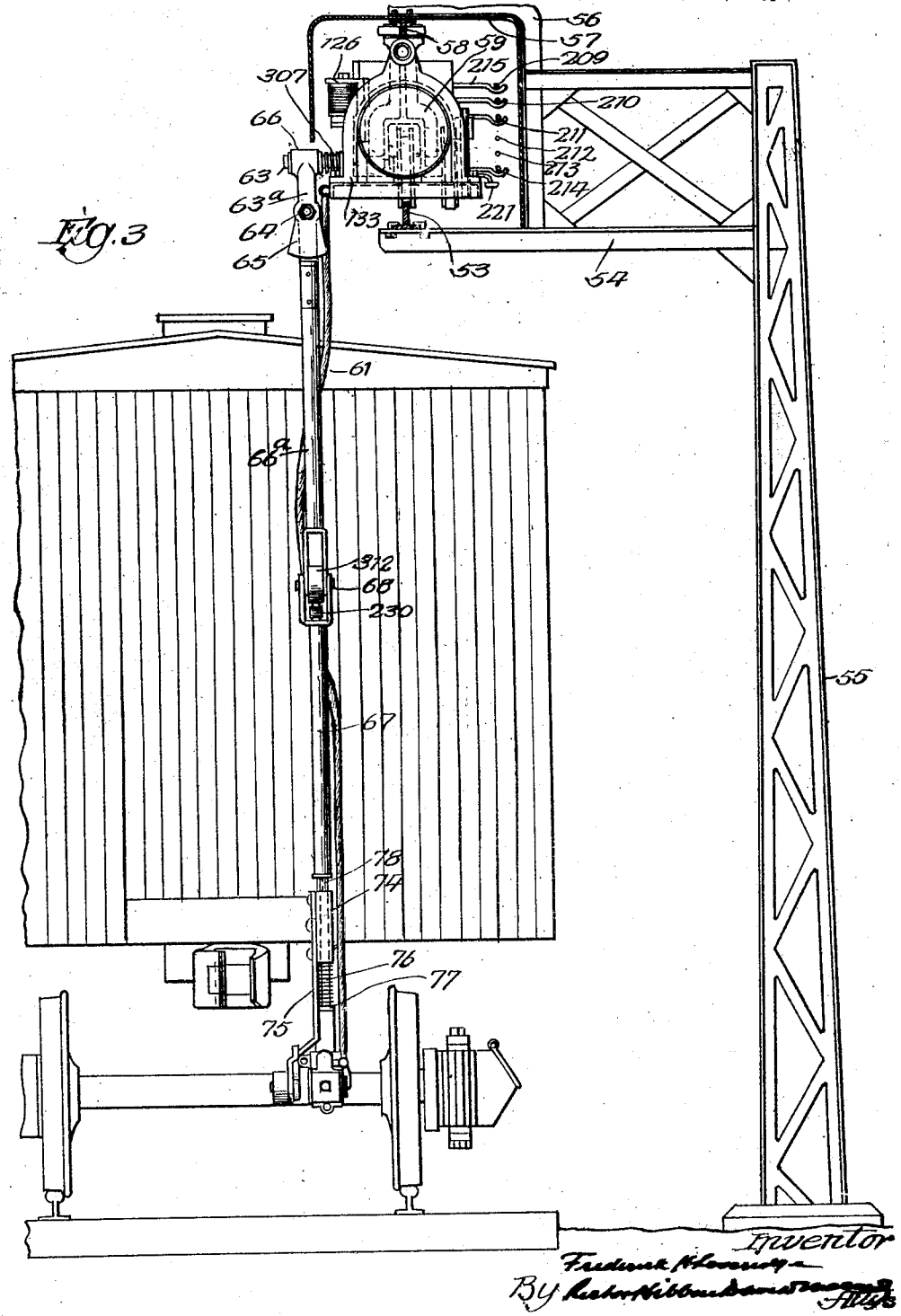


FIG. 3

Inventor
Frederick H. Loveridge
By Robb, Gibbons & Dawson
Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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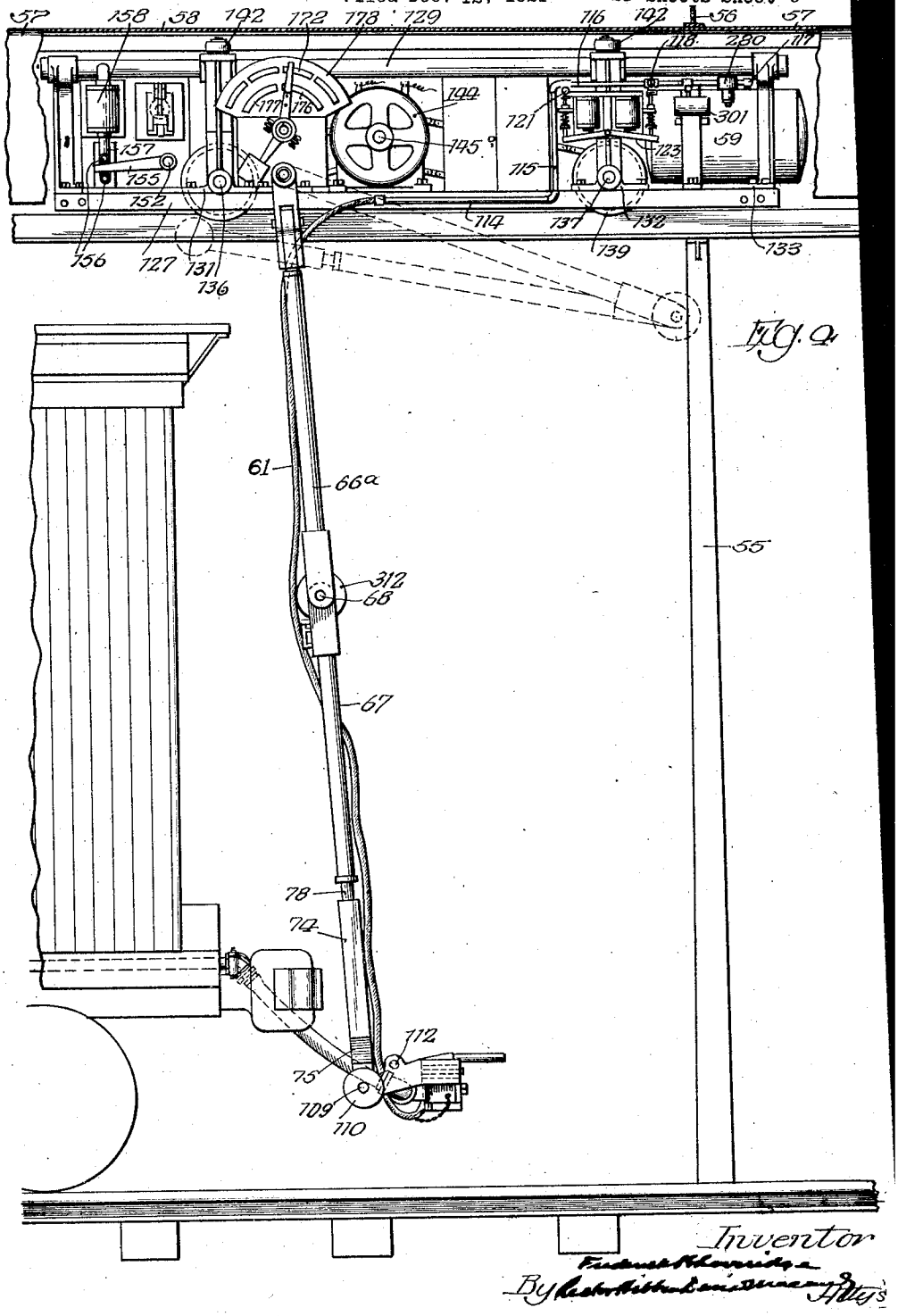


Fig. 4

Inventor

Frederick H. Loveridge

By Rector, Hibben, Davis & Davis

Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

Filed Dec. 12, 1921 23 Sheets-Sheet 4

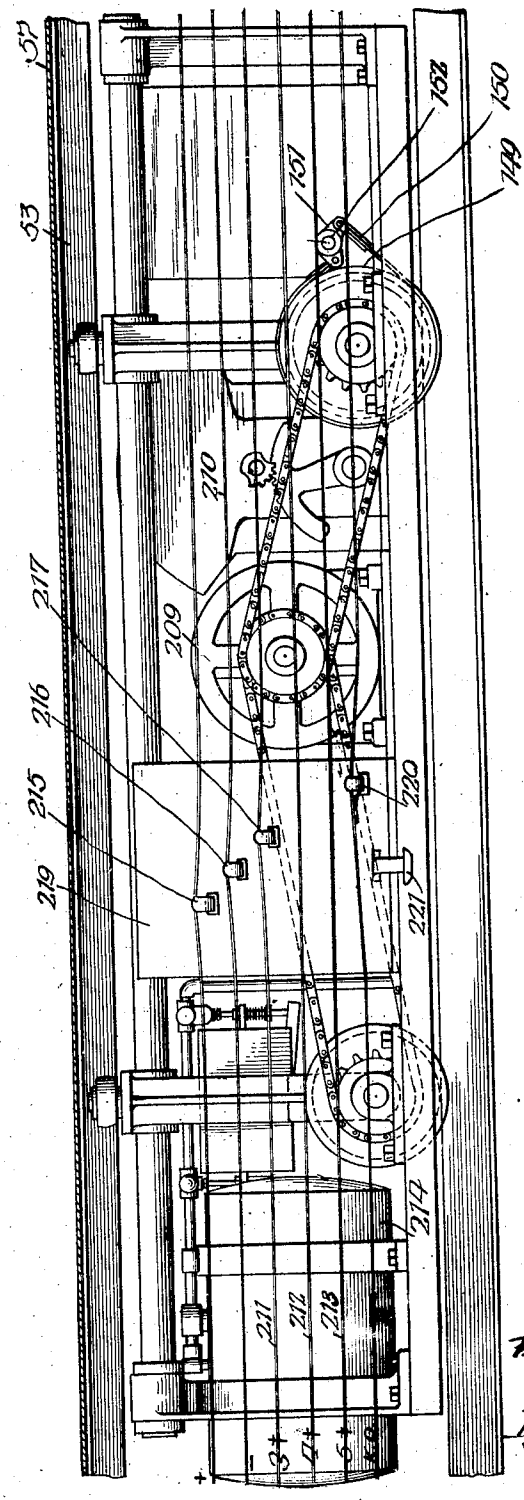


FIG. 5

Inventor

By

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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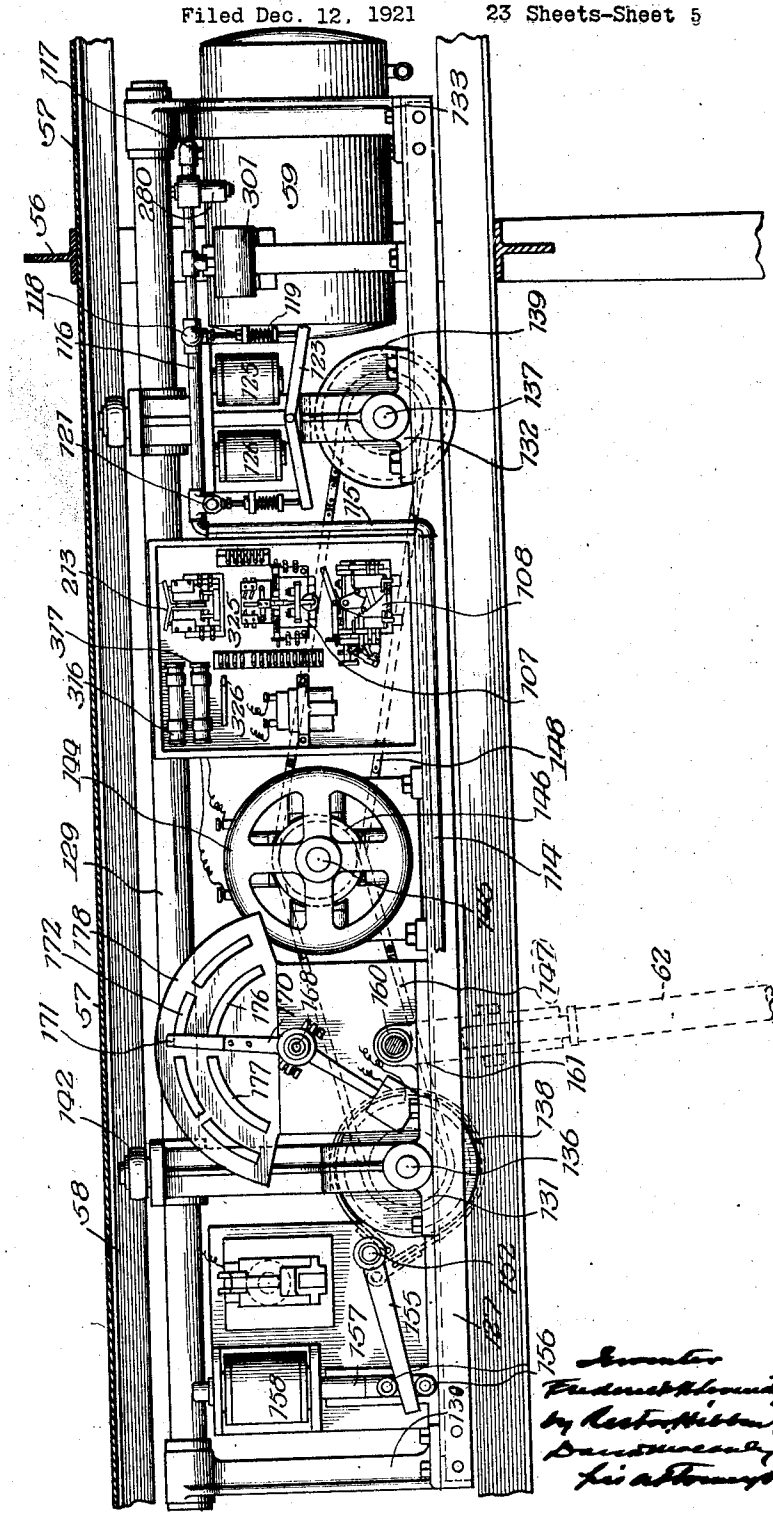


Fig. 6

Inventor
Frederick H. Loveridge
by Rector, Hibben, Davis & Kennedy
his attorneys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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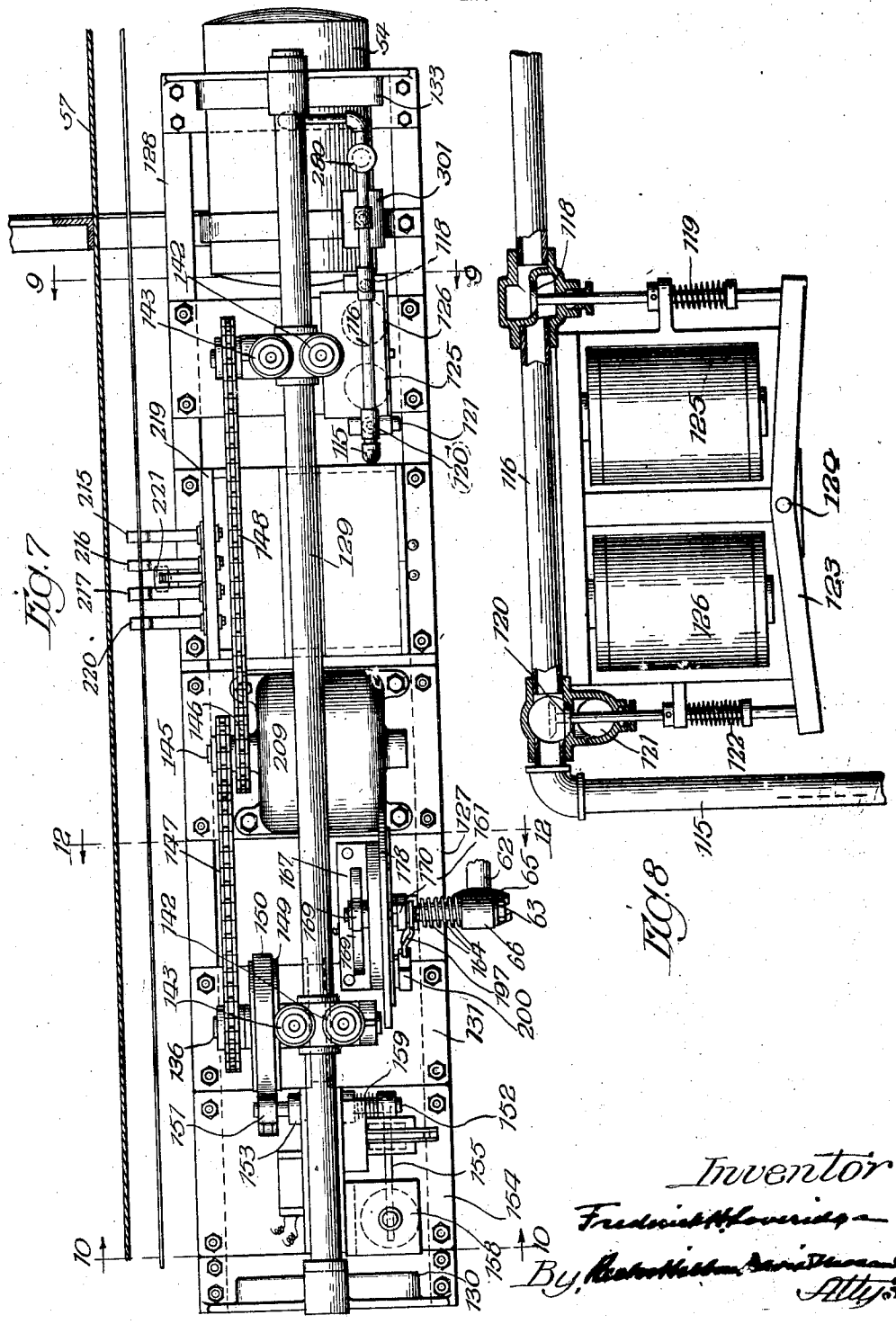


FIG. 7

FIG. 8

Inventor

Frederick H. Loveridge

By Robert Hill Van Benthuysen

Atty.

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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Fig. 12

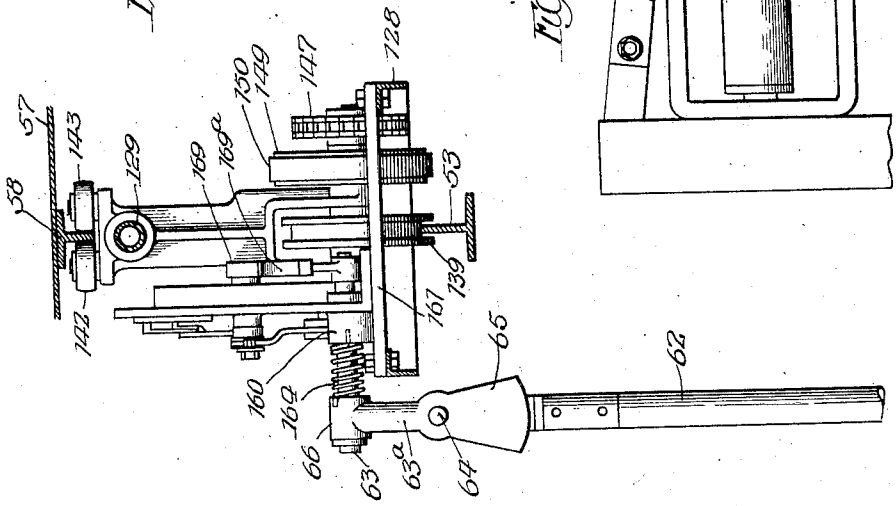


Fig. 11

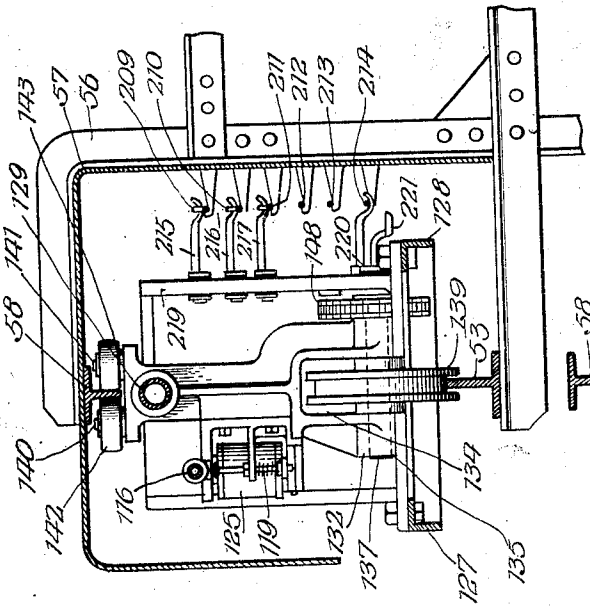
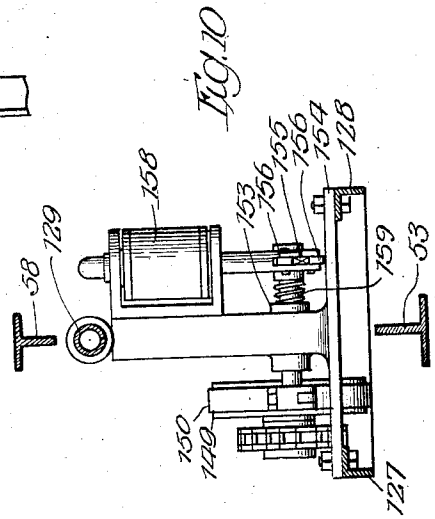


Fig. 9

Fig. 10



Inventor:—
Frederick H. Loveridge
By Rector Hibben Davis & Thurman
Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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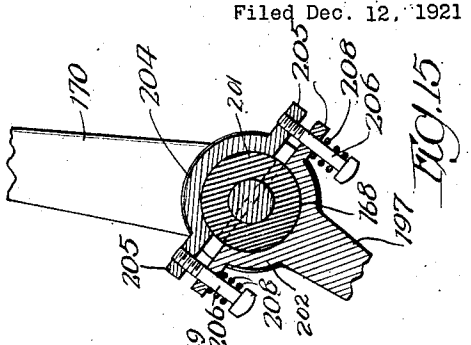


FIG. 15

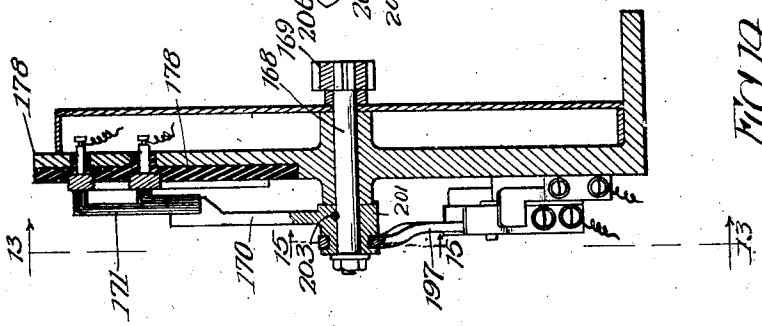


FIG. 12

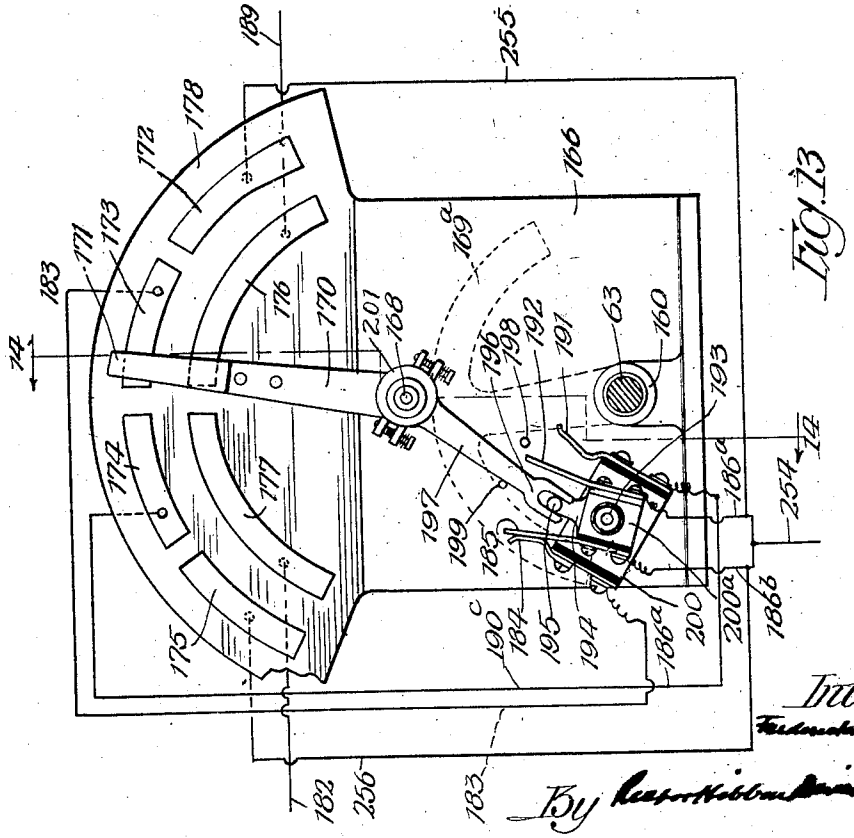


FIG. 13

Inventor

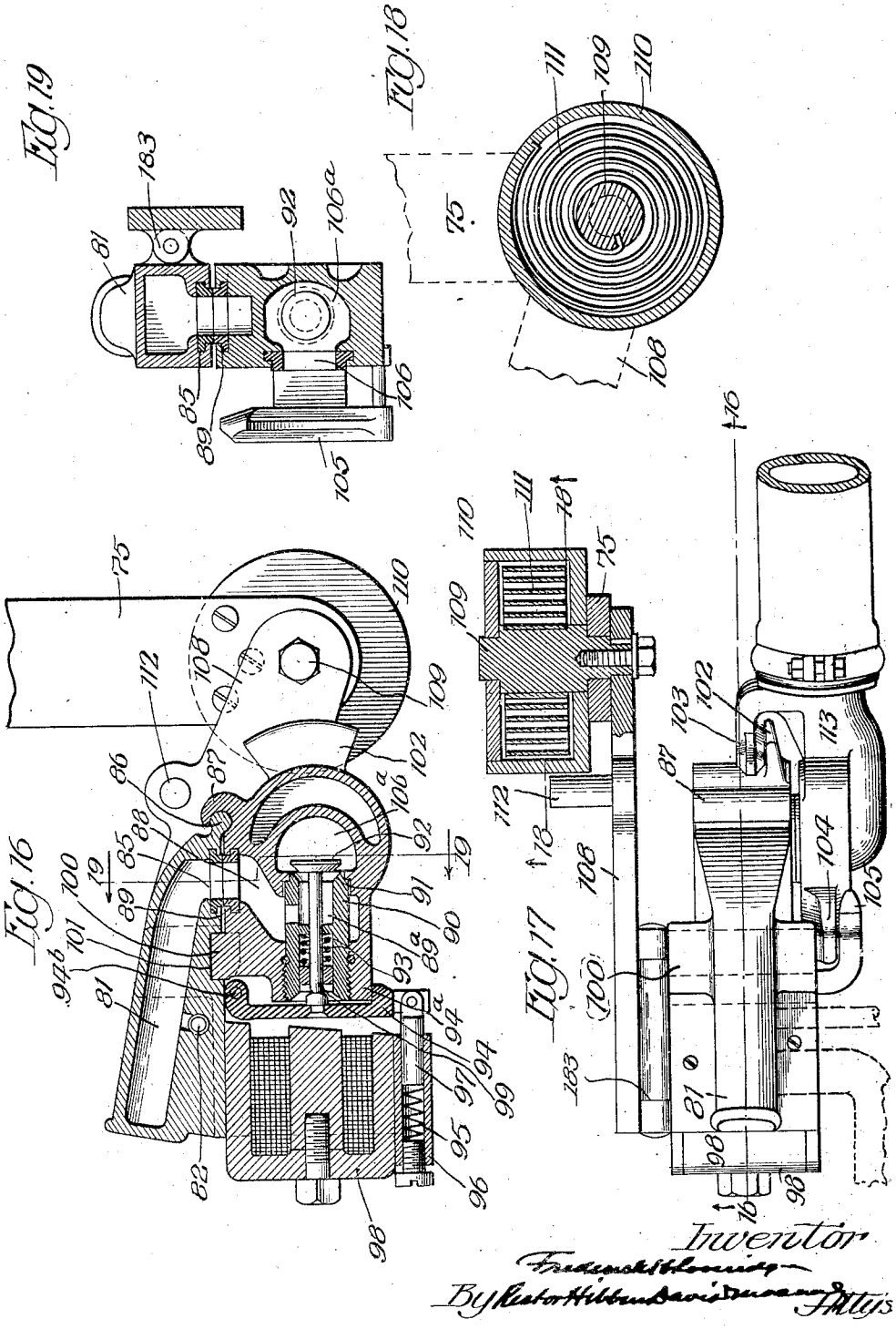
By

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

Filed Dec. 12, 1921 23 Sheets-Sheet 9



Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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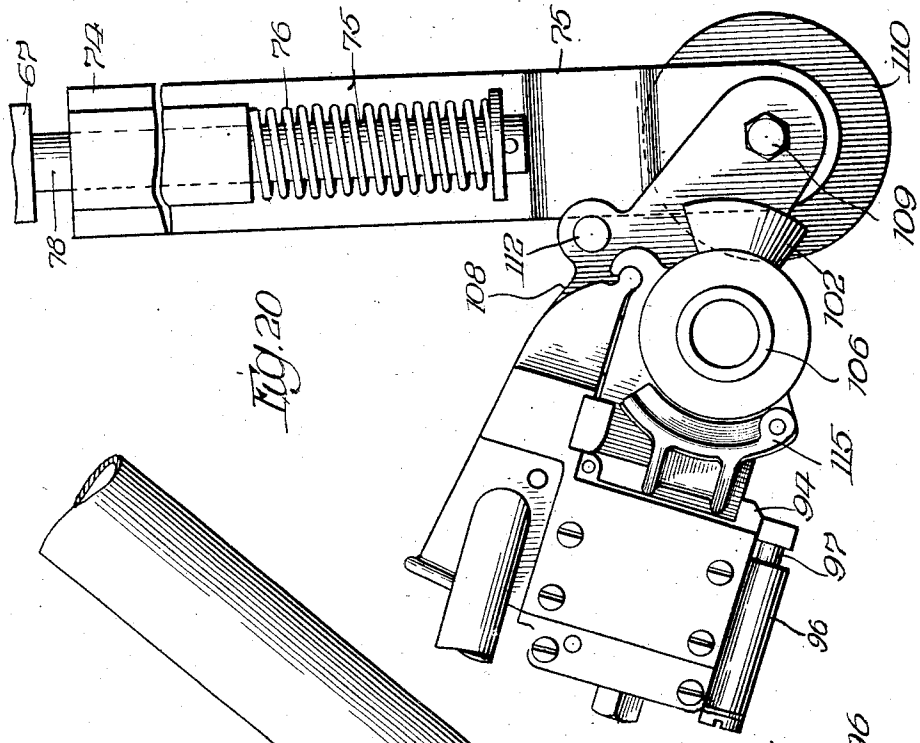


Fig. 20

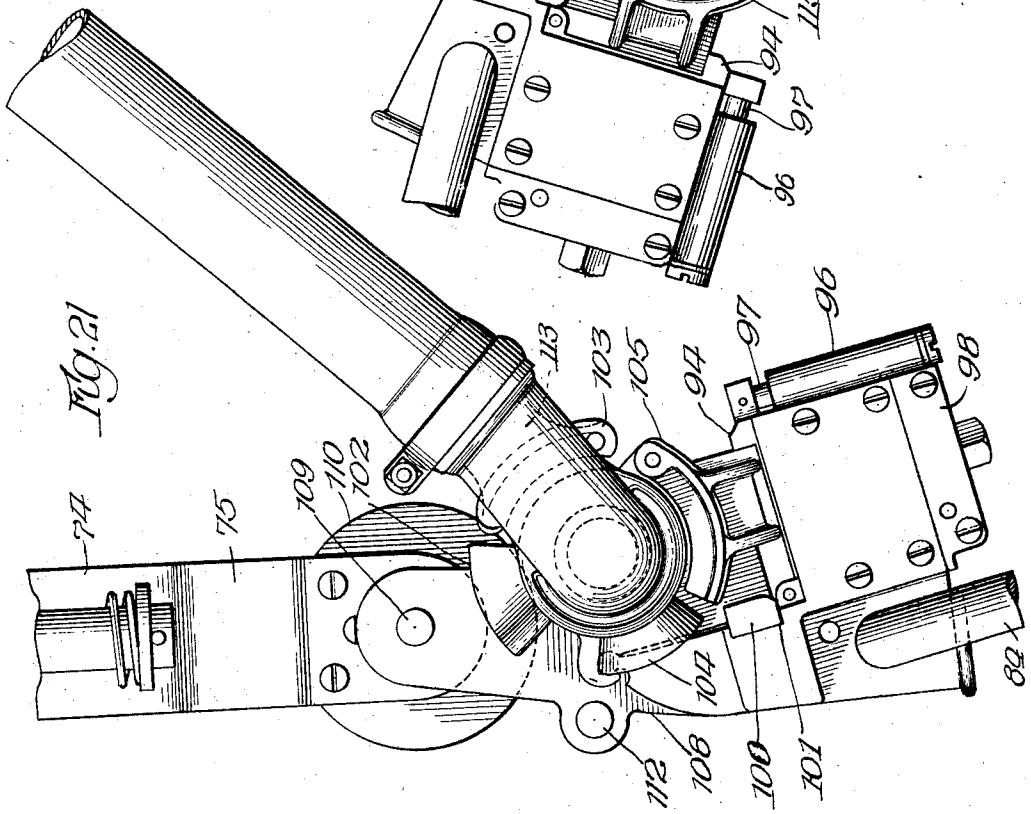


Fig. 21

Inventor:-

Frederick H. Loveridge

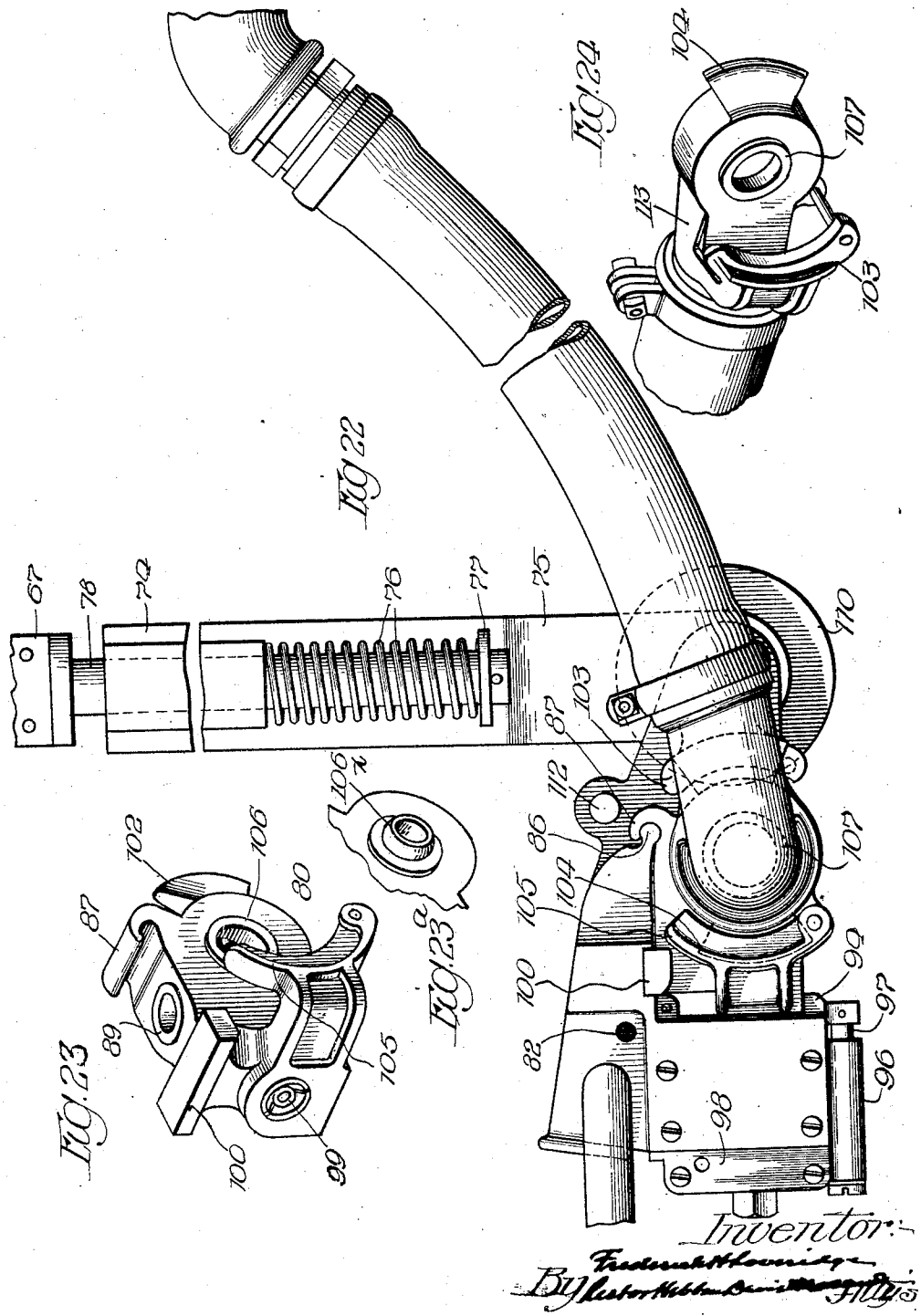
By Victor Hobson, Davis & Howard Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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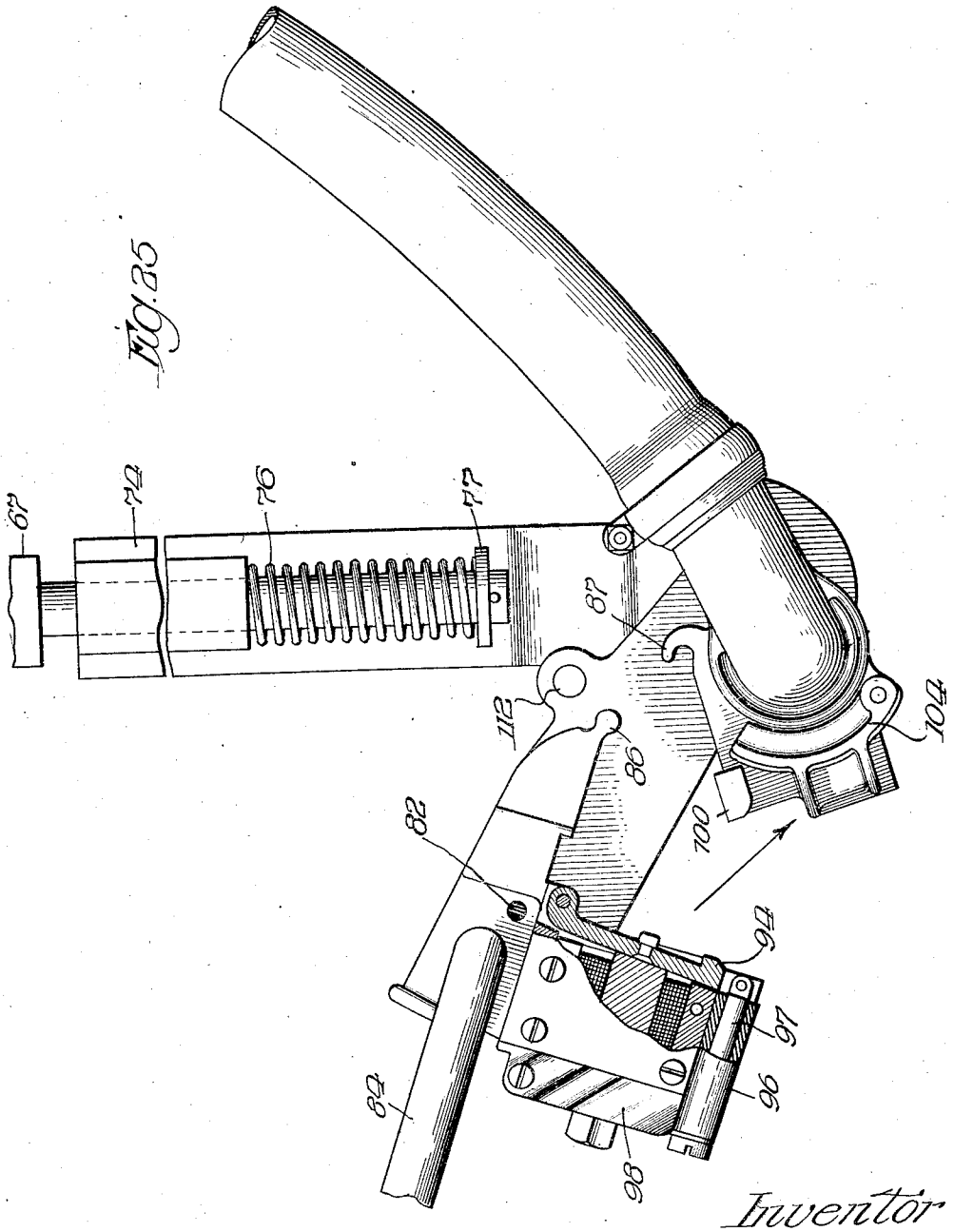
Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

Filed Dec. 12, 1921 23 Sheets-Sheet 12

Fig. 35



Inventor

Frederick H. Loveridge

By Rector, Hibben, Davis & Duncan

Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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Fig. 26

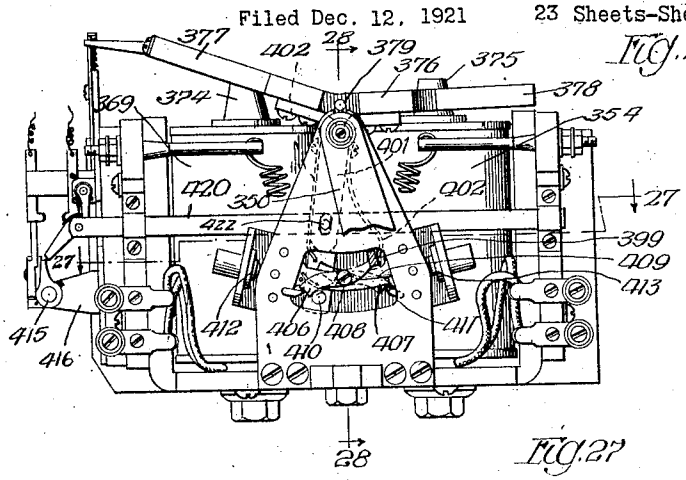


Fig. 27

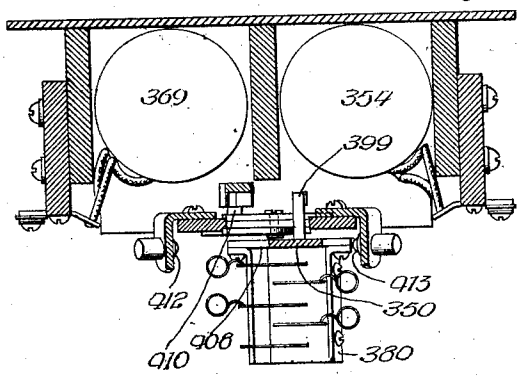


Fig. 28

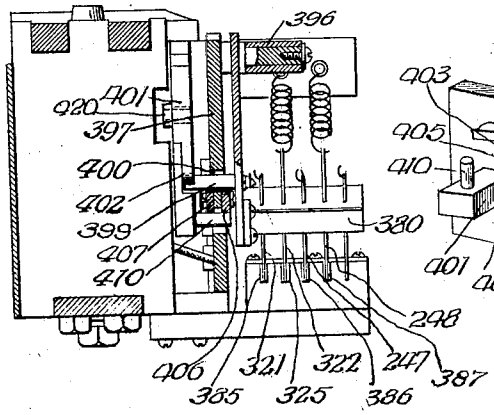
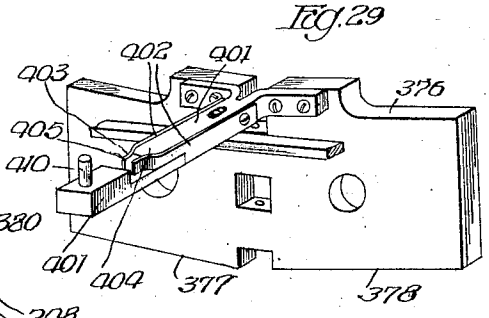


Fig. 29



Inventor

By Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

Filed Dec. 12, 1921 23 Sheets-Sheet 14

Fig. 30

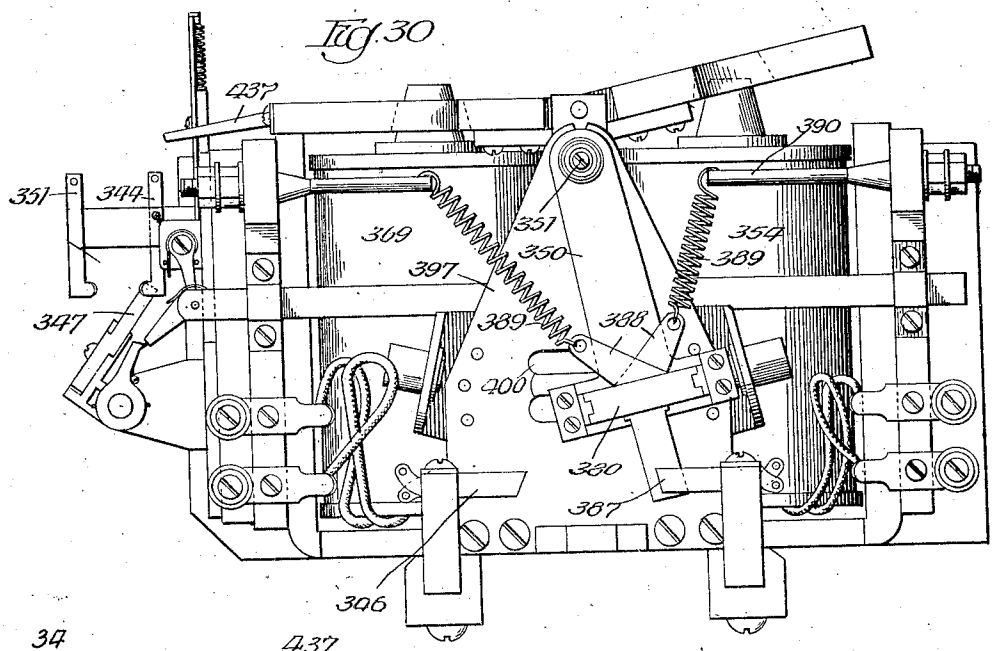
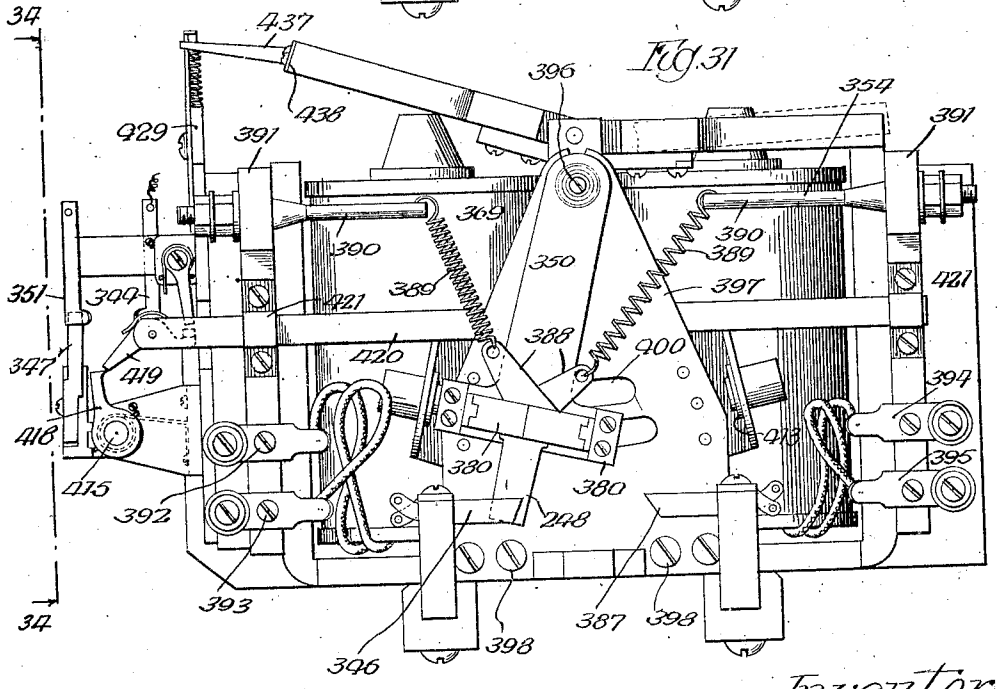


Fig. 31



Inventor

Frederick H. Loveridge

By Rector, Hibben, Davis & Macauley

Attys.

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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Fig. 32

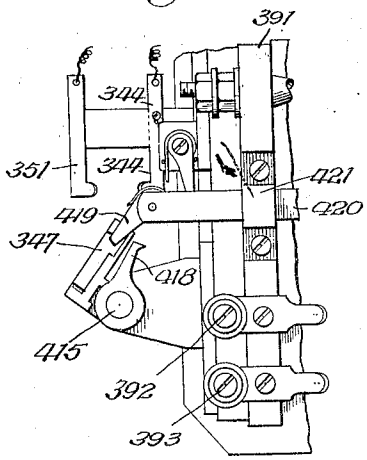


Fig. 33

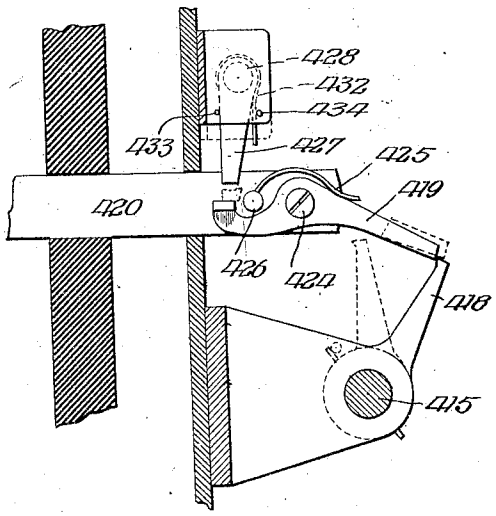
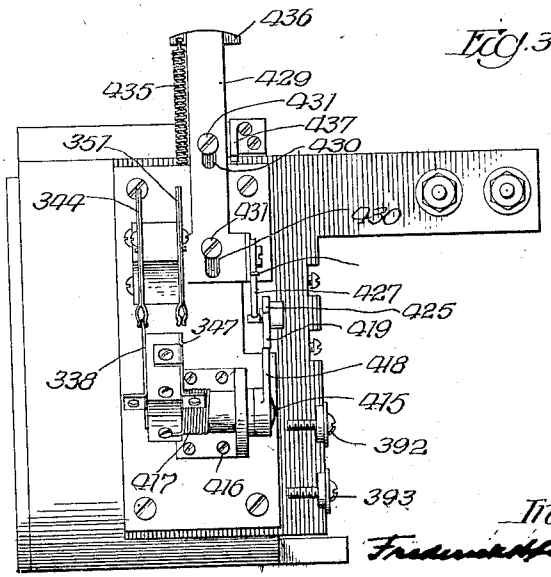


Fig. 34



Inventor

Frederick H. Loveridge

By Rector, Hibben, Davis & Rector

Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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Fig. 36

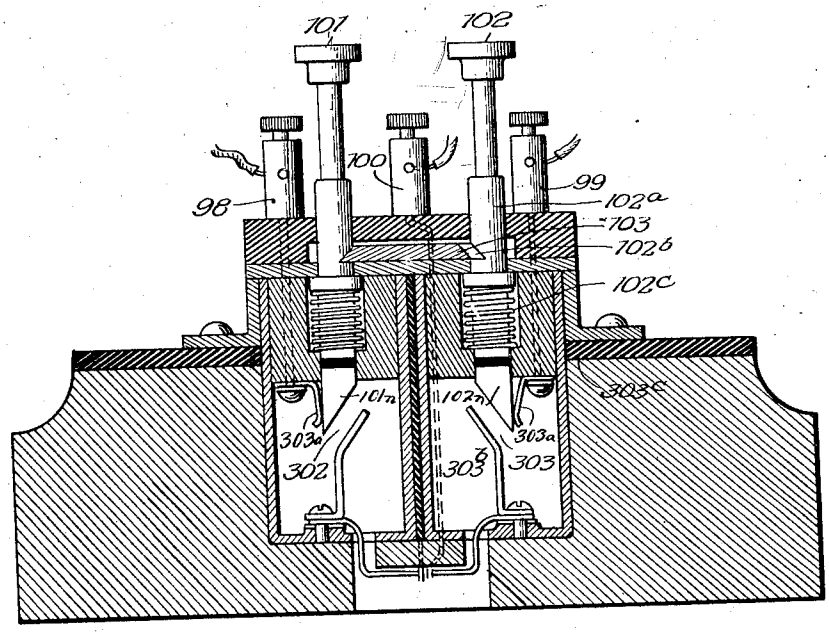
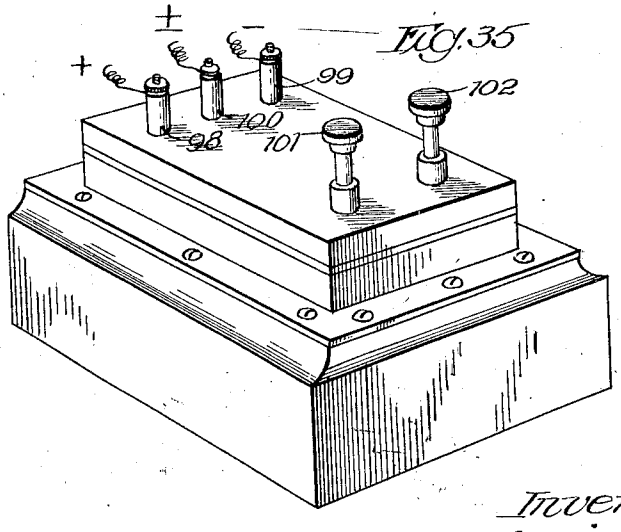


Fig. 35



Inventor

Frederick H. Loveridge

By Rector Hibben Davis & Macy

Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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Fig. 37

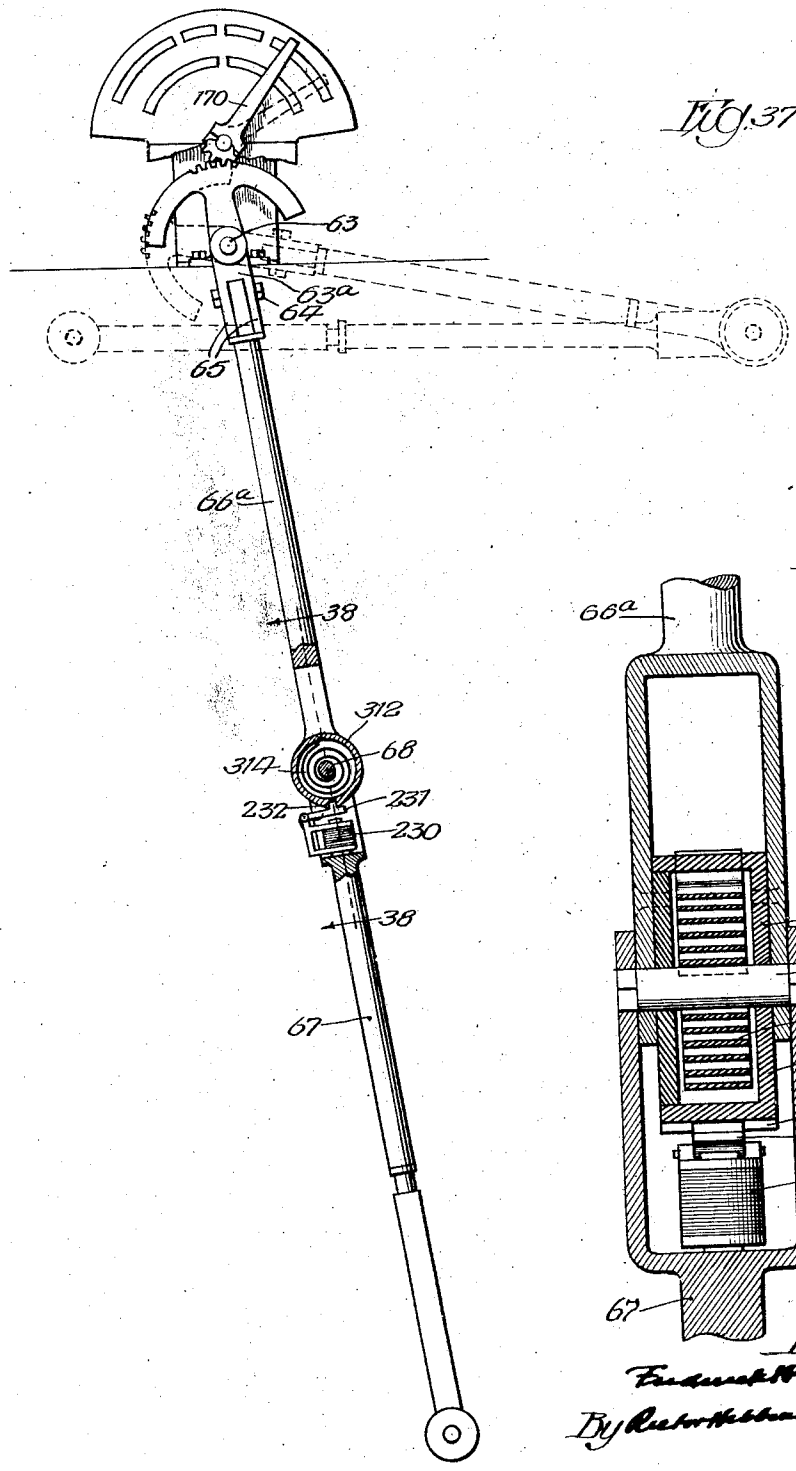


Fig. 38

Inventor

Frederick H. Loveridge

By Rector, Hibben, Davis & Howard

Attys.

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

Filed Dec. 12, 1921 23 Sheets-Sheet 18

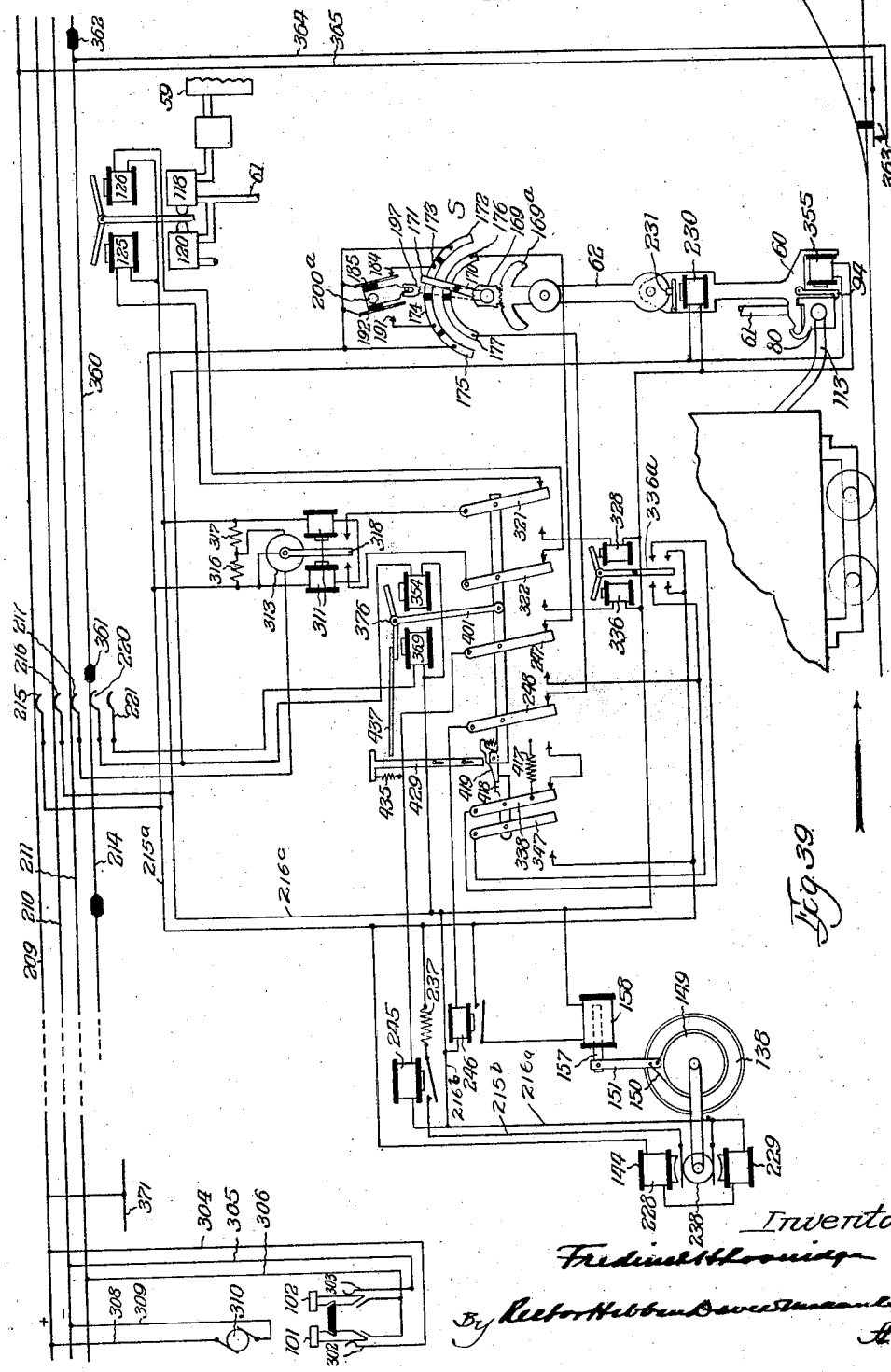


Fig 39.

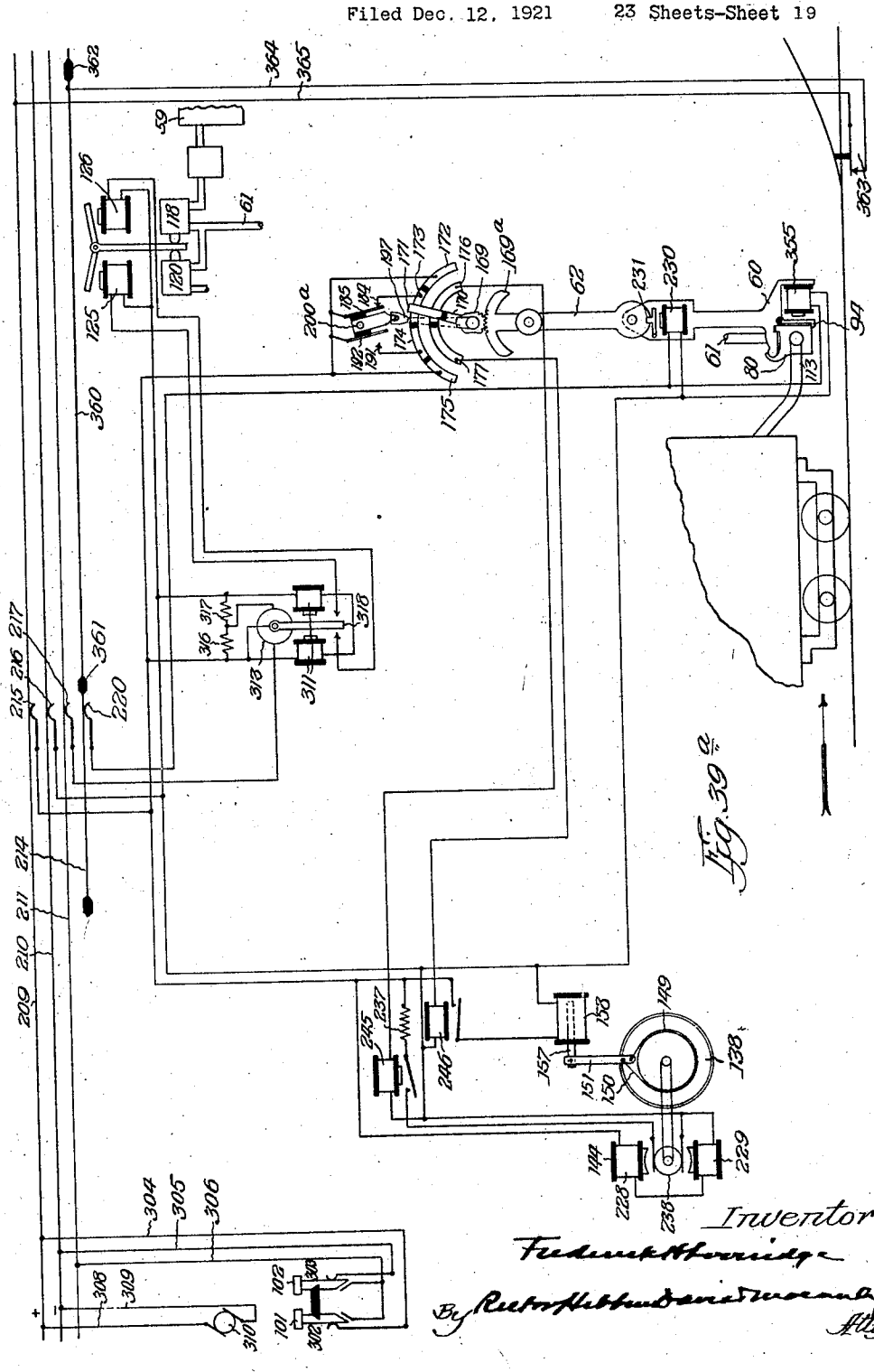
Inventor
Frederick H. Loveridge
By Rector, Hibben, Davis & Macauley
Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

Filed Dec. 12, 1921 23 Sheets-Sheet 19



Inventor

Frederick H. Loveridge

By Rector, Hibben & Davis & Thurman

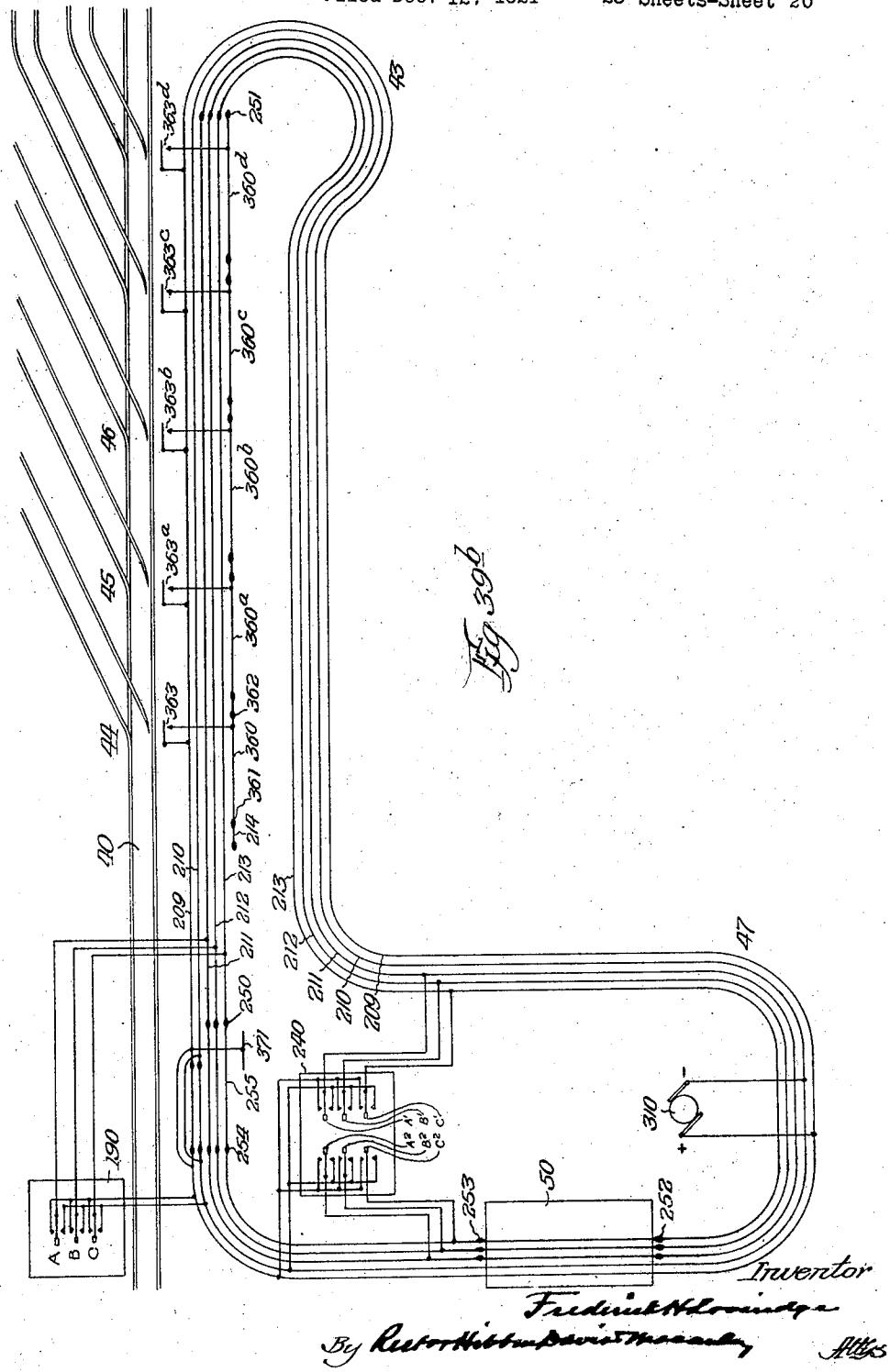
Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

Filed Dec. 12, 1921 23 Sheets-Sheet 20



Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

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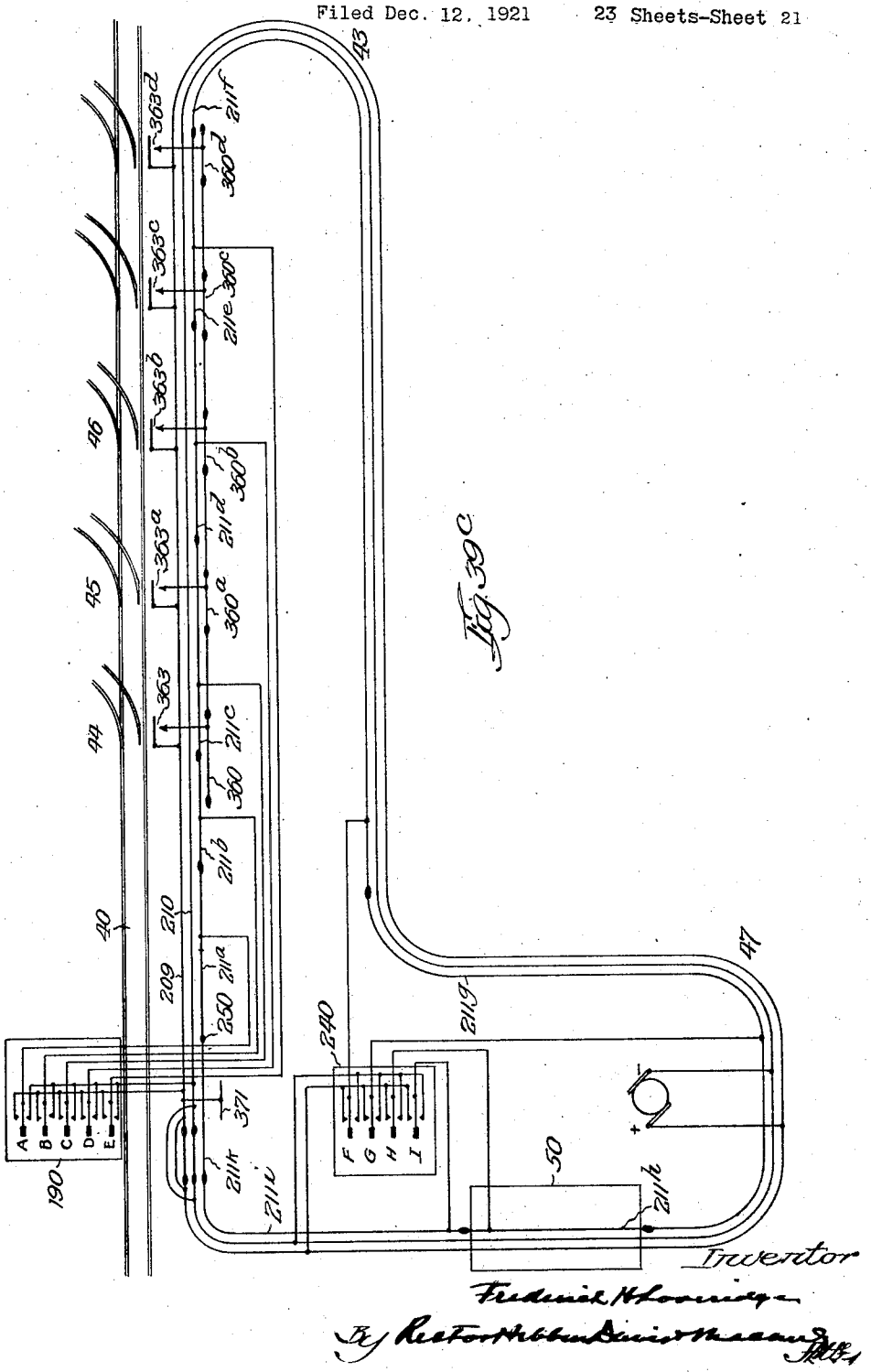


Fig. 39c

Inventor

Frederick H. Loveridge

By Rector Hibben Davis & Macauley

Attys.

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

Filed Dec. 12, 1921 23 Sheets-Sheet 22

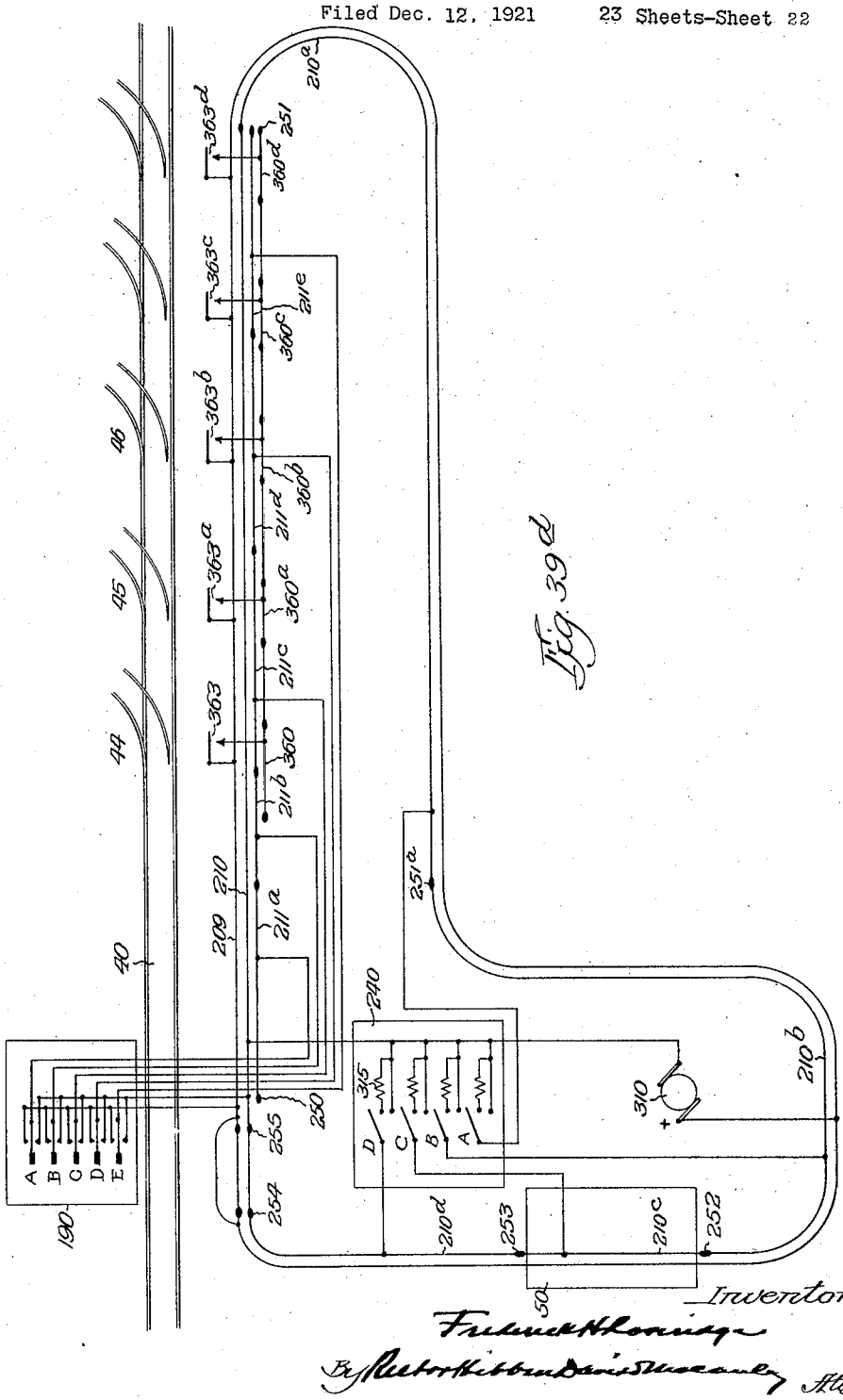


Fig. 39d

Inventor

Frederick H. Loveridge

By Robert Ritter Davis & Mecaskey Attys

Nov. 30, 1926. 1,609,121

F. H. LOVERIDGE

RAILWAY CAR CONTROL

Filed Dec. 12, 1921 23 Sheets-Sheet 23

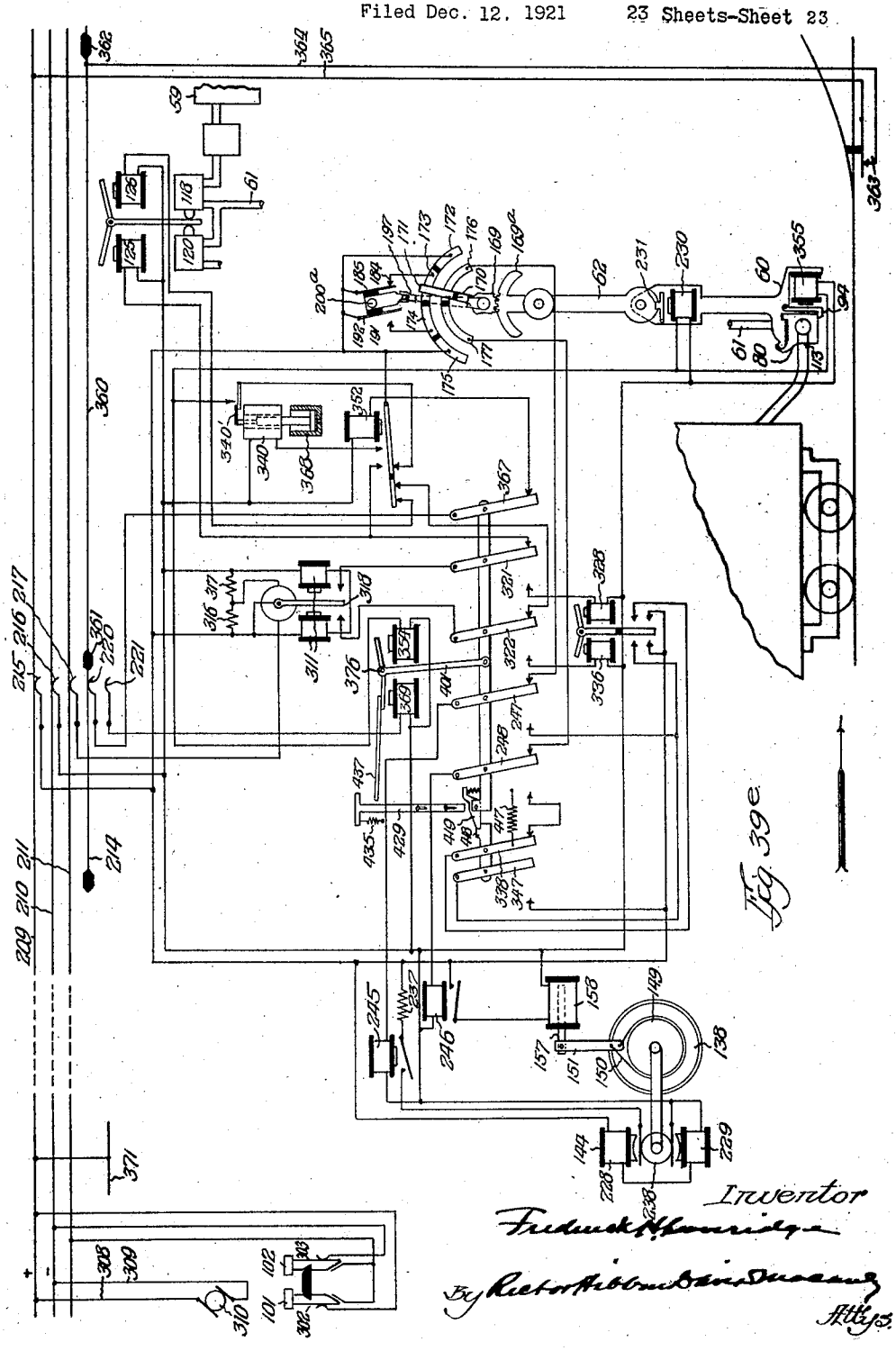


Fig. 39e

Inventor

Frederick H. Loveridge

By Rector, Ribbon, Davis & Duncan

Attys.

Patented Nov. 30, 1926. 1,609,121

UNITED STATES PATENT OFFICE.

FREDERICK H. LOVERIDGE, OF CHICAGO, ILLINOIS.

RAILWAY-CAR CONTROL.

Application filed December 12, 1921. Serial No. 521,845.

My invention more particularly described relates to the control of traffic cars provided with speed regulating devices, motors or brakes, from a control point or control points by means of a pilot mechanism, or pilot as it is hereinafter called, which is temporarily attached to the traffic car to move therewith, and which is provided with means under the control of an operator at the control point for affecting or controlling the speed regulating means of the car. The invention has been designed more particularly for use in connection with car classification yards and will be hereinafter more specifically described in relation thereto, though as will appear from what follows, in its broader aspect it is applicable to a variety of other more or less similar uses.

A car classification yard such as that in connection with which my invention will be described, has for its purpose to receive incoming trains of freight or other traffic cars and redistribute them in trains or on branch tracks in accordance with their further destinations. In its simplest form, and in the example hereinafter considered, such a yard comprises a main track leading over a "hump" or elevation and provided at or near the bottom of the incline from the elevation with a succession of branch tracks connected to the main track by switches controlled by hand or from a switching tower. In operation a train of cars to be classified or grouped upon the branch tracks is pushed over the apex of the hump and as each car or "cut" of cars reaches the downward incline it is uncoupled from the train and permitted to descend the incline by gravity and switched on to the proper branch. It has been necessary heretofore to employ a considerable number of brakemen in such a classification yard, one or more being sent on each car or "cut" of cars to apply the hand brakes thereon so that it may be stopped at the desired point on the branch line to which it has been switched. The employment of a large number of brakemen for this purpose is expensive, and the practice of controlling the cars by hand brakes results in frequent injury and loss of life to the brakemen who ride the cars.

My invention has specifically in view dispensing with the services of these brakemen and controlling the speed of the individual cars or "cuts" of cars from a suitable tower or control station or control points by a relatively small number of operatives stationed outside of the cars or "cuts" of cars. For this purpose I provide a suitable number of pilot cars or mechanisms, one of which is attached to each traffic car or "cut" of cars before it starts upon its descent on the incline of the main line. Each pilot is provided with means for governing the speed controlling means of the traffic car to which it is attached, preferably by means of the brakes thereof, and the means on the pilot for controlling the speed of the associated traffic car is under the complete control of the operator at the control point. In case the control is by means of the brakes of the traffic car, as in the exemplification of the invention hereinafter described, the operator can apply or release the brakes of the traffic car at will by operating the control mechanism on the pilot attached thereto. Thus the pilot, under the control of the operator, takes the place of the brakeman, so applying the brakes as the car descends that it will come to rest at the desired point. A single operator located at a central control tower or station, with the proper number of pilots, can take the place of a large number of brakemen. In case the traffic car is provided with motor mechanism the latter may be under the control of the operator through suitable devices on the pilot, the construction being correspondingly modified from that hereinafter described.

My invention is not dependent upon the employment of gravity to furnish the motive power for the cars being classified, and indeed, as above suggested, it may be used for other purposes than that of car classification, where it is desirable to control the motion of a car of any kind from a station located otherwise than on the car.

In the preferred form of the invention hereinafter described in detail, control of the speed of the traffic car is effected through the air brakes thereof, the air line of the traffic car being connected, by a coupling device, to an air system on the pilot by which air may be supplied to the air brake system on the car or released therefrom.

Obviously, however, the brakes might be operated by other than pneumatic means, though it is desirable that the invention be applicable to traffic cars without modification of the latter, and the specific embodiment of the invention disclosed has this advantage.

In the exemplifications of the invention herein given I have shown and described an electric system for controlling and operating the various instrumentalities on the pilot, and such a system is advantageous because of its flexibility; but it will be understood that in the broader aspect of the invention other than electric means may be employed for this purpose such as pneumatic or mechanical means or such means may be in part electric and in part pneumatic or mechanical.

In the present exemplification of the invention I have also shown and described the pilot as having its own independent motor and brake mechanism automatically so controlled as to synchronize the speed of the pilot with the speed of the traffic car to which it is attached. But it will be understood that such an arrangement of the pilot is not essential to an embodiment of the broader phases of the invention, as the pilot may be mechanically attached to the traffic car in such a way that it will be moved along with the latter during the period while the traffic car is under the control of the controlling mechanism of the pilot,—or until the traffic car has been brought to rest at the desired point, if it should prove desirable to follow this plan of operation. Obviously, where the movement of the traffic car is effected by gravitation, gravitation may also be thus relied upon for producing the movement of the pilot, thus dispensing with independent motor driving mechanism on the pilot. Although the pilot is illustrated and described herein as traveling upon its own rails, it will be understood that, without departing from the spirit of the invention, the pilot may, if desired, be arranged to travel upon the traffic car rails and to be switched therefrom onto a return track at any desired point; or, if desired, may be arranged to be suitably supported upon the traffic car itself and detached therefrom when it has served its purpose in connection with the control of the traffic car.

It will also be understood that the comprehensive car control system herein disclosed comprises various features that may, if desired, be utilized separately to secure certain of the advantages that inhere in the use of the system as a whole. For example, the devices on each pilot for controlling the speed of the associated car may be directly controlled by an operator individual to each pilot and accommodated thereon, instead of indirectly through the medium of circuits or operating connections extending to an operator station at a central controlling point. In such a case the central control feature is not utilized, but the feature of control by operators stationed elsewhere than on the traffic cars is retained, and the attendant advantage of safer operation is secured.

In the drawings Fig. 1 is a plan or layout of a classification yard in simple form to which my invention has been applied; Fig. 1ª a plan of a cross-over from one main distributing track to another; Fig. 2 a vertical section of the arrangement shown in Fig. 1; Fig. 3 an end elevation of a freight car and of a pilot attached thereto, certain parts being shown in vertical transverse section; Fig. 4 a side elevation of the front end of a freight car and a pilot attached thereto; Fig. 5 a side elevation on an enlarged scale of a pilot seen from the side opposite that of Fig. 4; Fig. 6 is a side elevation of the same on a similar scale, viewed from the same side as Fig. 4, parts being shown in vertical section; Fig. 7 a top plan of the pilot, parts being shown in section; Fig. 8 a side elevation of a detail, parts being shown in vertical section; Fig. 9 a transverse vertical section on an enlarged scale on the plane of line 9—9, Fig. 7; Fig. 10 a similar section on the line 10—10 of Fig. 7 looking in the direction of the arrows; Fig. 11 a side elevation partly in section of a detail; Fig. 12 a vertical transverse section on the line 12—12 of Fig. 7; Fig. 13 a side elevation on an enlarged scale, of a detail, parts being shown in section; Fig. 14 a vertical section of said detail on the line 14—14 of Fig. 13; Fig. 15 a vertical section of a detail on an enlarged scale on the line 15—15 of Fig. 14; Fig. 16 a vertical section on the line 16—16 of Fig. 17 looking in the direction of the arrows, showing the construction of the coupler; Fig. 17 a plan of the same, parts being shown in horizontal section; Fig. 18 a vertical section on the line 18—18 of Fig. 17, looking in the direction of the arrows; Fig. 19 a vertical section on a broken line 19—19 of Fig. 16 looking in the direction of the arrows; Fig. 20 a side elevation in detail of the pilot coupling; Fig. 21 an elevation of the same, with the traffic car coupler applied thereto in the position for coupling; Fig. 22 an elevation similar to Fig. 21 but showing the parts in coupled position; Figs. 23, 23ª and 24 perspective views of details; Fig. 25 a side elevation showing the pilot coupler and the traffic car coupler just after being kicked-off, the pilot car coupler being partly in section; Fig. 26 a side elevation of a detail partly broken away; Fig. 27 a horizontal section of the same on the line 27—27 of Fig. 26; Fig. 28 a vertical section of the same on the line 28—28 of Fig. 26 looking in the direction of the arrows; Fig. 29 a perspective of an element of the same detail; Figs. 30 and 31 side elevations of the same detail showing the parts in different positions; Fig. 32 a fragmentary view of a portion of the device shown in Figs. 30, 31 in similar

elevation but with the parts in a different position; Fig. 33 a vertical section on an enlarged scale of a portion of the same apparatus viewed from the side opposite to that of Fig. 32; Fig. 34 an end elevation of said apparatus looking in the direction of the arrows in Fig. 31; Fig. 35 a perspective of the operator's key block; Fig. 36 a transverse vertical section of the same on an enlarged scale; Fig. 37 a side elevation of the synchronizing arm and switch. Fig. 38 a detail of the synchronizing arm on the line 38—38 of Fig. 37; Fig. 39 a schematic diagram of the circuits and electro-magnetic mechanism of the preferred form of the invention with certain of the mechanically associated parts; Fig. 39[a] a schematic circuit diagram of a simplified form of the system; Fig. 39[b] the general plan of the energizing and controlling conductors with which the moving pilots cooperate in the preferred form of the invention; Fig. 39[c] a modified arrangement of the controlling conductors; Fig. 39[d] another modification of the system of energizing and controlling conductors; and Fig. 39[e] a schematic diagram of the circuits in a somewhat modified form. Each part is identified by the same reference character wherever it occurs in the several views.

The layout of a classification yard in a simplified form to which my invention is applied, may be understood by reference to Figs. 1 and 2 of the drawings. A main track 40 extends down a slight incline, as shown in Fig. 2, a number of branches 41 being connected thereto by switches controlled by hand or from a switching tower. A train of cars to be classified for further destination or disposition is pushed over the top of the incline, the cars being released one at a time or in "cuts" of several cars, and switched to the proper branch track as heretofore described. In applying the present form of my invention to the classification yard the main track is parallelled by a track 42 on which the pilot cars run. Preferably the track for the pilot cars is in the form of a loop so that each pilot car, after being released from a traffic car may be returned to starting position without reversal.

In the layout shown in Fig. 1, track 42 includes a bend 43 beyond the switching points 44, 45, 46 for the traffic cars and a loop 47 at the top of the hump. A number of branch tracks 48 extend through the headhouse 49 for storage, inspection or repair of the pilot cars, and from which the pilot cars may be sent to the service house 50. Ordinarily the pilot cars return directly to the service house 50 over a through track of the upper loop 47, and are sent to the headhouse 49 only as occasion requires. In the drawing 51 designates each of the pilot cars of which I have shown a number in storage, one in the service house, one on its way to be coupled to a traffic car 52, two coupled to traffic cars 52 on the descent of the main track and one just released from a traffic car which has entered a branch track, the last mentioned pilot car having started around the lower bend on its return to the headhouse. The arrows in Fig. 1 show the direction of travel of the cars.

Preferably, though not necessarily, the pilot cars are attached to the front ends of the traffic cars and they are so shown in the exemplification of the invention. It is also deemed advisable, though not essential, to mount the pilot cars on a single rail above the rails for the traffic cars. In Fig. 3 I have shown the single rail 53 mounted on arms 54 extending from posts 55 arranged at suitable intervals along the track. Brackets 56 on arms 54 support a housing or weather shield 57, which covers the pilot car track at all points and protects the cars thereon. A steadying rail 58 is also carried by the brackets to maintain the cars in position (see Figs. 3 and 9).

In the example of the invention chosen the framework of the pilot car comprises side rails 127, 128, an upper central tubular beam 129 and transverse yokes 130, 131, 132, 133, the latter connecting the longitudinal members, 127, 128 and 129 (see Figs. 6, 7 and 9). The intermediate yokes 131, 132 are recessed at 134 and bored at 135 to form bearings for the shafts 136, 137 of the respective traction wheels 138, 139. Yokes 131, 132 are further provided at their respective upper ends with pairs of arbors 140, 141, on which are journaled antifriction rollers 142, 143 which engage the steadying rail 58, above mentioned, to maintain the car in upright position.

The car is preferably driven by an electric motor 144 of suitable design, which is connected to and drives both traction wheels. The motor shaft 145 is provided with a sprocket 146 connected by chains 147, 148 respectively to said traction wheels. The shaft of wheel 138 has a friction sheave 149 keyed thereon which receives a brake band 150 (see Figs. 5, 7 and 12). The ends of the band are secured to a lever 151 keyed on shaft 152, the latter being mounted in a bearing 153, rising from plate 154 bolted to the side rails of the pilot. (See Figs. 5, 6, 7 and 10.)

An arm 155 on said shaft extends between the antifriction rolls 156 on the movable core 157 of the solenoid 158 (see Fig. 6), so that by energizing the solenoid (by connections to be described later) shaft 152 is turned thus applying the brake band to the friction sheave. A coiled spring 159 on shaft 152 normally holds the brake in released position. Obviously, by properly operating the motor and brake of the pilot the speed of the latter may be controlled to a nicety.

In the preferred embodiment of the invention specifically disclosed herein, the means

for controlling the air brakes of the traffic car comprise a tank containing a supply of compressed air mounted on the pilot and a flexible connection and coupling member for coupling the air supply on the pilot to the ordinary air coupling of the traffic car, valves being provided on the pilot for admitting air from the supply thereon to the air brake system of the traffic car and for releasing air from the latter. By certain operating connections to be described later these valves are under the control of the operator during the time that the pilot is attached to the traffic car, so that he may operate the valves and so regulate the speed of the traffic car during its descent of the incline that it will enter the proper switch at the required speed to bring it to a stand-still at the desired point. The only connection between the pilot and the traffic car is the air coupling to which reference has just been made and therefore it is necessary that the pilot, during the joint operation with the traffic car, move substantially at the same speed therewith. Provision must also be made for returning the pilot either to the point where it may be again coupled with a traffic car or to some storage point where it will be convenient and available for movement to the coupling point. In the preferred embodiment of the invention, I have provided automatic means for controlling the motor and brake of the pilot in accordance with the relative position of the pilot and traffic car during the time the cars are coupled together so that the pilot maintains substantially the same position relative to the traffic car. I disclose hereinafter alternative arrangements or systems for returning the pilot to the initial position or to storage from which it may be sent to initial position, after the pilot is detached from the traffic car. In the preferred arrangement, the kick-off or release of the pilot from the traffic car is accompanied or followed immediately and automatically by a continuous energization of the motor for a certain space, after which the operator's key, theretofore employed for controlling the valves in the air brake system, is automatically connected with the motor and brake controlling devices, so that thereafter the operator may control the movement of the pilot car. In the alternative construction, after the release of the pilot from the traffic car by the kick-off operation, the operator's key has no further control either over the valves of the air brake system or over the pilot car motor and brake controlling devices, the kick-off being following by a continuous energization of the motor which is interrupted only when the pilot has travelled on around the return circuit to the desired point. Where, as in the above mentioned preferred and alternative constructions, the pilot car is provided with a motor, it is convenient to use this motor for effecting the return of the pilot to the starting point. But it will be understood that if desired the return of the pilot cars may be brought about by mechanical or other convenient means. Such means, extraneous to the pilot cars themselves, will be employed in embodiments of the invention where the pilot cars are not provided with independent motors and are moved by gravity or by mechanical connection with the associated traffic cars.

In the preferred embodiment of the invention direct current is used for operating the various electrical devices on the pilot car. For the purpose of supplying power and controlling the electric devices wires are strung along parallel to the track of the pilot and within the weather shield 57, see Figs. 5 and 9. Wires 209 and 210 are the positive and negative power wires, respectively. Wire 214, to which reference will be again made, is the kick-off wire which conveys current to the electro-magnetic device hereinafter described by which the air pipes of the pilot car and traffic car are uncoupled at the proper time. Three control wires are illustrated at 211, 212 and 213 in said figures. In the preferred form of the invention the number of control wires depends upon the number of pilots which will be in action at the same time, there being a separate control wire 211, 212 or 213 for each car that is in action. Such an organization of the system is schematically illustrated in Fig. 39^b, the circuit arrangement of which will be particularly described hereinafter. In the alternative arrangements illustrated in Figs. 39^c and 39^d, however, there is but a single control wire 211 which is broken up into a plurality of sections (211^a to 211^i inclusive in the case of Fig. 39^c and 211^a to 211^e in the case of Fig. 39^d) electrically disconnected from each other, this single sectional control wire in each case serving as a common controlling conductor for all of the pilot cars that are in operation. These arrangements will be more fully described hereinafter. In the diagrams Figs. 39 and 39^a, for the sake of simplicity, I have shown a single control wire 211. It will be understood that where the plan of operation is in accordance with the plural control wire scheme of Fig. 39^b, there are additional control wires 212 and 213 and that each pilot has a brush 217 engaging a different one of these control wires; whereas if the plan of operation is in accordance with the sectional control wire scheme of Fig. 39^c, there is a single control wire 211 that is engaged by the brushes 217 of all of the pilots.

Each pilot is provided with shoes 215, 216 running on the power wires, with shoe 217 running on the control wire, as indicated above, and with shoe 220 running upon the

kick-off wire. Each pilot, in the form of the invention illustrated in Fig. 39, also has a shoe 221 that is adapted at one point in the travel of the pilot to engage for a short distance a conducting plate or wire 371 for a purpose that will hereinafter appear. These shoes are insulatedly mounted on a terminal block or plate 219 (Fig. 9), and are connected or wired in any approved manner to the various devices to which they are designed to feed current. Referring to Figs. 39 and 39[a], the brush 215 runs upon the positive power wire 209, the brush 216 runs upon the negative power wire 210, while the brushes 217 and 220 run upon the control wire 211 and the kick-off wire 214, respectively. The positive and negative power wires are energized by any suitable source of current, as by the generator 310 over the conductors 308 and 309. The field windings 228 and 229 of the motor 144 are energized by direct connection with the positive and negative power brushes 215 and 216. The armature circuit of the motor is under the control of the armature and contact of the relay 245, the operation of which relay connects the motor armature with the positive and negative power brushes by way of a current regulating or limiting resistance 237. The armature circuit may be traced as follows: from brush 215 through wire 215[a], resistance 237, the armature of magnet 245, wire 215[b], armature 238, wire 216[a], wire 216[b], wire 216[c] to brush 216. The solenoid 158 that acts when energized to tighten the brake band 150 upon the brake drum 149, is under the control of the brake relay 246. When this relay is energized, it connects the winding of the solenoid directly with the positive and negative power brushes or shoes.

As heretofore stated the operation of the motor and brake during the time when the pilot is coupled to the traffic car is controlled automatically by the relative position of the traffic car and pilot; and after the pilot is kicked off, in the preferred arrangement shown in Fig. 39, the control of the motor and solenoid is switched to the key in the hand of the operator. For this purpose the motor controlling relay 245 and the brake controlling relay 246 are arranged to be controlled during the first period by a device which I have hereinafter called a synchronizing switch indicated at S in the diagram, and during the second period by the operator's keys 101 and 102. Switches 247, 248, operated together as hereinafter described, control the circuits of the motor relay and brake relay, respectively, and determine whether said circuits are under control of the synchronizing switch or of the operator's key. In the position occupied by these switch arms in Fig. 39 the relays are under control of the synchronizing switch.

The synchronizing switch is governed by the relative position of the pilot and traffic car during the period when they are coupled together. The coupling member of the pilot is mounted upon an arm 62 secured to a shaft 63 which is journaled in a bearing 160 on the pilot so that the arm may swing longitudinally of the track. The coupling member of the pilot being in mechanical connection with the coupling member of the traffic car, it will be obvious that when the pilot moves faster than the traffic car the arm 62 is swung backward by the latter by reason of its connection to the coupling, but when the pilot lags the arm is swung forwardly by the traffic car. I take advantage of the movement of this arm to operate the synchronizing switch. The latter is best shown in Figs. 13, 14 and 15. It comprises two arcuate series of contacts with an electric bridge 171 carried thereover by a radius arm 170 to make connection between the respective inner and outer contacts. The radius arm is keyed or pinned to a shaft 168 which is journaled in an upright plate 166 mounted on the framework of the pilot and which plate forms a support for said contacts which are imbedded in an insulating plate 178 mounted on said upright plate. The shaft 168 carrying the radius arm 170 is keyed to pinion 169 which meshes with an arcuate rack 169[a] carried by the shaft 63 to which the depending arm 62 is secured. As the synchronizing arm 62, which supports the pilot coupling, is swung backward and forward by the relative movement of the traffic car and pilot, radius arm 170 carries the bridge 171 back and forth over the arcuate contacts. It will be observed that there are but two contacts in the inner arc, contact 176 being connected to one end of the winding of the motor relay 245 by way of switch arm 247 and its normal contact point, and contact 177 being connected to one end of the winding of the brake relay 246 by way of switch arm 248 and its normal contact point (Fig. 39). The other ends of the windings of the motor and brake relays are connected to the negative power brush or shoe 216. Thus when the bridge 171 is over contact 176, which occurs when the pilot lags with respect to the traffic car, bridge 171 is in position to close the circuit of the motor relay either through contact 172 or contact 173; and when bridge 171 is over contact 177, which occurs only when the pilot car is ahead of its normal position with respect to the traffic car, the brake relay may be energized through contact 174 or contact 175 according to the particular position of the bridge.

Contacts 172, 173, 174, 175 are all connected to the positive terminal or contact shoe 215. Contacts 172, 175 have a direct connection with said terminal. Thus whenever the pilot is so far behind the traffic car as to throw bridge 171 over contact 172 the

motor is energized until the pilot has caught up sufficiently to take the bridge off contact 172 and on to contact 173. Similarly whenever the pilot is so far ahead of the normal position as to carry the bridge over contact 175 the brake is applied until the pilot has lost sufficiently, relatively to the traffic car, to carry the bridge 171 back off from contact 175 to contact 174.

When the pilot lags sufficiently only to bring bridge 171 over contact 173, it is desirable to have the motor energized only in case the polit continues to lose; and on the other hand, when the pilot is ahead only sufficiently to carry the bridge over contact 174 it is desirable to have the brake applied only in the event that the pilot continues to gain. The connections of the contacts 173, 174 to the positive terminal are therefore interrupted by a switch which closes the circuit of contact 173 only when the pilot is increasing the amount of its lag and closes the circuit of contact 174 only when the pilot is increasing the amount of its gain. This switch is shown diagrammatically in Fig. 39 and as actually constructed in Figs. 13 to 15 inclusive. The switch comprises (as seen in Fig. 13) a stationary member 200 on which are mounted stationary contacts 191, 184, contact 191 being electrically connected with contact 174 and contact 184 being connected with contact 173. The switch also comprises a pivoted member 200^a journaled on a post 193 about which it swings and provided with contacts 192, 185 coacting, respectively, with contacts 191 and 184. Contacts 192, 185 are electrically connected with the positive contact brush or shoe 215. The movable member 200^a of the switch is provided with an arm 194 carrying the pin 195 and the latter is engaged by the fork 196 of an arm 197 so that the movement of the latter arm swings the movable member of the switch. Arm 197 is frictionally mounted on the shaft 168 (to which reference has been made) and its movement is limited by stops 198, 199 which, however, only check the movement of the arm after it has swung the movable element of the switch to close the contact on the same side thereof. It follows, therefore, that when the pilot is back of its normal position and falling behind relatively to the traffic car, the bridging of the contacts 173 and 176 will be effective to energize the motor only while the contacts 184 and 185 are in engagement. The motor will continue to be energized as long as the speed of the pilot is either less than or equal to the speed of the traffic car. As soon as the operation of the motor results in a relative increase in the speed of the pilot over that of the traffic car, the contacts 184, 185 will open and deenergize the motor, notwithstanding the fact that the switch arm is still bridging contacts 173, 176. Thus it follows that though the pilot may be behind its normal position sufficiently to bridge contacts 173 and 176, the motor is not energized unless the pilot is continuing to lose and therefore the contacts 184, 185 are in engagement. Similarly, though the pilot may be ahead of the traffic car sufficiently to cause the bridging arm 171 to connect contacts 174 and 177, the solenoid 158 is not energized to apply the brake unless the pilot continues to gain so as to close the contacts 191, 192. Obviously, the contacts 191, 192 are not effective to apply the brake when the pilot is behind the traffic car, nor are the contacts 184, 185 able to bring about the energization of the motor when the pilot is ahead of the traffic car.

The specific means for providing frictional engagement between the arm 197 and shaft 168 is not important. As shown in Figs. 13, 14 and 15, the hub 201 of arm 170 is somewhat elongated and pinned to said shaft by a pin 203. The hub of the arm 197 is divided, one of the members 202 being integral with the arm and the other 204, connected thereto by bolts 208 extending through flanges 205 on both members. Springs 206 interposed between the heads of the bolts and the flanges of the integral member serve to create sufficient pressure between the members against the hub 201 to provide the required amount of friction.

By the means described above I am able to nicely govern the speed of the pilot automatically so that it substantially keeps pace with the traffic car so long as it is coupled thereto, neither gaining nor losing a substantial amount.

Before describing the manner in which the motor and brake on the pilot are controlled after the air connection has been kicked off and the pilot released from the traffic car which it has just accompanied down the incline, it will be convenient to describe the air pressure system for governing the air brakes of the traffic car from the pilot.

In its preferred form my invention may be applied to ordinary traffic cars with air brakes without altering the latter. Each pilot car carries a tank 59 for compressed air to operate the air brakes of the traffic cars, a coupling 60 (to be described in detail later) and a flexible connection 61 between the coupling and the air tank.

The coupling for obvious reasons must be capable of lateral, vertical and angular adjustment. With this in view it is carried by the swinging arm 62, mounted, as described above, on a transverse shaft 63 (Figs. 3, 4 and 37) journaled on the pilot car in a bearing 160 formed on base plate 161. The arm comprises three members articulated with respect to each other, to-wit, casting 63^a, secured to shaft 63, and upper and lower sections 66^a, 67. Lateral movement of the sec-

tions is provided by pivoting the upper section at its upper end, at 64, between check pieces 65 formed integral with the boss 66 of casting 63a by which the arm as a whole is secured to shaft 63. The arm is capable of folding in a vertical plane, the casting 63a, as has been described, being carried on the transverse shaft 63 and provided with a coiled spring 307 so tensed as to swing the arm forward and upward when it is free to move, and the sections 66a, 67 being hinged on a transverse short shaft 68 and provided with spring means for folding them together. The shaft 68 extends transversely across between the arms of the forked upper portion of the section 67, being fixed to the arms to turn therewith. The shaft 68 is journaled in the arms of the lower fork of section 66a, and passes through a drum 312 rigidly secured between the arms of the fork. A spiral spring 314 is connected between the shaft and the drum, and is so tensed as to produce a force normally tending to fold the sections 66a and 67 together. When the arm 62 is extended the sections 66a and 67 are locked in their extended position by means of a latch 231 of magnetic material that engages a shoulder 232 formed on the outer surface of the drum 312. Associated with the latch is an electromagnet 230 that acts when energized to withdraw the latch from the shoulder 232 and permit the sections 66a and 67 to fold together under the influence of the spring 314. This occurs when the coupler body carried by the arm is kicked off or released from the traffic car; and at the same time the coiled spring 307 is left free to swing the arm 62 upwardly, as a result of which the arm collapses and assumes the position shown in broken lines in Figs. 4 and 37. The gear teeth of the arcuate rack 169a and pinion 169 are mutilated so that the rotation of the rack in the upward movement of the arm 62 does not swing arm 170 of the synchronizing switch beyond the desired limit.

To provide for yielding vertical adjustment of the coupling member on the arm the lower end of section 67 is reduced at 78 to receive a sleeve 74 which is reciprocable thereon and carries coupling 60 at the end of arm 75. A spring 76 is interposed between a head 77 on the end of the reduced section and said sleeve yieldingly supports the latter and the coupling. Thus the coupling member may be adjusted vertically and laterally to accommodate it to the coupling of the air pipe of the traffic car.

As heretofore indicated the coupling connects the air system of the pilot car to the air system of the traffic car which it controls, the coupling operation being effected by hand before the car starts down the grade; and the pilot car is automatically disconnected from the traffic car at a desired point just before the latter enters the branch track to which it is directed. In the exemplification specifically disclosed the uncoupling is effected electromagnetically and at the same time provision is made against the escape of air from the brake system of the traffic car by means of a valve which is held open when the cars are coupled and is automatically closed when they are uncoupled, as will presently appear.

The construction of the pilot coupling is best seen in Figs. 16 to 25 inclusive. It comprises when complete a main coupler body and a detachable valve carrying coupler head 80 (shown in perspective in Fig. 23). Before the pilot coupling is connected to the coupling of a traffic car the coupler head is attached to the main coupler body. When the pilot car is automatically detached from the traffic car the coupler head remains temporarily with the coupling on the latter, the valve (which is open when the cars are coupled) closing and preventing escape of air from the air line of the traffic car.

The main coupler body is in the nature of a casting formed with an air passage 81 (Fig. 16) communicating by duct 82 with a nipple to which the flexible air pipe 61, leading from the air tank on the pilot car, is attached. Passage 81 terminates in a bushed side opening 85 by which communication is established with the coupler head. The main coupler body is also formed with a pintle 86 which is received in an open hook bearing 87 (Figs. 16 and 23) on the coupler head so that the latter may swing through an arc in being attached to and detached from the coupler body. The coupler head is formed with a passage 88, bushed at 89 to make a close joint with the passage of the main coupler body and said passage communicates with the passage 89a of a valved plug 90 having a seat 91 and a check valve 92 yieldingly held thereto by spring 93. When the valve is open communication is established with chamber 106a which has side port 106 by which communication is established with the traffic car coupling member.

When the coupler head is swung upwardly about pintle 86 to the position shown in Fig. 16, a latch 94 pivoted to the main coupler body engages under shoulder 94a of the coupler head to hold it in operative position. The latch is pivoted at 94b and yieldingly held in engagement with the shoulder by a spring 95 in barrel 96 operating on plunger 97 loosely fitted in the barrel and pivoted to the free end of the latch. The latter is of magnetic material and constitutes the armature of an electromagnet 98 secured to the coupler body. When said magnet is energized through connections shortly to be described, it retracts the latch permitting the

coupler head to swing down about pintle 86. The latch has the further function of holding the valve open when the parts are in the assembled position shown in Fig. 16, bearing upon the protruding valve stem 99 for this purpose. When the latch is retracted, in automatically or otherwise uncoupling the coupler head from the coupler body, the valve seats. The coupler head is formed with a cross rib 100 (Figs. 16, 22, 23) which, when the coupler head and main coupler body are assembled, extends into a groove 101 in the latter (Fig. 16), preventing the separation of these parts by a direct pull. When the head swings downward on its pintle on the withdrawal of the latch, however, the rib leaves the groove permitting the open hook to leave the pintle 86, thus separating the coupler head from the main coupler body.

When the pilot coupling is attached to the coupling 113 of a traffic car (such as is shown in its usual form in Fig. 24) the fin 102 on the coupler head interlocks with the bracket 103 of the traffic car coupling and the fin 104 of the latter engages the bracket 105 of the coupler head in a manner familiar to those acquainted with air pipe couplings. The port 106 of the coupler head is then in registry with the port 107 of the traffic car coupling and, the valve 92 of the coupler head and the angle cock of the traffic car being open, communication is established between the air brake system of the traffic car and the air system of the pilot car.

In order that the pilot car coupling may be given the necessary angular movement in interlocking it with the coupling on the traffic car, the former is hinged at 183 to an arm 108 and the latter keyed or pinned to a short shaft 109 journaled in the lower end of arm 75, heretofore described, which has a longitudinal movement on the lower end of the supporting arm of the pilot car (Figs. 16, 17, 18). Shaft 109 is likewise journaled in a drum 110 secured to arm 75 and a coiled spring 111 within the drum is connected thereto and to the shaft and so tensed as to exert an upward pressure on arm 108. The upward movement of the latter is limited by pin 112 thereon meeting the edge of arm 75. Obviously the coupling members on the pilot and traffic cars respectively may be coupled by swinging the former downward about shaft 109 until the fin on each clears the bracket on the other (see Fig. 21), bringing the orifices 106 and 107 into contact and then permitting the pilot car member to swing up under the influence of spring 111, until the fin on each member is wedged behind the bracket on the other as usual in such couplings. To facilitate coupling the head may be provided with a nipple 106^{x} (see Fig. 23^{a}).

The operation of automatically uncoupling, (which preferably takes place just before the traffic car is switched at the bottom of the incline as previously described) is made clear in Fig. 25. The latch is there shown as retracted by the magnet and the traffic car coupling, with the coupler head attached thereto, as dropping away from the main coupler body of the pilot car coupling. The latter has swung upward under the impulse of the coiled spring until stopped by pin 112.

As heretofore stated the air system of the pilot car is provided with valves under the control of the operator at the control station which govern the flow of air from the tank to the air brake system of the traffic car to which the pilot car is attached and the escape of air therefrom. This is best shown in Figs. 4, 6, 7 and 8. As seen in Fig. 4 the flexible hose 61 leading from the coupling is attached to a rigid pipe 114 connected by vertical pipe 115 to horizontal pipe 116 which is connected to air tank 59 at 117 (Fig. 6). The passage of air from the tank to the coupling is controlled by reciprocating valve 118 which is normally closed by spring 119 (see Fig. 8). The escape of air from the brake system of the traffic car is controlled by a valve 120 intermediate pipe 115 and an outlet port 121. Valve 120 is normally seated by spring 122. Valves 120 and 118 are operated by a walking beam lever 123, pivoted at 124 and acted on by magnets 125, 126 of which it constitutes the armature. In the neutral position of the beam neither valve is open. Energization of magnet 125 opens valve 118 without affecting valve 120 and similarly energization of magnet 126 opens valve 120 without affecting valve 118. Thus by energizing the magnets through connections to be later described the air brakes of the traffic car may be applied or released to control the speed of the car. An expansion valve 280 reduces the pressure of the air escaping from the tank to operating pressure and an air expansion chamber 301 cushions the operation of the air.

The operator's control of the air valves, and afterwards of the motor and brake devices of the pilot, is exercised through the medium of any suitable key or switch. One form of operator's key that may be used is shown diagrammatically in Fig. 39 and in structural detail in Figs. 35 and 36. Referring to the last mentioned figures, two keys, 101 and 102, of the plunger type are illustrated mounted upon a suitable base of insulating material upon which three binding posts 98, 99 and 100 are also mounted. Each of the keys has a metallic plunger 102^{a}, the lower end of which is insulated and in rubbing engagement with a metallic brush 303^{a} and is adapted when the button at the top of the plunger is pressed to engage a contact piece 303^{b}. The contact pieces 303^{b} of the

two keys are connected together and wired to the binding post 100. The brush 303[a] of key 101 is connected with the binding post 98 and the corresponding brush of key 102 is connected with binding post 99. The plungers of the two keys have facing wedge-shaped notches 102[b] adapted to co-operate with the correspondingly bevelled ends of an interlocking slide bar 103. When either key is depressed, the notch in its plunger throws the opposite bevelled end of the slide bar 103 into the notch of the plunger of the other key. Thus the depressing of either key prevents for the time being the depression of the other. Binding post 98 is connected by way of conductor 304 with the positive power wire 209, binding post 99 is connected by way of conductor 305 with the negative power wire 210, and binding post 100 is connected by way of conductor 306 with the control wire 211 (Fig. 39). Thus the pressing of key 101 connects the positive power wire and the pressing of key 102 connects the negative power wire with the control wire. The interlocking arrangement of the two keys is to prevent the short circuiting of the positive and negative wires that might occur if it were possible to depress both keys simultaneously.

The operator's keys 101 and 102 exercise their control over the air controlling devices and the motor and brake controlling devices of the pilot car through the medium of a polarized relay located upon the pilot. This polarized relay, which is shown at 325 on Fig. 6, may be of a usual and well-known form and is illustrated diagrammatically in Fig. 39. It comprises permanent magnet coils 311 that are included serially in a circuit that extends between the positive and negative terminals or brushes 215, 216. The armature 318 of the polarized relay is normally yieldingly held in a neutral position mid-way between the permanent magnet poles. The armature 318 is magnetically connected with a magnetically neutral part of the permanent magnet circuit by way of the core of an electromagnet 313. One end of the winding of the electromagnet 313 has a mid-point connection with two resistance coils 316, 317 that are bridged serially across the positive and negative power conductors of the pilot, while the other end of the winding of magnet 313 is connected with the brush 217 that engages the control wire 211. The magnetic effects of the permanent magnet and armature windings are so related that when the operator's key 101 is pressed to apply positive potential to the control conductor 211, the resulting flow of current through the winding of magnet 313 causes the armature of the polarized relay to swing toward the left and engage its left hand contact point; whereas when the operator presses key 102, the polarized relay armature swings to the right and engages its right hand contact. As the armature is electrically connected with the positive power conductor of the pilot, the operator is thus enabled to connect the positive power conductor of the pilot to either arm 322 or arm 321 of the throw-over switch, and through these arms either to one or the other of the air controlling electromagnets or to one or the other of the brake and motor controlling electromagnets to effect their operation, depending upon the position of the throw-over switch, as will hereinafter be described.

The preferred construction of the throw-over switch referred to above is shown in Figs. 26 to 34, inclusive. The function of the throw-over switch is to effect such a rearrangement of the circuit connections when the switch arms are swung to the left (Fig. 39), that the synchronizing switch is deprived of its normal control over the motor and brake mechanism of the pilot car, and at the same time the operator's keys are given control of the pilot motor and brake mechanism and are deprived of the control that they previously had of the air controlling mechanism of the pilot car. A portion of the throw-over switch also operates to suspend for a limited period of time the operator's control over the pilot car motor and brake mechanism and automatically energize the pilot car motor during this limited interval to cause the pilot speedily to draw away from the traffic car as soon as it is released therefrom. The movements of the throw-over switch are effected by means of two electromagnets 369 and 354, the magnet 369 being energized at the instant the kick-off operation takes place and the magnet 354 being energized when the pilot car has been returned to its starting position and just before it is coupled to the traffic car, the movement of which it is to control. The magnets 369 and 354, in the physical movements illustrated in Figs. 26 to 34, inclusive, are arranged parallel to each other on a support and have their poles 374, 375 arranged to co-operate with a common armature 376. The latter is composed of arms 377, 378 arranged at a slight angle to each other, and is pivoted at 379 (see Fig. 26). When the throw-over magnet 354 is energized the armature is swung to the position shown in Fig. 31 and when the magnet 369, which for convenience I shall refer to as the restoring magnet, is energized, the armature is swung to the position shown in Fig. 30. The swinging of the armature swings a contact carrier 380 which carries four contact blades 321, 322, 247, 248, which are the physical embodiment of the switch arms diagrammatically shown and similarly identified in Fig. 39. Said switch blades co-operate with two sets of contacts accordingly as the carrier is in the position shown in Fig. 30 or in that shown

in Fig. 31. The position shown in Fig. 30, in which the armature is in the position to which it is attracted by the restoring magnet, corresponds to the switch arm position shown in the diagrammatic view Fig. 39 with the switch arms engaging their right-hand contacts. When the parts occupy the position illustrated in Fig. 31, as a result of the operation of the throw-over magnet, the switch arms diagrammatically illustrated in Fig. 39 are in engagement with their left-hand contacts. In Fig. 28 the switch blades 321, 322, 247, 248 are shown in engagement with the contacts 385, 325, 386, 387 corresponding respectively to the right-hand contacts of these blades or switch arms in Fig. 39. Contacts 346 and 387 being the outside contacts of the two series are shown in Figs. 30 and 31, and it will be understood that the remaining contacts of each series with which the switch arms are in engagement in their alternative positions are arranged in line behind said respective outside contacts. The switch blades 248, 247, 322, 321 are insulated from the body of the carrier and the shanks 388 thereof are connected by spring conducting wires 389 to binding posts 390 mounted on insulating plates 391 carried on the stationary structure of the device. The binding posts for the restoring magnet 369 are shown at 392, 393 respectively and those for the kick-off magnet at 394 and 395.

The switch blade carrier 350 is pivoted on a post 396 mounted in supporting plate 397, the latter being secured to the frame-work of the device by screws 398. The swing of the knife carrier 350 is limited by its contact with stops 412 and 413. A finger 399 extends rearwardly from the carrier through an arcuate slot 400 in the supporting plate. The armature carries a depending arm 401 to the opposite edges of which are secured leaf springs 402, the ends of which project at 403 beyond a spacing portion 404 of the arm, a space 405 being left between the ends of said springs. The above mentioned finger 399 on the switch blade carrier projects into said space and it is through the medium of this finger and the leaf springs 402 that the armature operates the carrier and its switch blades.

To prevent the possibility of the switch blades being left in an intermediate position, provision is made for locking the carrier in its opposite positions; and it follows that when the arm 401 is swung to the opposite position to that occupied by the knife carrier one of the leaf springs 402 is put under tension by the finger 399, as seen in dotted lines in Fig. 26. The locking of the carrier is effected by means of a pair of latches 406, 407 that are pivoted on screw 408 and are normally forced by springs 409 into the path of the finger 399 as it swings from one position to the other. In the movement of the knife carrier to the right (as seen in Fig. 26) the finger 399 wipes past the latch 406 which, when the finger has passed the end thereof, springs upward into the position shown and holds the finger, and therefore the knife carrier, in the position at the right. In like manner the latch 407 is depressed by the pin 399 as the latter moves to the left and then springs into engagement with the finger to hold the knife carrier at the left.

The arm 401 is provided near its end with a pin 410 which projects forwardly through a slot 411 in the supporting plate and is carried by the arm in an arcuate path in which it engages the tails of the latches 406, 407, respectively as it approaches either end of its movement. In Figs. 26 and 30 it will be observed that the switch blade carrier is in the position in which the blades are in engagement with the right hand contacts following the energization of the magnet 369 by which the blades 321, 322, 247 and 248 are restored to normal. In Fig. 26, however, the armature has been attracted by the kick-off magnet 354, but has not reached its ultimate position under the pull of the magnet. It will be seen that the latch 406 is still in engagement with the finger 399 and holds the carrier to the right. The movement of the arm 401 to the left, however, has flexed the right hand spring 402 and put a tension thereon tending to throw the finger 399 and the carrier to the left. When the arm 401 completes its movement to the left it engages the tail of and trips the latch 406. Thereupon the carrier and finger 399, under the influence of the flexed spring, are immediately swung over to the left hand position where the finger 399 is caught and held by latch 407. In this manner the switch blades are moved to and held in the position shown in Fig. 31.

It will be understood that the movement of the arm pin 410 to the right operates the switch blade carrier in a similar manner, first flexing and tensioning the left hand spring 402 until the carrier is released by the latch 407, whereupon it is moved to and held in the position shown in Fig. 30. Thus the movement of the armature is followed by a quick and positive movement of the knife carrier and knives to the limit of their throw in the same direction.

Reference has heretofore been made to a portion of the throw-over switch the function of which is to suspend the operator's control over the pilot for a brief space of time immediately following the kick-off or release operation, and to cause the pilot car to shoot ahead during this interval of time in order to clear the traffic car. The circuit controlling elements of this auxiliary switch and the general nature of their mechanical

operative relation with the other portions of the throw-over switch are shown in the diagrammatic drawing, Fig. 39, the auxiliary switch arms or blades being designated 338 and 347. These switch arms are so related with the other parts of the throw-over switch that they are swung to their left-hand position by the throw-over magnet 354 at the same time that the associated switch arms 321, 322, 247 and 248 are similarly moved toward the left, but return to their normal or right-hand position before the associated switch arms or blades are returned to normal by the action of the restoring magnet 369.

Referring now to the mechanical structure of the throw-over auxiliary switch as illustrated in Figs. 26 and 30 to 34 inclusive, the switch arms or blades 338 and 347 are mounted on a rotary shaft 415, but not in the same plane. Therefore only contact 347 is shown in Figs. 26 and 30 to 33 inclusive, but both the contacts appear in the end view Fig. 34. The shaft 415 is journaled in a suitable bearing 416 on the end of said switch, and a coil spring 417 encircling the bearing and connected at one end to said shaft and at the other end to a stationary part of the device tends to move the shaft clockwise as seen in the figures. The shaft also carries a trip arm 418 by which the shaft 415 is swung contra-clockwise against the tension of the spring to throw the contact 347 into engagement with the stationary contact 351. To rotate the shaft and parts carried thereby to this position arm 418 is engaged by a pawl 419 on a sliding bar 420 which is mounted in guides 421 secured to the frame work of the device. The bar 420 has a pin and slot connection 422 to the arm 401 depending from the armature so that said bar slides to the right when the armature is attracted by the restoring magnet 369 and slides to the left when the armature is tilted by the attraction of the throw-over magnet 354.

The specific construction of the pawl 419 is best seen in Fig. 33. It is pivoted to the bearing at 424 and its operating end pressed down by spring 425, the movement of the pawl under the pressure of the spring being limited by pin 426. When in the position shown in said figure the pawl is adapted to engage the trip arm 418 above described as the bar 420 is carried to the left. Thus when the throw-over magnet 354 is energized the armature arm carries the bar to the left and the pawl engaging the arm 418 rocks the shaft 415 and carries the switch 347 into engagement with contact 351, as shown in Fig. 31. In order to release arm 418 however and permit shaft 415 to turn so that switch 347 leaves contact 351 and switch 338 engages contact 344, corresponding to the position of the parts shown in Fig. 39, provision is made for tripping the tail of the pawl 419. For this purpose a pawl 427 is pivoted at 428 to a vertical sliding carrier 429, the latter being slotted at 430 and mounted on screws 431. The pawl 427 has a limited movement under pressure of its spring 432, the movement being checked by stops 433, 434. Plate 429 is drawn toward the normal position shown in Fig. 34 with the screws at the tops of the respective slots by a coil spring 435 secured at one end to one end of the pawl carrier and at the other to a stationary part of the device. The pawl carrier is formed with a lug 436 at its upper end which extends over a finger 437 secured at 438 to one end of the armature, see Fig. 31. When the armature is in the position shown in Fig. 30 the pawl carrier is in its lower position as shown in Fig. 34; but when the armature is attracted by the throw-over magnet 354 the finger 437 is raised and, engaging lug 436, raises the plate 429 so that pawl 427 is out of the path of the tail of pawl 419 when the latter is carried to the left (as viewed in Fig. 31), and hence the pawl 419 engages on arm 418 to rotate shaft 415 as before described. Pawl 427 is maintained clear of the tail of pawl 419 so long as magnet 354 is energized and maintains the armature in closely attracted position. Referring to the diagram Fig. 39, this condition continues until the shoe 220 passes off the live portion 360 of the kick-off wire, as will subsequently be described. When the latter happens the throw-over magnet is de-energized so that the armature is released, and as a consequence, though the switch blade carrier is still latched in its left hand position (as seen in Fig. 31) the armature under the tension of spring 435 acting on finger 437 leaves the pole of the magnet sufficiently to permit the pawl 427 to engage the tail of pawl 419 and thus release arm 418. This permits shaft 15 to swing clockwise to carry switch arms 338, 347 to their normal position as shown in the diagram.

The kick-off wire 214, to which reference has heretofore been made, is dead except for certain sections, such as 360, which are insulated at their opposite ends at 361, 362 (see Fig. 39), and arranged to be energized under the conditions stated below. One of these insulated sections is arranged in proper relation to each switch leading to a branch track and provided with means, preferably automatically operated just before the car reaches the switching position, to energize such section so that it may energize the proper devices on the pilot car to uncouple the latter from the traffic car with which it is connected and operate the switches heretofore described, by which the control of the motor and brake on the pilot car are taken from the synchronizing switch, the

pilot shot ahead and the control then transferred to the operator. One form of device and connections for energizing sections 360 is shown diagrammatically in Fig. 39, and consists in a switch 363 the stationary contact of which is connected by wire 364 to said section and the movable contact by wire 365 to the positive power wire 209. Switch 363 may be operated in any desired manner, either manually or automatically. In Fig. 39 I have indicated means by which the switch is operated by the action of the rail switch with which it is associated and which controls the assignment of the car to the desired branch. As these sections are normally dead and each section energized only in connection with the operation of the rail switch with which it is associated, the kick-off devices on each pilot, which in the preferred embodiment include the kick-off magnet 355, the throw-over magnet 354, and the arm collapsing magnet 230, are operated only at or just about the time when the associated traffic car enters the branch track to which it has been assigned.

In the foregoing I have described the construction and functions of the preferred forms of the various elements that enter into the complete car controlling organization of my invention. I shall now describe the operation of the system as a whole in its application to the control of traffic cars to be distributed or classified in a hump or gravity switch system.

A train, the cars of which are to be distributed by gravity among a number of branch tracks in accordance with their further destination, is pushed over the top of the hump or incline. The air pressure for the operation of the air brakes of the cars is maintained upon the train line, and at some convenient point before the top of the hump is reached the cars or "cuts" of cars, if several adjoining cars are to be directed into the same branch track, are uncoupled and the angle cocks at the ends of each car or "cut" are turned to hold the air pressure in the air system of the car.

As each successive car or "cut" reaches the top of the hump the preceding car, which has has moved on to the down grade, draws away from it. At this moment the coupling operator stationed at the top of the hump seizes the coupling member at the front of the advancing car or "cut," and also the coupling member of a pilot which has been moved into position to bring its extended synchronizing arm into the path of movement of the advancing traffic car, and brings the two coupling members together by a movement illustrated in Figs. 21 and 22. The coupling operator then opens the angle cock on the end of the advancing car, and thereupon the air systems of the traffic car and pilot are in full communication and the brakes of the traffic car can be controlled in the manner hereinafter described. Just prior to the opening of the angle cock the air applying valve 118 of the pilot is operated, as will subsequently be described, in order that the placing of the air systems of the traffic car and pilot in communication may not reduce the pressure in the traffic car air system and apply the brakes.

Referring now more particularly to the diagrammatic drawing Fig. 39, as the traffic car or "cut" of cars moves over the top of the hump and commences to accelerate its speed as it runs down the grade, pressure is exerted upon the lower end of the synchronizing arm 62. Assuming that the gathering speed of the traffic car is such as to tend to make it run ahead of the pilot, the angular position of the synchronizing arm 62 is so changed as to cause the rotation of the arm 170 of the synchronizing switch in a clockwise direction to bring it into position to bridge the switch segments 176 and 173. At the same time the synchronizing auxiliary switch is swung over to bring contacts 184, 185 into engagement. As a result a circuit is completed that extends from the positive brush 215 of the pilot by way of closed auxiliary switch contacts 185 and 184, bridged switch segments 173 and 176, right hand contact and armature 247 of the throw-over switch, and winding of the motor relay 245 to the conductor extending to the negative power brush 216 of the pilot. Motor relay 245 in operating closes a circuit that extends from the positive power wire of the pilot by way of limiting resistance 237, armature and front contact of motor relay 245, and the armature 238 of the pilot motor 144, to the negative power wire of the pilot. As the circuit through the field windings 228 and 229 of the motor 144 is normally closed between the positive and negative power wires of the pilot, the motor immediately operates to turn the traction wheel 138 of the pilot and cause the pilot to increase its speed in the direction of movement of the traffic car.

As heretofore explained, the instant the speed of the pilot becomes greater than that of the attached traffic car, the contacts 184, 185 of the synchronizing auxiliary switch separate, and the consequent deenergization of the motor relay 245 deenergizes the motor. If the momentum that the pilot has acquired is such as to carry it ahead of the traffic car, the change in the angular position of the synchronizing arm 62 swings the arm 170 of the synchronizing switch into position to bridge contacts 177 and 174, the synchronizing auxiliary switch at the same time swinging over to bring contacts 191 and 192 into engagement. When this occurs a circuit is completed that extends from the positive power brush 215 of the pilot through

closed contacts 192 and 191, bridged switching segments 174 and 177, right hand contact and arm 248 of the throw-over switch and winding of brake relay 246 to the negative power brush 216 of the pilot. Brake relay 246 in operating closes at its associated contact a circuit from the positive to the negative power wire of the pilot that includes the winding of brake solenoid 158; and solenoid 158 thereupon draws in its core 157 and tightens the brake band 150 about the brake drum 149 of the pilot traction wheel 138. Consequently the speed of the pilot car is diminished to prevent it from running ahead of the associated traffic car. As soon as the speed of the pilot, as a result of the application of the brake, becomes slightly less than the speed of the traffic car, the synchronizing auxiliary switch contacts 191, 192 separate, and the brake relay 246 is deenergized to release the brake band. Thereupon the pilot car runs freely under its own momentum and without either the brake or motor controlling it until such a time as the relative positions of the pilot and traffic car again change sufficiently to complete the brake or motor circuits.

In case of an abrupt change in the relative speeds of the pilot and traffic car, the angular movement of the synchronizing arm 62 may be such as to cause the switch arm 170 to swing into one or the other of its extreme positions to bridge either the switch segment 172 with segment 176 or segment 175 with segment 177. In the former case, the motor relay energizing circuit previously traced is closed directly and independently of the synchronizing auxiliary switch contacts 184, 185 to operate the pilot motor steadily as long as the segments 172 and 176 are bridged; in the latter case the previously traced brake relay energizing circuit is closed directly and independently of the synchronizing auxiliary switch contacts 191, 192 to apply the brake as long as the segments 175 and 177 are bridged.

It is assumed that the traffic car or "cut" of cars is moving down the grade of the hump toward the branch or classification tracks 41 (Fig. 1), and that the accompanying pilot with its motor and brake mechanism under the control of the synchronizing switch, as has been described, is continuously adapting its speed so as to keep pace with the traffic car. In order that the car or "cut" of cars may have just enough momentum to carry it into the particular predetermined branch track and bring it to rest at the desired point, the operator in the central station or controlling tower operates the keys 101 and 102 to apply and release the brakes of the traffic car as it moves down the grade. If the traffic car attached to the pilot to which the pair of keys 101, 102 (Fig. 39) correspond is moving too fast, the operator presses key 101. As a result a circuit is closed that extends from the positive power wire by way of conductor 304, closed contacts 302 of key 101, conductor 306, control wire 211, control brush 217 of the pilot, winding 313 of the polarized relay on the pilot, resistance 317 and negative power brush 216, back to the negative power wire 210. The magnetic effect of the current thus caused to flow through polarized relay winding 313 is such as to move the armature 318 of that relay into engagement with its left hand contact point. As a result a circuit is closed that extends from the positive power brush 215 of the pilot by way of armature 318 and left hand contact of the polarized relay, arm 322 and right hand contact of the throw-over switch, and electromagnet 126 of the electromagnetic valve controlling mechanism to the negative power brush 216. The valve controlling armature is thereupon swung in a clockwise direction and valve 120 is opened to release pressure from the pipe or hose 61 connected by way of the pilot and traffic car coupling members with the air system of the traffic car. This release of air pressure as a result of the pressing of key 101 by the distant operator causes the application of the brakes and the slowing down of the traffic car.

When the control operator wishes to release the brakes and let the car run freely again, he presses key 102. This closes a circuit that extends from the negative power wire by way of conductor 305, closed contacts 303 of key 102, conductor 306, control conductor 211, control brush 217 of the pilot car, winding 313 of the polarized relay on the pilot car, resistance 316 and positive power brush 215 to the positive power wire 209. Current is thus caused to flow in a reverse direction through winding 313 of the polarized relay, and as a result the polarized relay armature 318 is attracted into engagement with its right hand contact point. This closes a circuit that extends from the positive power brush 215 by way of armature 318 and right hand contact point of the polarized relay, arm 321 and right hand contact point of the throw-over switch, and magnet winding 125 of the air controlling electromagnetic switch to the negative power brush 216. The consequent energization of magnet 125 causes the associated armature to swing in a contra-clockwise direction and operate valve 118. This opens the passage from the pilot air tank 59 to the air hose 61 and restores the pressure in the air system of the train line by way of the connection that exists between the coupling members of the pilot and the traffic car. As a result, the brakes are released and the traffic car permitted to run freely and gather speed.

In the manner described above, the traffic

car or "cut" of cars is controlled by the operator so as to approach its branch or classification track at such speed as, in the judgment of the operator, is necessary to permit it to come to rest at the desired point on the branch track. As the traffic car approaches the branch into which it is to be diverted the branch track switch is thrown, either by hand or by means of automatic switch controlling mechanism under the control of an operator in the control station. In the specific embodiment of the invention that is now being described the throwing of the track switch operates an associated electric circuit switch 363 that connects the positive power wire with a corresponding insulated section 360 of the kick-off conductor 214. It will be understood, however, that the switch 363 may be located wherever convenient and may be operated in any desired manner. As has been stated, the effect of closing switch 363 is to connect the positive power conductor with the insulated kick-off section 360. Consequently the instant the brush 220 of the pilot rides over the insulator 361 and upon the live section 360 a path for current flow is completed from this section through brush 220 and thence back to the negative brush 216 and the negative power conductor by way of three branches. One of these branches includes the winding of the kick-off magnet 355 that controls the coupling between the pilot and the traffic car. Another branch includes the winding of the magnet 230 which controls the latch 231 that serves to hold the two lower sections of the synchronizing arm 62 in their straight, extended relation. The third branch of the energizing circuit completed when the kick-off brush 220 engages the live kick-off section 360 includes the winding of the throw-over magnet 354 of the throw-over switch. Consequently when the brush 220 passes on to the live section 360, all three magnets are energized. The kick-off magnet 355 in operating withdraws the associated latch 94 and permits the traffic car coupling with the valved coupler head attached thereto to drop away from the main coupler body of the pilot car coupling. As has previously been described, the disconnection of these parts is accompanied by the automatic closing of the check valve 92 in the valve head, so that the air pressure is maintained in the train line to keep the brakes from being applied. At the same time, magnet 230 operates the latch 231. Spiral spring 314 (Fig. 37) thereupon acts to fold the sections 66[a] and 67 of the synchronizing arm together, while the spring 164 (Fig. 12), being left free to act on account of the disconnection of the pilot and traffic car couplings, swings the folded arm up into the position indicated in broken lines in Fig. 37. This causes the swinging of arm 170 of the synchronizing switch into its extreme right hand position, but as the synchronizing arm has lost control of the pilot circuits, as a result of circuit changes that will hereinafter be described, this is without effect. In consequence, therefore, of the energization of the kick-off magnet 355 and collapsing magnet 230, the operative connection between the pilot and the traffic car is broken and the synchronizing arm is collapsed and drawn up out of the way.

At the same time that this occurs, throw-over magnet 354 is energized and causes the movement of the switch arms 321, 322, 247, 248 of the throw-over switch proper and switch arms 338 and 347 of the throw-over auxiliary switch from their right hand to their left hand positions. The first effect of this movement is to close a circuit that extends from the positive power brush 215 by way of left hand contact and arm 347 of the auxiliary switch, left hand contact and arm 247 of the throw-over switch and winding of motor relay 245, back to the negative power brush 216. The motor relay 245 thereupon operates and closes its contacts to complete the operating circuit through the pilot motor armature, thus causing the motor to drive the pilot ahead. At the same time the movement of arms 247 and 248 of the throw-over switch opens the right hand contacts of these arms so that thereafter the synchronizing switch has no control over the energizing circuits of the motor relay 245 and brake relay 246, and consequently loses control over the motor and brake of the pilot car. The movement of switch arms 321 and 322 from their right hand to their left hand position opens, at the right hand contacts of these arms, the circuits over which the operator previously, through the medium of the polarized relay 311, 313, had control over the valve operating magnets 125 and 126. The closure of the left hand contacts of arms 321 and 322 extends the control of the operator's keys 101 and 102, exercised through the medium of the polarized relay, to the relay magnets 328 and 336. Magnets 328 and 336 control the double switch 336[a] which in turn controls the motor relay 245 and the brake relay 246. But so long as the auxiliary switch with its arms 338 and 347 is in the left-hand position the control of magnets 336 and 328 cannot be exercised for the reason that the connection from the right-hand contact of switch 336[a] to magnet 246 is open at 338, and the connection from the left-hand contact of switch 336[a] through arm 247 to motor relay 245 is short-circuited through arm 347.

The result of the above described operation of the throw-over and throw-over auxiliary switch arms is that the synchronizing switch and the valve controlling magnets of the pilot are rendered ineffective, the pilot

motor is operated to speed up the pilot and cause it to draw away from the traffic car, and the polarized relay 311, 313 controlled by the operator's keys is placed in readiness to assume control over the motor and brake of the pilot as soon as the throw-over auxiliary switch arms 338 and 347 are returned to their normal position.

As long as the pilot is moving along the energized or live section 360 of the kick-off wire the throw-over magnet 354 remains energized. When the throw-over brush 220 reaches the end of the energized section and passes on to the insulator 362, throw-over magnet 354 is deenergized. When this occurs the downward pull of the spring 435 becomes effective to thrust the lower end of the carrier plate 429 against the tail of the latch 419, thus lifting the nose of the latch from the catch 418 and permitting the throw-over auxiliary switch arms 338, 347 to return under the influence of spring 417 to their normal position. But, as has previously been described, the arms 321, 322, 247, 248 when swung to their left hand position by the operation of the throw-over magnet 354 are latched and held in that position. The result of the movement of the pilot beyond the energized kick-off section 360 and the consequent deenergization of the throw-over magnet 354 is, therefore, to leave switch arms 321, 322, 247 and 248 thrown to the left and throw switch arms 338 and 347 to the right.

When this condition is established the operator has control of the motor and brake of the pilot, and can regulate the speed of the pilot to keep it clear of other pilots that may be accompanying other traffic cars down the grade, or that, having discharged their traffic cars, are running free. After the pilot has passed beyond the energized kick-off section 360 associated with the branch track into which the traffic car accompanying the pilot is shunted, the pilot mechanism is unaffected by succeeding energized kick-off sections over which its brush 220 may be carried in its further movement down the grade. This is because the switch arms 321, 322, 247 and 248, once they are thrown to their left hand position, are latched and held there unaffected by subsequent energizations and deenergizations of the throw-over magnet 354; while when the auxiliary switch arms 338 and 347 are once tripped and restored to their right hand position as a result of the deenergization of throw-over magnet 354 following its energization, they are not again subject to the operation of magnet 354 until the restoring magnet 369 has been operated, at a later stage, to return the throw-over switch arms to their normal position.

If the operator desires to speed up the pilot after it has passed its energized kick-off section 360, he presses key 102. This closes an energizing circuit that has been previously traced for causing the armature 318 of the polarized relay on the pilot to engage its right hand contact point. As the arms of the throw-over switch are now swung toward the left, this closes a circuit that extends from the positive power brush 215, armature 318 and right hand contact of the polarized relay, throw-over switch arm 321 and its left hand contact, and winding of magnet 328 to the negative power brush 216. The energization of magnet 328 swings the associated armature in a clockwise direction and bridges the left hand pair of the associated contacts. This results in the closure of a circuit that extends from the positive power brush 215 by way of the left hand pair of contacts closed by the operation of magnet 328, left hand contact and arm 247 of the throw-over switch and winding of the motor relay 245 to the negative power brush 216. The motor relay 245 in operating closes a circuit for causing the rotation of the armature of the pilot motor 144, in a manner already described. Consequently the controlling operator by pressing key 102 is able to speed up the pilot that is in operative relation with the associated control wire 211.

If the operator wishes the pilot car to travel more slowly, he presses key 101. This establishes connection between the positive power wire and the control wire 211 and brings about the swinging of the polarized relay armature 318 of the pilot into engagement with its left hand contact point, in a manner previously described. As a result, a circuit is established that extends from the positive power brush 215 by way of polarized relay armature 318 and its left hand contact, arm 322 and left hand contact of the throw-over switch, and winding of magnet 336 to the negative power brush. The energization of magnet 336 causes the movement of the associated armature to bridge its right hand pair of contacts. This closes a circuit that extends from the positive power brush 215 by way of the pair of contacts bridged by the operation of magnet 336, arm 338 and right hand contact of the throw-over auxiliary switch, left hand contact and arm 248 of the throw-over switch and winding of brake relay 246 to the negative power brush 216. Brake relay 246 in operating brings about the energization of the brake solenoid 158 and the application of the brake to the traction wheel of the pilot, in a manner already described.

I shall now refer to the schematic layout of Fig. 39[b] in order to afford a clearer understanding of the complete cycle of operation of a pilot car from the time it is attached to one traffic car to conduct the same down the grade until it is returned and in readiness for attachment to another car. By

reference to Fig. 39[b] an understanding may also be had of one of the arrangements whereby a number of pilot cars may be kept simultaneously in use. As shown diagrammatically in Fig. 39[b], the main track 40 of the hump is provided with a number of branch tracks with track switches at 44, 45, 46, etc. Electric switches 363, 363[a], 363[b], etc., are associated with the track switches in such a way as to be closed when the corresponding track switches are thrown. The throwing of the track switches and closing of the associated electrical switches causes the energization of corresponding kick-off sections 360, 360[a], 360[b], etc., of the kick-off wire 214, these kick-off sections being insulated from each other by insulators, as 361, 362, with short interspersed dead sections of wire. The dead sections of the kick-off wire 214 need be no longer than is necessary to insure the reliable release of the throw-over auxiliary switch by the deenergization of the throw-over magnet 354 as the shoe or brush 220 of a pilot passes from one kick-off section to another. As the kick-off wire is needed only over that portion of the travel of the pilot cars in which the branch tracks lead off from the main track 40, the kick-off wire commences a short distance in advance of the first track switch and terminates at a point about opposite the last track switch of the series.

In the layout diagrammatically shown in Fig. 39[b] there are assumed to be three classes of pilot cars, each pilot car of a particular class having a control shoe 217 running upon a particular corresponding one of the three control conductors 211, 212, and 213. Each of the three control conductors 211, 212 and 213, in the plan shown in Fig. 39[b], is divided into three control sections. The first section extends from a point 250 just back of where the coupling operation is performed to a point 251 at the bottom of the hump beyond the last switch point. The second section commences at the point 251, extends around the bend 43 at the bottom of the hump, and passes along the return track of the pilot cars to a point 252 at the entrance of the service house 50. The third section extends from a point 253 at the exit from the service house to a point 254 at about the top of the hump. Between the points 252 and 253, in this particular arrangement, a dead section of each control wire extends through the service house 50; likewise between the two points 254 and 250 there is a dead section of each control wire. The three control sections of the control conductors 211, 212 and 213 are under the control of three groups of operator's key sets. One of the groups of key sets, A, B and C, is located in the control tower or central controlling station 190, and the other two groups, A′, B′, C′ and A², B², C², respectively, are located at a return controlling station 240. The three live sections of the control wire 211 are controlled by the key sets A, A′, A²; the three live sections of control wire 212 are controlled by key sets B, B′, B²; and the three live sections of control wire 213 are controlled by key sets C, C′, C², respectively. Each of the above mentioned key sets may comprise a pair of keys corresponding with keys 101 and 102 of Fig. 39. In Fig. 39[b], the electrical effect produced by each key set is conventionally represented by a single switch lever so arranged as to connect the positive power wire to the corresponding control section when it is moved into one of its positions, and to connect the negative power wire to the controlling section when it is moved into the other of its alternative positions.

Resuming now the description of the operation of the system, with particular reference to the plan represented in Fig. 39[b], the operator in the control tower 190 has control over the mechanism of three pilots of different classes that may simultaneously be moving down the hump between the points 250 and 251. Each of the three pilots has its control brush or shoe 217 (Fig. 39) in engagement with a different one of the control wires 211, 212 and 213, and each pilot may carry some designation or signal that indicates to the tower operator the particular control wire with which it is in operative relation, and, therefore, the particular one of the key sets, A, B and C, that is to be used in controlling the pilot mechanism. As has heretofore been explained, the key sets A, B and C are used to control, through the pilot mechanism, the air brakes of the associated traffic cars up to the point where the pilot moves on to the energized kick-off section of the branch track down which the traffic car is to be discharged. When the pilot reaches this section, the traffic car is disconnected from it as has been described, and the pilot runs full spead ahead until it reaches the end of its particular energized kick-off section. Beyond that point the operator, by means of key set A, B or C, as the case may be, controls the motor and brake of the pilot car to control the speed of the pilot and keep it clear of other pilots which may be running free, or which may be running ahead of it and have not yet released their traffic cars.

When each pilot reaches and passes beyond the point 251 at the bottom of the hump, it commences its return movement with its control shoe engaging the section of the control conductor that extends from the point 251 to the point 252 at the entrance of the service house 50. During this part of its movement each pilot is under the control of the key sets A′, B′, C′ located, preferably, in the return control station 240, so that the operator at that point may con-

trol the speed of movement of the pilots and keep them clear of each other. As each pilot runs into the service house 50 its control shoe moves on to the dead section of the control wire, so that the attendant stationed in the service house may move the pilot through the service house by hand. It will be understood, however, that if desired other key sets associated with each of the three control wires may be provided in the service house so that the attendant may control the pilot motor and brake mechanism to effect the movement of the pilots through the house.

In the service house means are provided for recharging the air tanks 59 of the pilots if the charge in the tanks has been depleted to the point where recharging is necessary. Such recharging means may be of any well-known kind, and need not be described or shown. In the service house, the air coupler body of each pilot car is also fitted with a coupler head 80 (Fig. 23), of which a number may be kept on hand for this purpose. These coupler heads are disconnected from the coupling members of the traffic cars after the cars have come to rest at their destinations on the branch tracks of the classification yard, and are returned to the service house for reconnection with the coupling members of the pilot cars.

Each pilot after being again prepared for service is moved out of the service house, and as the pilot passes the point 253 its control shoe engages the section of the control wire that extends from 253 to 254. These sections, as has been stated, are under the control of key sets A^2, B^2 and C^2 which may be located in the return controlling station 240, so that the operator, by means of the proper one of these key sets, takes control of each pilot as it issues from the service house and moves it to the point 254 at the top of the hump. At the point 254 not only are the control conductors 211, 212 and 213 interrupted, and dead sections interposed between the point 254 and the point 250; but the power conductors 209 and 210 are also interrupted and dead sections placed between 254 and the point 255. Consequently after passing the point 254 the pilot is dead electrically. After passing the point 254, the synchronizing arm 62 of the pilot is straightened and swung down into position and the pilot is moved by hand until it reaches the point 255. This is at the top of the hump at the point where the pilots are attached to the traffic cars that are going over the hump. Each pilot as it is needed is pushed along until the point 255 is passed, whereupon the power shoes or brushes 215, 216 of the pilot are again in engagement with the live power wires 209, 210; and at the same time the pilot brush or shoe 221 (Fig. 39) comes into engagement with the short conducting plate or wire 371 which is permanently connected with the positive power wire. As a result of this engagement the restoring magnet 369 of the pilot is energized. Referring to Fig. 39, the energizing circuit may be traced from the positive power wire through the conducting plate 371 and brush 221, which at this time is in engagement therewith, and thence by way of the winding of restoring magnet 369 and the brush 216 back to the negative power wire. As a result restoring magnet 369 is energized and swings the throw-over switch arms 321, 322, 247 and 248 back to their normal or right hand position. As the auxiliary switch arms 338 and 347 have already been returned to their right hand position, as previously described, all of the switch arms are now restored to normal. This again places the air valve controlling magnets 125 and 126 of the pilot under the control of the operator in the controlling tower 190 and gives the synchronizing switch S control over the motor and brake mechanism of the pilot. The tower operator's control over the air valve magnets of the pilot, however, does not become effective until the pilot has passed beyond the point 250.

As soon as the motor and brake mechanism of the pilot has been brought under the control of the synchronizing switch S by the operation of the restoring magnet 369, as described, the motor tends to drive the pilot ahead until the pilot occupies a position in which the synchronizing arm is vertical and the arm 170 of the synchronizing switch (Fig. 39) has been swung off of the motor segments of the switch. Consequently as soon as the point 250 is passed the coupling operator, by grasping the lower end of the synchronizing arm 62, may lead the pilot, driven by its own motor, to the point where operative connection may conveniently be established between the coupling member of the pilot and the coupling member of the traffic car by manipulating the parts in the manner hereinbefore described. When the pilot and traffic car have been coupled and the angle cock of the traffic car opened, the pilot, under the control of its synchronizing mechanism, commences to move with the traffic car down the grade. The point 250 has been passed before the angle cock is opened, and consequently the control shoe of the pilot rides upon one or another of the three control wires 211, 212, 213, depending upon the class or designation of the pilot, and thereafter the valve operating mechanism of the pilot is under the control of the tower operator's key set. The operator may have key 102 (Fig. 39) depressed to apply air pressure from the pilot to the traffic car air system as soon as the point 250 is passed, thus ensuring the withdrawal of the brakes as the traffic car com-

mences to run down the incline; and the speed of the car thereafter may be controlled in the manner already described. As soon as the pilot has been coupled to a traffic car, another pilot of a different class or designation is moved past the point 255 and placed under the control of the coupling operator, so that each traffic car as it starts down the incline has attached to it a pilot controlled by a different one of the sets of keys in the controlling operator's tower.

The car controlling system may be so organized that instead of there being a different control wire for each of as many pilots as may simultaneously be running down the grade, there may be a single controlling wire divided into a number of sections on the down-grade of the hump, so that the control of the pilot mechanism may be effected by way of one section after another as the pilot runs down the grade. Such an organization of the system is represented in the schematic drawing Fig. 39^c. As indicated in this drawing, the portion of the control wire 211 that extends from the top to the bottom of the hump is divided into sections designated 211^a to 211^e, inclusive. There may be as many of these sections as desired, or as necessary to provide for the independent control of the pilots that are simultaneously moving down the incline. These control wire sections are controlled respectively by key sets A, B, C, D and E located in the controlling tower 190, each key set being arranged to connect the section that it controls alternatively with the positive and negative power wires. Thus, as each pilot starts down the hump, the pilot mechanism is successively under the control of each of the key sets A, B, C, D and E in the order named. The limits of each of the control sections may be marked by suitable signals so that the tower operator may readily know which key set to operate in order to control the mechanism of a particular one of the various pilots that may simultaneously be moving down the hump. There are as many kick-off sections 360 as there are branch tracks diverging from the main track, and the energization of each kick-off section is under the control of an electric switch 363 operated by the track switch associated with the particular corresponding kick-off section. The return portion of the control conductor is divided, in the particular layout shown in Fig. 39^c, into four sections. The first section 211^f extends from the bottom of the hump to a point at about the beginning of the loop at the top of the hump; the second section 211^g extends from this point to the entrance of the service house 50; the third section 211^h extends through the service house; and the fourth section 211^i extends from the exit of the service house to the point at the top of the hump where the power conductors 209 and 210 are interrupted and insulating sections interposed. Each of these four sections is under the control of a different one of the four key sets F, G, H and I located in a return control station 240 at the top of the hump. Thus the operator at the station 240 may control the return movement of the pilots from the bottom of the hump through the service house 50 and back to the point at the top of the hump where the pilots are moved into position where they may again be attached to the traffic cars as they go over the crest of the hump. At this point there is a dead section 211^k interposed in the control wire, which section extends to the point 250 where the tower operator again takes control of the mechanism of the pilot car. If desired, the key set H, shown in the return control operator's station, may be located in the service house 50 so that it may be used to control the movement of the pilots therein.

While the preferred embodiment of my invention is one which includes the various features and elements that have been described, it will be understood that it is possible to embody the invention in forms that are more simple and that omit certain of the elements hereinbefore described, but which still retain certain of the more important advantages of the preferred embodiment. One of the simpler forms in which the invention may be practiced is illustrated in the diagrammatic drawing Fig. 39^a and in the schematic layout shown in Fig. 39^d. Referring to the circuit diagram illustrated in Fig. 39^a, it may be seen that the circuit arrangement is substantially that of Fig. 39 excepting for the omission of the throw-over and throw-over auxiliary switch elements and the associated relay comprising the magnets 328 and 336, together with the rearrangement of the controlling relation between the elements that are retained, as will be described. In the simplified organization illustrated in Fig. 39^a, the energizing circuits of the valve controlling electromagnets 125 and 126 are continuously under the control of the polarized relay armature 318, the movement of the armature 318 to the left in response to the pressing of operator's key 101 causing the energization of the air releasing magnet 126, and the movement of the armature to the right in response to the pressing of key 102 causing the operation of the air applying magnet 125. As indicated, this control of the operator's keys over the air releasing and applying magnets continues as long as the control brush 217 is riding upon the control wire 211 irrespective of whether the kick-off has taken place or not. Of course after the kick-off operation has occurred, the magnets

125 and 126, although still under the control of the operator, can perform no useful function, as the kick-off has uncoupled the pilot from the traffic car. Furthermore, as may be seen, the polarized relay armature 318 at no time has any control over the pilot motor and brake, its control being solely over the valve operating magnets 125 and 126. The motor and brake of the pilot are at all times under the control of the synchronizing switch S, even after the kick-off has taken place. Segment 176 of the synchronizing switch is connected directly and permanently with the energizing winding of the motor relay 245, and segment 177, of the synchronizing switch is connected directly and permanently with the energizing winding of brake relay 246. Before the kick-off occurs the motor and brake are automatically operated, just as in the case of the circuit of Fig. 39, to cause the pilot car to keep pace with the traffic car that it is accompanying down the grade. When the kick-off occurs, as a result of the brush 220 coming into engagement with a live or energized section 360 of the kick-off wire, the kick-off magnet 355 and the arm collapsing magnet 230 are both operated, and in consequence the air coupling of the pilot is disconnected from the air coupling of the traffic car while the synchronizing arm is collapsed and folded up. But as in the circuit organization of Fig. 39[a] segment 176 of the synchronizing switch is permanently connected with the energizing winding of the motor relay 245, and as the swinging up of the synchronizing arm moves the switch arm 170 into its extreme position to bridge segments 176 and 172 of the synchronizing switch (shown in broken lines in Fig. 37), the motor relay 245 is thereafter maintained continuously energized and the motor 144 drives the pilot full speed ahead.

The simplified form illustrated in Fig. 39[a] is more particularly adapted for a car control system in which the classification yard is smaller and the hump shorter, in consequence of which it is not necessary to make provision for the control of more than one pilot at a time on the downward incline of the hump. Fig. 39[d] shows the schematic layout of a system adapted for the use of pilots having the circuit arrangement illustrated in Fig. 39[a]. Referring to Fig. 39[d], the control wire 211 extends only from the point 250, a slight distance along the downgrade from the top of the hump, to point 251 at the bottom of the hump. The control wire is discontinued at the bottom of the hump, as it serves no function beyond the last switch point of the distributing track 40. The control wire between points 250 and 251 is divided, in the embodiment shown, into five sections designated 211[a] to 211[e], inclusive. These sections are controlled by key sets A, B, C, D and E, respectively, located at the control station 190. Each of these key sets is wired to control the connection of either the positive or negative power wire with its corresponding section at the will of operator. The layout of Fig. 39[d] as shown also includes a kick-off section, 360 to 360[d] inclusive, for each distributing track switching point, these kick-off sections being energized under the control of electrical switches 363 to 363[d], inclusive, operated in the operation of the corresponding track switches.

Beyond the point 251 at the bottom of the hump only the two power conductors 209, 210 are continued along the return path of the pilots back to the top of the hump. One of the power wires is continuous, while the other is divided into a number of sections, each section being energized under the control of a switch. In the present instance, the positive power wire 209 is continuous, while the negative power wire 210 is interrupted to divide it into four sections. The section 210[a], in the present instance extends from point 251 at the bottom of the hump to point 251[a] at the beginning of the loop toward the top of the hump; section 210[b] extends from point 251[a] to point 252 at the entrance to the service house 50; section 210[c] extends through the service house to point 253 at the exit thereof; and section 210[d] extends from this point to point 254 at the crest of the hump. Between points 254 and 255 each of the power wires is interrupted by a dead section. The energization of sections 210[a], 210[b], 210[c] and 210[d] of the negative power wire is under the control of switches A, B, C and D respectively, located at the return control station 240. Each of these switches consists of a movable switch arm or member that may occupy three positions. In the normal position of each switch the circuit that it controls is open; in the next position of the switch the circuit that it controls is closed through a limiting resistance 315; and in the last position of the switch the circuit is closed directly without any included resistance. The circuit that each switch closes extends from the negative terminal of the source of power 310 to the particular section of the negative power wire that this switch is adapted to control.

In the operation of the simplified system that is represented in Fig. 39[a] and Fig. 39[d], the pilot runs down the incline of the hump with its air controlling mechanism successively under the control of key sets A, B, C, D and E at the control operator's station 190, and the kick-off takes place when the pilot reaches the particular kick-off section 360 that corresponds with an operated track switch, as has been described. The swinging upward of the released synchronizing arm 62 of the pilot then closes the pilot

motor circuit to cause the pilot to run at full speed on down the incline of the hump. When the pilot reaches the point 251 at the bottom of the hump its negative power brush comes into engagement with section 210^a. When this occurs the subsequent energization of the pilot motor depends upon the position of switch A at return control station 240. If the operator wishes the pilot to run at full speed while it is on section 210^a, he moves switch A to its last position. If he wishes the pilot to run at reduced speed over this section, he moves the switch A to its middle position where resistance is interposed in the circuit of the negative power wire from which the pilot motor derives current for its operation. If the operator desires to stop the returning pilot at any point on section 210^a, he moves switch A to its normal or open position, thus entirely interrupting the connection of section 210^a, with the negative pole of the source of power 310. In like manner, by manipulating the proper one of his switches B, C and D, the operator at the return control station can control the movement of the pilot as it traverses each of the succeeding sections 210^b, 210^c, and 210^d in its return movement. After the pilot has entered the service house 50, it is moved through the same under the control of the switch C which may, if desired, be placed in the service station itself. Or, if desired, the section 210^c through the service house may be a dead section, and the pilot may be moved through the service house by hand. When the pilot has been placed in readiness for its next trip by being recharged with air and having its air coupling member provided with a coupler head, it is moved onto section 210^d and along this section, under the control of switch D, to point 254 at the crest of the hump. Between points 254 and 255 both power conductors are replaced with dead sections; and as the pilot is manually moved over this stretch, its synchronizing arm is straightened and swung down so that upon passing point 255, where the positive and negative power wires are resumed, the pilot is in readines to be again attached to a traffic car by the coupling operator.

In the preferred embodiment of the invention diagrammatically illustrated in Fig. 39 I have described how the organization operates automatically immediately following the kick-off to energize the pilot motor and suspend for an interval the operator's control over the speed controlling mechanism of the pilot. In the modified form illustrated in Fig. 39^e this principle is further extended to provide for the suspension of the operator's control and the automatic releasing of the brakes of the traffic car for an interval preceding the kick-off or separation of the pilot from the traffic car. This additional result is attained by the addition of certain elements to those forming part of the organization of Fig. 39, and by corresponding modifications in the circuit connections through the medium of which the various parts are inter-related. Referring to Fig. 39^e, when the brush 220 moves on to the energized kick-off section 360 a circuit is closed that extends from energized section 360 and brush 220 in engagement therewith, by way of an additional arm 367 of the throw-over switch and the right-hand contact point with which this arm is normally in engagement, and thence through the winding of an added relay 352 to the negative power brush 216. As a result of the closure of this circuit relay 352 is energized to open its back contacts and close its front contacts. The outer pair of back contacts of relay 352 are included in the path over which magnet 126 is energized. Consequently when the relay 352 operates the operator is no longer able to control the valve 120 through the medium of the magnet 126 to release pressure in the train line and thus apply the brakes. At the same time the closing of the outer front contact of relay 352 closes a circuit that extends from the positive power brush 215 by way of the armature and outer front contact of relay 352, and thence through the winding of magnet 125 to the negative power brush 216. Magnet 125 in operating opens valve 118, and thus applies pressure to the train line to release the brakes of the traffic car. It may be seen therefore that the effect of the engagement of kick-off brush 220 with the energized kick-off section 360 is to suspend the operator's control of the valve controlling mechanism and to release the brakes of the traffic car. The object of this is automatically to insure the release of the traffic car brakes before the pilot is disconnected so that the traffic car may run freely into its branch track.

When relay 352 is operated as a result of brush 220 encountering the energized kick-off section, it closes at its inner front contact a circuit extending between the positive and negative power brushes and including the winding of solenoid 340. The speed of movement of the core of the solenoid 340 is regulated by an associated dashpot 368, the relation being such that the movement of the core is practically unimpeded when the solenoid is energized, but is retarded by the dashpot in its return to normal upon the deenergization of the solenoid. The movement of the solenoid core operates associated contacts 340′; and in consequence of the above mentioned relation between the core and the dashpot 368, contacts 340′ are closed immediately upon the energization of the solenoid, but are not again opened after the deenergization of the solenoid until an

interval of time that may be regulated as may be desired by the adjustment of the dashpot. Consequently, when the kick-off shoe 220 moves off of the energized kick-off section 360 in the travel of the pilot, the resultant deenergization of relay 352 immediately deenergizes solenoid 340; but until the expiration of the pre-determined time interval, a circuit is closed that extends from the positive power brush by way of the armature and right-hand back contact of relay 352, closed contacts 340′ of solenoid 340, and thence to the negative power brush by way of the three parallel branches including the throw-over magnet 354, the kick-off magnet 355, and the arm collapsing magnet 230. These three magnets thereupon operate to perform their respective functions as has previously been described in connection with the organization illustrated in Fig. 39.

During the interval determined by the retarding action of the dashpot 368 the energizing circuit for the three magnets remains closed, and consequently the two arms of the throw-over auxiliary switch as well as the five arms of the throw-over switch are held in their left-hand position. But when the dashpot 368 finally permits the opening of contacts 340′, the arms 347 and 338 of the throw-over auxiliary switch are released by the deenergization of throw-over magnet 354, as has previously been described, and these arms then return to their right-hand position. The effect is just as was described in connection with Fig. 39,—namely, to energize the motor of the pilot and suspend the operator's control of the pilot speed controlling mechanism while the throw-over auxiliary switch arms are in their left-hand position, and to restore the operator's control when these arms swing back into their right-hand position.

Obviously the dashpot 368 connected with the core of solenoid 340 may be regulated to make the interval during which the pilot is speeded up and the operator's control is suspended whatever length of time may be deemed to be necessary. While a dashpot arrangement for regulating this time interval has been shown and described, it will be understood that any one of the various movement retarding devices well known in the art may be substituted. It will also be understood that the length of the kick-off section 360 and its positional relation to the track switch of the traffic car track may be varied as may be desired to accomplish the results above described.

In Fig. 1ª I have shown an arrangement of monorail switches to enable the pilot to accompany a traffic car through a "cross-over" switch such as is commonly employed between two parallel railway tracks of standard construction. In a classification yard where two main tracks are provided, to permit one train to be brought to the top of the hump on one track while another train is being pushed over the top on a second track, it is necessary to provide a cross-over switch so that cars sent down on either main track may be directed into the continuation of the other parallel main track and its associated branch tracks. Such railway cross-over switches are well known and need no description. In order that the pilot may accompany the traffic car through the cross-over, I employ switches for the monorail structure such as those that are commonly employed in connection with the monorail structures used in warehouses and similar places. Such switches are made by pivoting a section of rail at one end in the monorail line and swinging this section so as to be continuous with one or another of two branches. In Fig. 1ª I have shown four such switches, the switches 224 and 225 being arranged in the upper track and the switches 226 and 227 being arranged in the lower track. The movable switch sections are pivoted at 224′, 225′, 226′, and 227′, respectively, and are capable of movement into one or another of two alternative positions, as indicated by the full line and the broken lines in the drawing. At the intersection of the monorails at the center of the cross-over the monorail switch consists of a section 234 pivoted at its center 256 and adapted to be swung into position to constitute a continuation of either one of the two main monorail tracks. In the figure the position of the switches is such that a pilot, starting from the left on the lower track, passes through switch 226, thence over switch 234 and switch 225, to the upper track. As successive pilots follow along on the lower track they will be sent on through to the upper track or caused to continue on the lower track depending on the position of switch 226. When pilots are moving from the left on the upper rail, then switches 234, 225 and 227 will be moved to their broken line positions, and the position of switch 224 will determine which of the two main tracks the pilots will follow.

It will be understood that the movement of the monorail switches with their corresponding track switches may be brought about by the provision of such well known devices of the art as are necessary for this purpose. It also will be understood that the power and control wires are arranged to be secured to and to move with the swinging monorail switch sections so that the power application to the pilots moving through such switches and the control thereof may be continuous.

I claim:

1. In a gravity car distributing system, a pilot, means thereon for controlling the rate of movement down the incline of a gravity

propelled and temporarily associated traffic car, and connections including a manually operable device located at a point detached from the pilot for exercising substantially continuous control over said means during the association of said pilot and said car.

2. In a gravity car distributing system, a pilot, means thereon for controlling the operation of the brakes of a gravity propelled and temporarily associated traffic car, and connections including a manually operable device located at a point detached from the pilot for operating said means at will during the association of said pilot and said car to control the rate of movement of said traffic car down the incline.

3. In a gravity car distributing system, a pilot adapted temporarily to travel with and to have its movement controlled by the movement of a traffic car, means on said pilot for supplying air under pressure, means for connecting the first said means to the air brake line of said traffic car, means for controlling the passage of air from the first said means to said air line, and connections from a point detached from the pilot for operating the last said means.

4. In a device of the class described, a pilot, an air system thereon, comprising means for connection to the air brake line of a gravity propelled traffic car and valves for controlling the access of air to and its escape from the air line of the traffic car, and connections from a point detached from the pilot for operating said valves to retard the movement of said car or to permit it to run freely under the influence of gravity.

5. In a device of the class described, a pilot, a tank thereon for storing air under pressure, means for connecting the tank to the air line of an independently propelled traffic car, means for controlling the passage of air from the tank to said air line to release the brakes of said traffic car, and connections from a point detached from the pilot for operating the last said means.

6. In a device of the class described, a pilot for controlling a traffic car but in substantially tractionless relation therewith, a tank on said pilot for storing air under pressure, means for connecting the tank to the air brake line of said traffic car, said means including a valve, a valve for releasing pressure in said connecting means, and connections from a point detached from the pilot for exercising substantially continuous control over said valves during the association of said pilot and said car.

7. In a device of the class described, a pilot, means thereon for governing the speed controlling means of a traffic car, and means including a mechanical coupling between said pilot and traffic car incapable of exercising any substantial traction for causing the pilot to travel with the traffic car.

8. In a device of the class described, a pilot, means thereon for controlling the brakes of a traffic car, and means incapable of exercising any substantial traction connecting the pilot and traffic car and operating to cause them to travel together.

9. In a device of the class described, a pilot, a source of compressed air thereon, means for detachably connecting the same to the air brake line of a traffic car, a valve in said means, means for operating said valve, and means on said pilot responsive to control exercised by said traffic car for accelerating or retarding the movement of said pilot to cause it to travel with the traffic car.

10. In a device of the class described, a pilot, means thereon for governing the speed controlling means of a traffic car, a motor for driving the pilot, braking means for the pilot, means movable with respect to the pilot for connecting the pilot to a traffic car, and means governed by the movement of said connecting means controlling the motor and brake for causing the pilot to travel with the traffic car.

11. In a device of the class described, a pilot, means thereon for governing the speed controlling means of a traffic car, a motor driving the pilot, a brake for retarding the motion of the pilot, a non-rigid connection for attaching the pilot car to the traffic car, and means operated by said connection when the pilot travels slower than the traffic car for energizing the motor.

12. In a device of the class described, a pilot, means thereon for governing the speed controlling means of a traffic car, a motor driving the pilot, a brake for retarding the motion of the pilot, a non-rigid connection for attaching the pilot to a traffic car, and means operated by said connection when the pilot travels faster than the traffic car for applying said brake.

13. In a device of the class described, a pilot, means thereon adapted to be connected to the speed controlling means of a traffic car for governing the latter, an electric motor driving the pilot, a non-rigid connection for attaching the pilot to a traffic car, permitting the car and pilot to travel at different rates of speed, and a switch governing said electric mator and controlled by said connection to be opened when the pilot travels faster than the traffic car and closed when the pilot travels slower than the traffic car.

14. In a device of the class described, means including a valve adapted and arranged to be connected to the air brake system of a gravity propelled traffic car for controlling the same, and connections from a point detached from said means for exercising substantially continuous control over said valve to effect the retardation or acceleration of the movement of said car.

15. The combination of a traffic car having an air brake system, means including a valve temporarily associated with the air brake system for controlling the air supply of the latter, and connections from a stationary point for exercising substantially continuous control over said valve during the association of said means with said air brake system for continuously controlling the rate of movement of said car.

16. In a gravity car distributing system, the combination of a gravity propelled traffic car having an air brake system, substantially tractionless controlling means temporarily associated with the air brake system, including a valve for controlling the air therein, and a device and connections for operating the valve from a fixed point.

17. The combination of a traffic car having an air-brake system, means temporarily associated with said traffic car and the movement of which is controlled thereby for controlling the air-brake system thereof, and means controlled from a distant fixed point for disconnecting the first said means from the traffic car.

18. In a gravity car distributing system, the combination of a traffic car having an air brake system, detachable means temporarily associated with the traffic car for controlling the air brake system thereof, detaching means, a track switch, and controlling connections made operative in throwing said track switch for operating said detaching means to detach said first mentioned controlling means from the traffic car.

19. In a device of the class described, a pilot, means thereon for controlling the movement of a traffic car, a coupling element for establishing operative relation between the pilot and the traffic car, means operable from a fixed point for controlling said coupling element to dis-establish said operative relation, and operating connections for controlling said means from a distant point.

20. In a device of the class described, a pilot, means thereon for controlling the operation of the brakes of a traffic car, a coupling element for establishing controlling relation between the pilot and the traffic car, mechanism associated with said coupling element for dis-establishing said controlling relation, and connections operable from a fixed point for controlling the operation of said mechanism.

21. In a device of the class described, a pilot, means for driving the same, movable means for connecting the pilot to a traffic car controlling the first said means, means on said pilot for controlling the movement of said traffic car, means for establishing controlling relation between said controlling means of the pilot and the traffic car, and means automatically operated for disestablishing said controlling relation.

22. In a device of the class described, a pilot, means thereon for controlling the operation of the air-brakes of a traffic car, coupling means for establishing controlling relation between said controlling means of the pilot and the air-brakes of the traffic car, means associated with said coupling means for dis-establishing said controlling relation, and connections from a point detached from the pilot for controlling the operation of said last mentioned means.

23. The combination of a traffic car provided with an air-brake system and an air coupling member, a pilot having an air-brake controlling system and a coupling member connected with the coupling member connected with the coupling member of the traffic car, said pilot coupling member having a detachable coupler head through which connection between the pilot coupling member and the traffic car coupling member is established, and means associated with said pilot coupling member and adapted to be controlled from a distant point for detaching said coupler head from the pilot coupling member and leaving it attached to the traffic car coupling member.

24. The combination of a traffic car provided with an air-brake system and an air coupling member, a pilot having an air-brake controlling system and a coupling member connected with the coupling member of the traffic car, said pilot coupling member having a detachable coupler head through which connection between the pilot coupling member and the traffic car coupling member is established, and means associated with said pilot coupling member and adapted to be controlled from a distant point for detaching said coupler head from the pilot coupling member and leaving it attached to the traffic car coupling member, said coupler head having a valve with means for automatically closing the same upon the detachment of said head to hold the pressure in the air-brake system of the traffic car.

25. The combination of a traffic car provided with an air-brake system and an air coupling member, a pilot having an air-brake controlling system and an air coupling member detachably connected with the air coupling member of the traffic car, means adapted to be controlled from a distant point for disconnecting the pilot coupling member from the traffic car coupling member, and means automatically operated upon said disconnection for holding the pressure in the air-brake system of the traffic car.

26. The combination of a traffic car having an air-brake system and an air coupling member, an air brake controlling system provided with a coupling member connected with the coupling member of said

traffic car, means controlled from a distant point for disconnecting said coupling members, and means made operative upon said disconnection for holding the pressure in the air-brake system of the traffic car.

27. The combination of a traffic car having an air-brake system and an air coupling member, an air-brake controlling system having a coupling member connected with the coupling member of said traffic car, means associated with said coupling members for disconnecting the same, and operating connections for controlling said means from a distant fixed point.

28. In a device of the class described, a pilot adapted and arranged to travel with a traffic car, said traffic car being provided with speed controlling means, means on said pilot for governing said speed controlling means to accelerate or retard the rate of movement of said traffic car, and operative connections including a manually operated device for controlling said speed governing means of the pilot from a fixed point.

29. The method of controlling cars in a gravity classification yard, which consists in causing a succession of cars each provided with an air brake system to move down a main track and into various branch tracks under the influence of gravity, associating intermediate controlling devices with the cars during their movement down the main track, and independently controlling the air brake systems of the various cars from a fixed point through the medium of said intermediate controlling device.

30. The method of controlling the movement of cars in a gravity distributing system, which consists in causing a succession of cars or cuts of cars each provided with an air brake system to move down an incline under the influence of gravity, associating intermediate controlling devices with said cars or cuts of cars during their movement down the incline, and independently controlling the air brake system of each car or cut of cars through the medium of said intermediate controlling device from points detached from said cars or cuts of cars.

31. In a device of the class described, a pilot, means thereon for governing the speed controlling means of a traffic car, a motor for driving the pilot, braking means for the pilot, means for connecting the pilot to a traffic car, means governed thereby controlling the motor and brake for causing the pilot to travel with the traffic car, means for automatically disconnecting the pilot from the traffic car at a pre-determined point, and means automatically operated upon said disconnection for changing the speed of the pilot to cause it quickly to separate from the traffic car.

32. In a device of the class described, a pilot, means thereon for governing the speed controlling means of a traffic car, means for connecting the pilot to the traffic car and placing the traffic car under the control of said governing means, means for automatically disconnecting the pilot car from the traffic car at a pre-determined point, and means automatically operated upon said disconnection for changing the speed of the pilot.

33. In a device of the class described, a pilot, means thereon for governing the speed controlling means of a traffic car, means for connecting the pilot to the traffic car and placing the traffic car under the control of said governing means, means for automatically disconnecting the pilot car from the traffic car at a predetermined point, motor mechanism for said pilot, and means made operative after the disconnection of the pilot car from the traffic car for placing said motor mechanism under the control of a distant control station.

34. In a device of the class described, a pilot having driving and braking means thereon, means on said pilot for governing the speed controlling means of a traffic car, means for connecting the pilot to the traffic car and thereby placing the traffic car under the control of said governing means, and means associated with said connecting means for controlling said driving and braking means of said pilot for causing the pilot to travel with the traffic car.

35. In a gravity car distributing system, a pilot provided with speed controlling means and with means for temporarily connecting the same with a traffic car having speed controlling means, means on said pilot adapted to be substantially continuously controlled from a point extraneous to said pilot and said traffic car during the association of the same for controlling the speed controlling means of said traffic car, and means controlled by said traffic car for controlling the speed controlling means of said pilot.

36. The combination of a traffic car and a pilot car each provided with a braking system, connecting means between said cars adapted and arranged to be moved in the movement of said cars relative to each other, and means controlled by the movement of said connecting means for controlling the operation of the braking system of one of said cars to cause said cars to travel together.

37. The combination of a traffic car and a pilot car, speed controlling mechanism on each of said cars, means acting through the medium of the speed controlling mechanism of one of said cars for changing the speed of said car, and means made operative in changing the speed of said car and acting through the medium of the speed controlling mechanism of the other car for causing a

corresponding change of speed in said other car.

38. The combination of a traffic car and a pilot car, speed controlling mechanism on each of said cars, means acting through the medium of the speed controlling mechanism of one of said cars for changing the speed of said car, connecting means between said cars adapted and arranged to be moved in the resultant movement of said cars relative to each other, and means controlled by the movement of said connecting means and acting through the medium of the speed controlling mechanism of the other car for causing a corresponding change of speed in said other car.

39. In a device of the class described, a pilot, means on said pilot for controlling the speed controlling means of a traffic car, an arm connecting said pilot and traffic car and constituting the operative connection therebetween, operating connections controlled to cause the disconnection of said arm, and means automatically operated upon said disconnection for clearing said arm from the path of movement of the car from which it is disconnected.

40. In a device of the class described, a pilot provided with means for controlling the speed controlling means of a traffic car, an arm for connecting said pilot and traffic car and constituting the operative connection therebetween, operating connections with means for controlling the same to cause the disconnection of said arm, and means automatically operated upon said disconnection for collapsing said arm.

41. In a device of the class described, a pilot provided with speed controlling means and means for controlling the speed controlling means of a traffic car, a connection between said pilot and traffic car through the medium of which the control of the speed controlling means of the traffic car is effected, means controlled from a distant point for severing said connection, and means automatically operated upon the severance of said connection for controlling the speed controlling means of said pilot.

42. In an air-brake system, the combination with two air coupling members, of a detachable coupler head interposed between and detachably connected with said coupling members, a latch controlling the connection of said coupler head with one of said members, and operating means and connections controlled from a distant point for effecting the movement of said latch to disconnect said coupler head from the corresponding associated member.

43. In a pneumatic power transmission system, the combination with two connected coupling members with a latch for holding the same in coupling relation, an electro-magnet for moving said latch to effect the disconnection of said members, and an energizing circuit for said electro-magnet with means at a distant point for controlling the same.

44. In a pneumatic power transmission system, the combination of two connected coupling members with an interposed coupler head, a check valve in said coupler head, means acting to maintain said valve open while said coupling members are connected, operating means and connections adapted to be controlled from a distant point for disconnecting said members and leaving said coupler head connected with one of them, and means made operative in the disconnection of said members for closing said check valve.

45. In a pneumatic power transmission system, the combination of two connected coupling members, a check valve interposed between said members at the point of connection, means for holding said check valve open while the members are connected, means controlled from a distant point for disconnecting said members, and means operating automatically upon the disconnection of said members for closing said check valve.

46. In a car control system, a pilot provided with means for controlling the speed controlling means of a traffic car, connecting means between the pilot and traffic car through the medium of which said control is exercised, electro-magnetic mechanism for disconnecting said connecting means, an energizing circuit for said electro-magnetic mechanism, and a controlling switch for said circuit adapted and arranged to be operated in the movement of a track switch associated with the track over which the traffic car moves.

47. In a car control system, the combination of a pilot provided with means for controlling the speed controlling means of a traffic car, means for operatively connecting said pilot with the traffic car, means for disconnecting the pilot and traffic car, and means moved in the movement of a track switch in the track over which said traffic car moves for controlling the operation of said disconnecting means.

48. In a car control system, a traffic car and a controlling pilot attached thereto to travel therewith, speed controlling mechanism and controlling means therefor on said pilot, and means automatically operated at a predetermined point in the movement of said pilot and traffic car to disconnect said pilot and traffic car and actuate said controlling means of said pilot.

49. In a device of the class described, a pilot provided with a valve for controlling the air-brake system of a connected traffic car and with mechanism for controlling the speed of said pilot, a controlling device at a point outside of said pilot, operating con-

nections between said device and said pilot arranged to give said device control over said valve, means associated with said pilot for disconnecting said pilot from the associated traffic car, and means made operative upon said disconnection for shifting the control exercised by said controlling device from said valve to said pilot speed controlling mechanism.

50. In a device of the class described, a pilot provided with mechanism for controlling the speed thereof, means on said pilot for controlling the speed controlling mechanism of a traffic car, on operator's controlling device, operative connections between said controlling device and the aforesaid speed controlling mechanism on said pilot, and means automatically operated at a predetermined point in the movement of said pilot for depriving said operator's controlling device of its control over said pilot speed controlling mechanism and controlling said mechanism directly.

51. In a device of the class described, a pilot provided with mechanism for controlling the speed thereof, means on said pilot for controlling the speed controlling mechanism of an associated traffic car, an operator's controlling device, operative connections for normally giving the same control alternatively over the speed controlling mechanism of the traffic car and over the speed controlling mechanism of the pilot, and means automatically operated during a predetermined part of the travel of the pilot for operating one of said speed controlling mechanisms independently of control by said operator's controlling device.

52. In a device of the class described, a pilot having speed controlling mechanism therefor, means on said pilot for controlling the speed controlling mechanism of an associated traffic car, connecting means for establishing operative relation between the aforesaid controlling means on said pilot car and the speed controlling mechanism of the traffic car, said connecting means normally operating to control the speed controlling mechanism of said pilot, an operator's controlling device normally adapted to exercise control over said traffic car speed controlling means on said pilot, and a switch automatically operated at any desired point in the travel of said pilot for discontinuing the operative relation between said connecting means and the speed controlling mechanism of the pilot and shifting the control exercised by said operator's controlling device from said traffic car controlling means on the pilot to said speed controlling mechanism of the pilot.

53. In a car control system, a traffic car and a pilot, a main traffic car track having a plurality of associated branch tracks with a track switch for each branch, a main pilot track paralleling said main traffic car track, an operative connection between said traffic car and said pilot, disconnecting means for breaking said operative connection, and means associated with each track switch for controlling the actuation of said disconnecting means when the corresponding track switch is thrown.

54. In a car control system, a main track having a plurality of branch tracks with a track switch for each, traffic cars adapted to travel over said main track and to be shunted into any desired one of said branch tracks by the operation of the appropriate track switch, a pilot track paralleling said main track, a plurality of pilots adapted to travel over said pilot track and to be temporarily operatively connected with different traffic cars or cuts of traffic cars, controlling means on each of said pilots for controlling the movement of said pilot and the associated traffic car, an operator's control station provided with a plurality of controlling devices, and operative connections between said controlling devices and the controlling means of different ones of said pilots whereby the pilots and their associated traffic cars may be separately and individually controlled as they move along their respective tracks.

55. In a car control system, the combination of traffic cars and a main track over which said traffic cars are adapted to travel, a paralleling pilot track, a plurality of pilots adapted to move along said pilot track and to be operatively connected with different ones of said traffic cars, controlling mechanism on each pilot, a control station provided with controlling devices and separate connections extending therefrom for separately controlling the controlling mechanisms of the various pilots, means for disconnecting each traffic car from its accompanying pilot, a return track for said pilots, and means for individually controlling the movement of said pilots in their travel over said return track.

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