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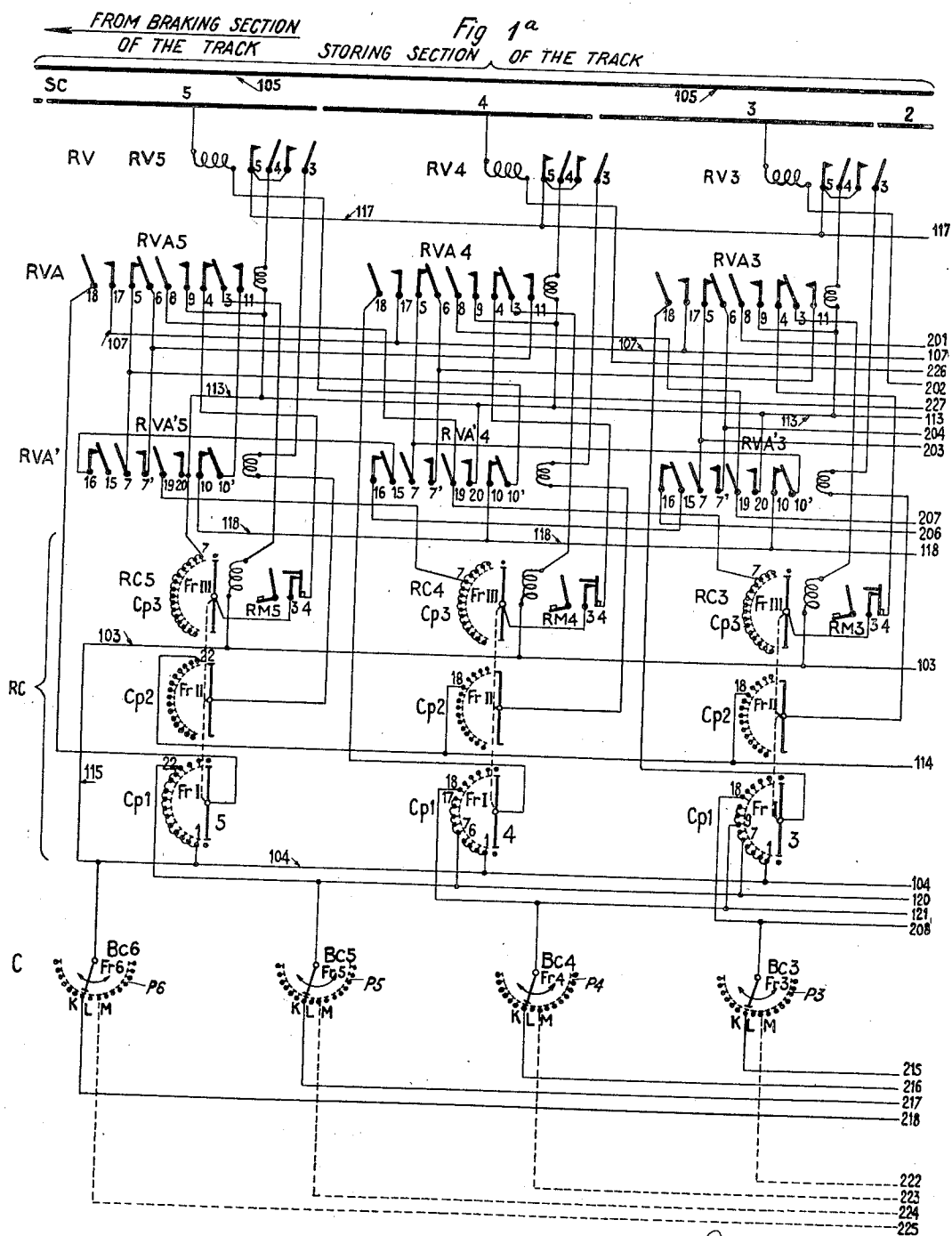
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2,045,201

CAR BRAKING APPARATUS FOR RAILROADS

Filed April 28, 1930

8 Sheets-Sheet 1



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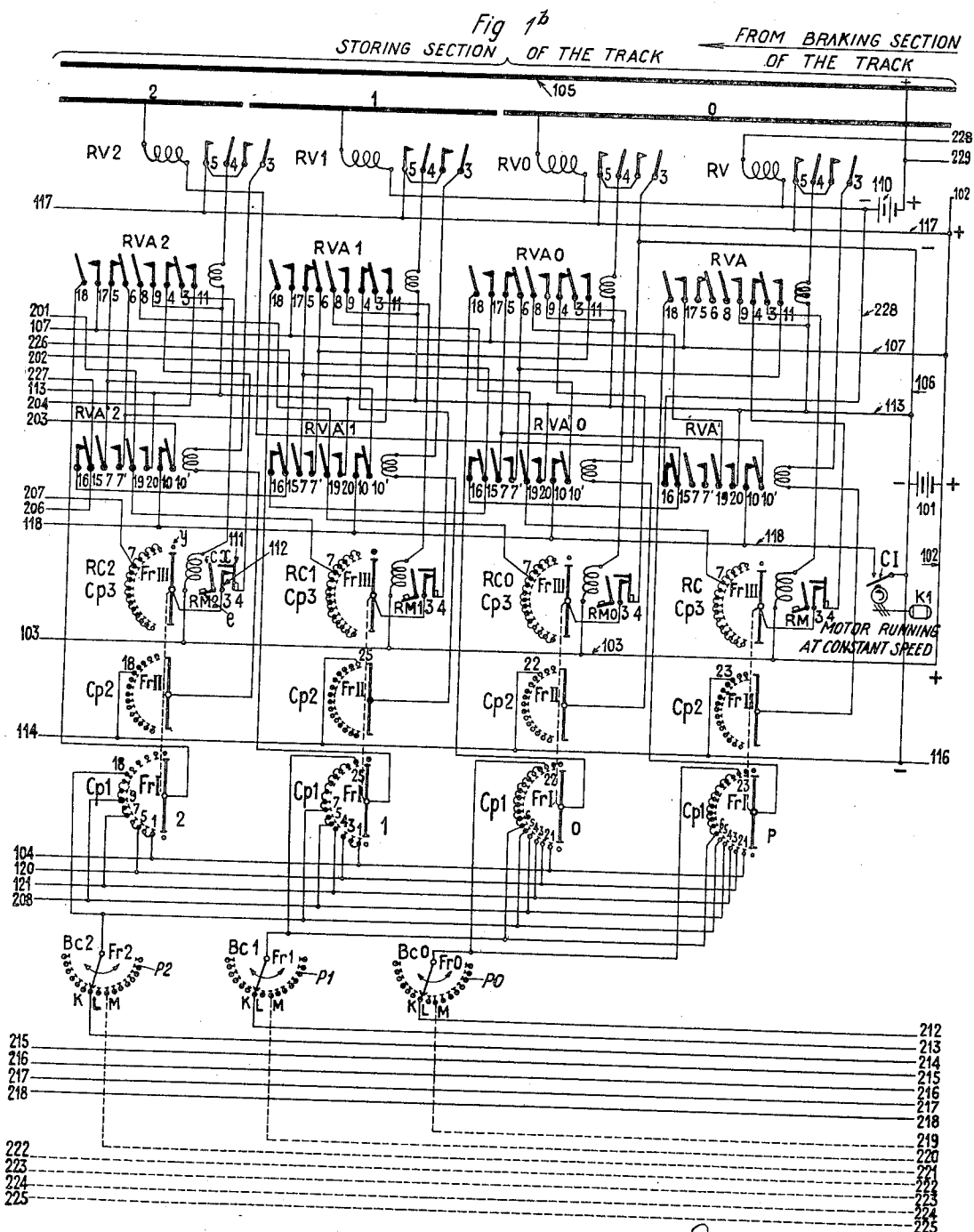
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CAR BRAKING APPARATUS FOR RAILROADS

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8 Sheets-Sheet 2



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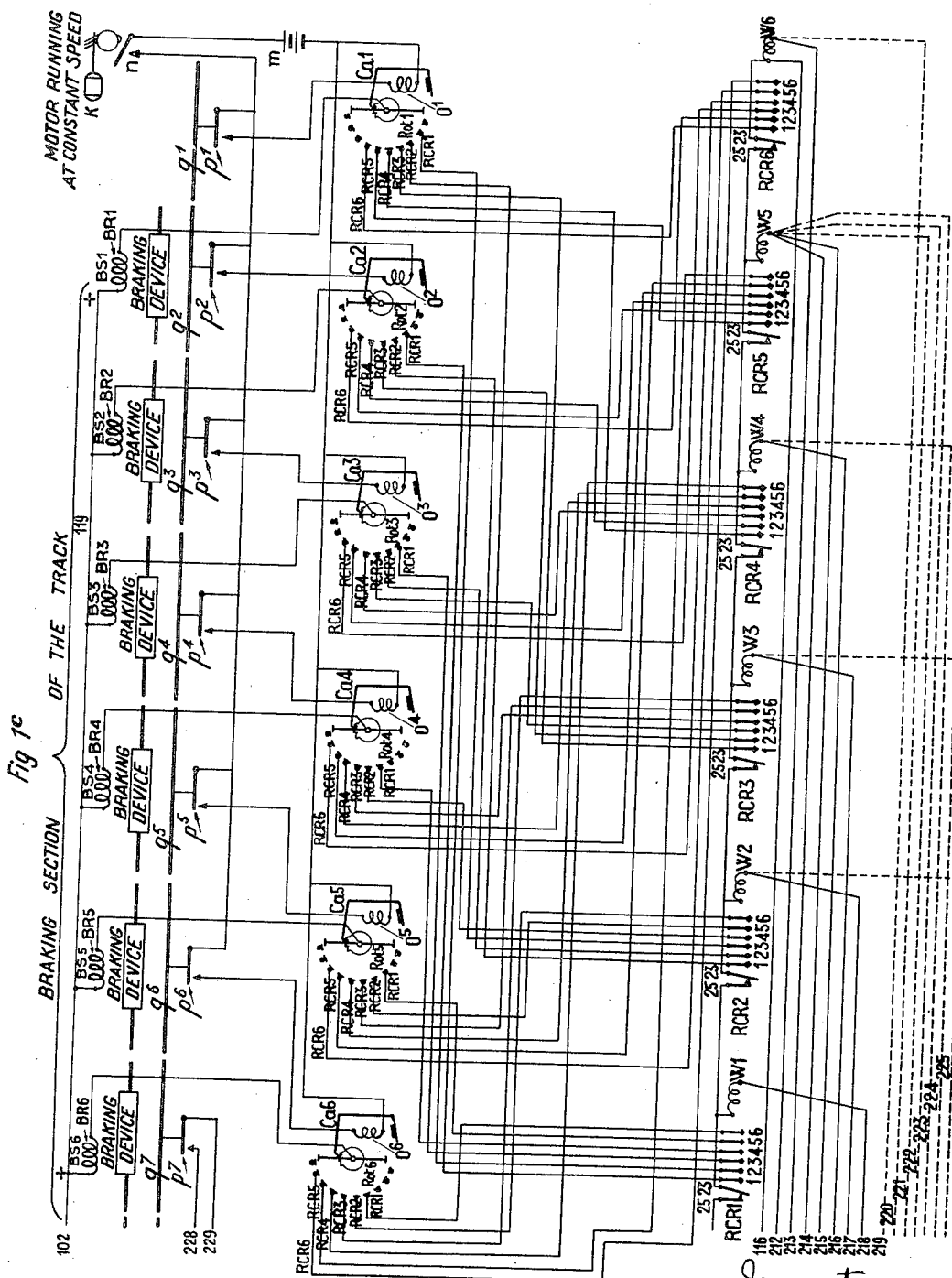
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Fig. 2.

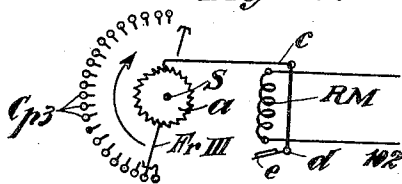


Fig. 3.

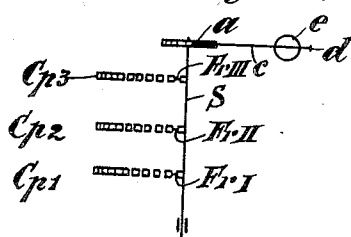


Fig. 4.

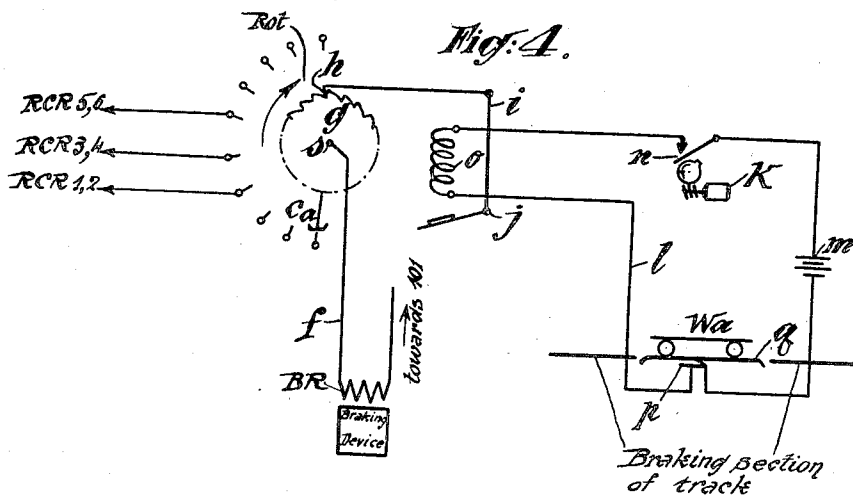
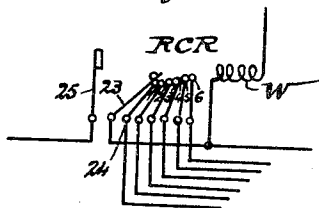


Fig. 5.



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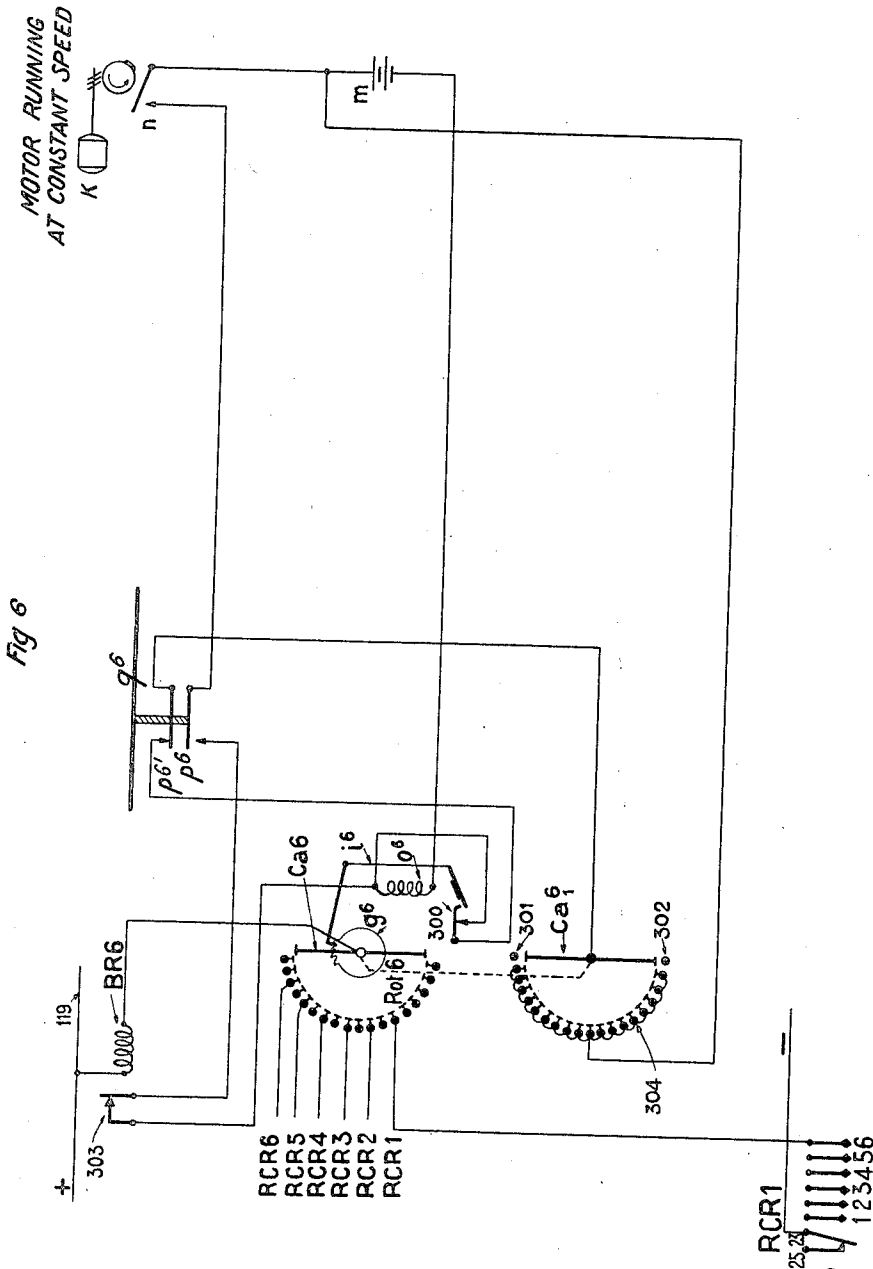
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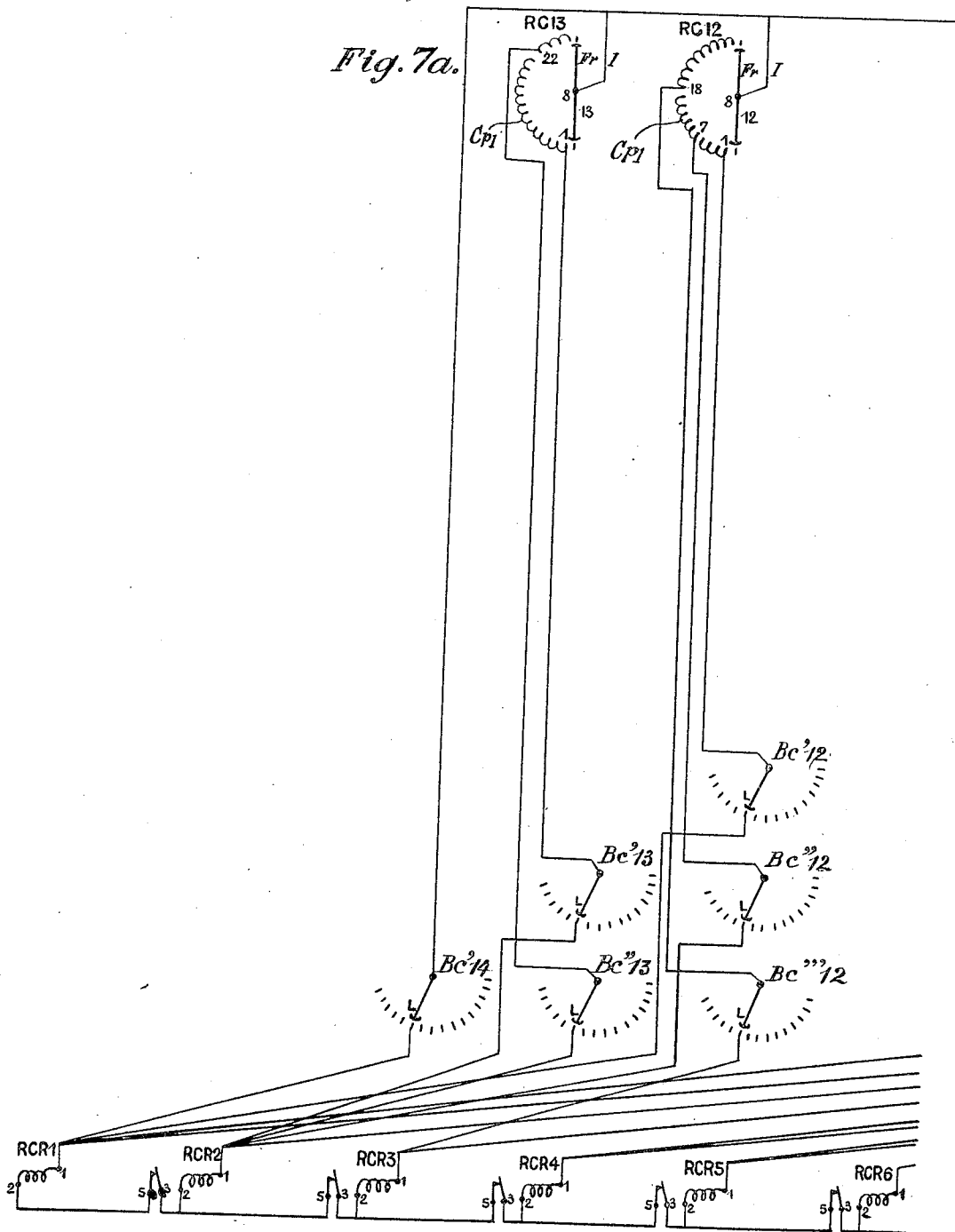
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Fig. 7a.



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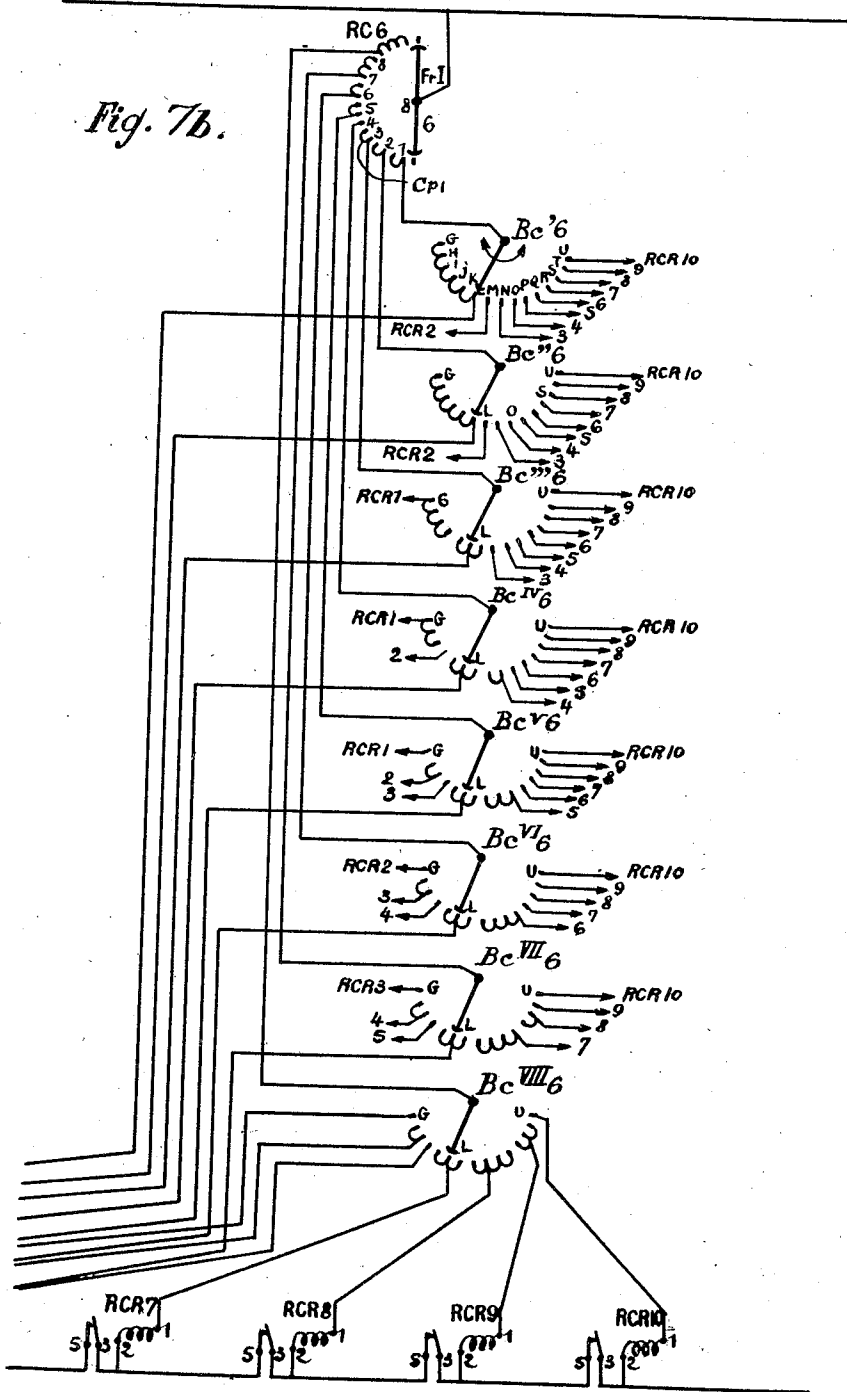
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Fig. 7b.



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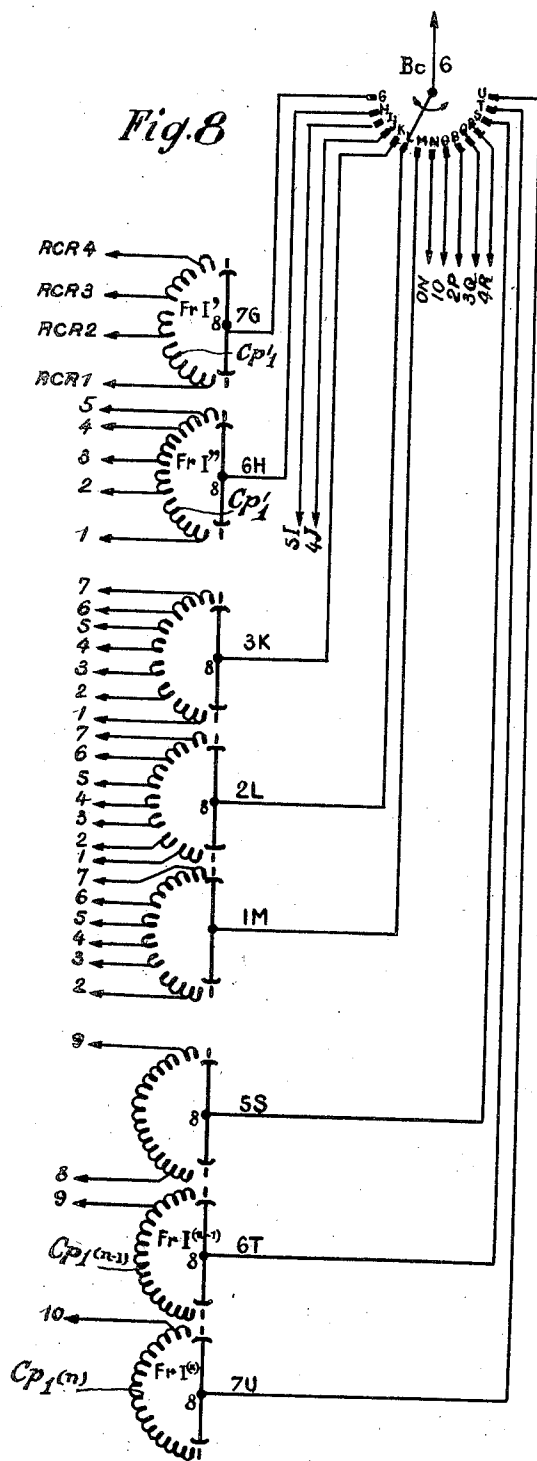
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CAR BRAKING APPARATUS FOR RAILROADS

Filed April 28, 1930

8 Sheets-Sheet 8



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UNITED STATES PATENT OFFICE

2,045,201

CAR BRAKING APPARATUS FOR
RAILROADS

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Application April 28, 1930, Serial No. 448,152
In France May 11, 1929

26 Claims. (Cl. 104—26)

It may prove useful to determine at each instant the speed and optionally the point of stopping of a movable device travelling upon a determined path, that is, the time within which the said device will come to a stop, or the point on the said path at which it will be stopped.

For instance, it is useful, for the sorting of railroad cars, to ascertain as closely as possible, for each track, the stopping point of the cars which have been uncoupled by any means and are travelling on the track in question. This factor may serve to determine the degree of the braking to be applied to the succeeding cars. For the better understanding of the invention, it will be supposed in the following description that the question relates to this specific application, it being understood that the invention is not limited to this particular use.

Electric devices of the delayed action type are already known, which devices comprise an element adapted to close a circuit only for a certain time after it has been released or set in operation. Such devices may operate upon variable time delays, and for instance may consist of impulse devices in which the armature or movable element move over successive contact studs or members and close a circuit only when one of such contact studs or members is connected in a circuit.

Such relays are already employed in braking devices for causing or not causing, according as the car to be braked is moving more or less slowly, the side-tracking or the maintenance of a brake shoe upon the rail. In such known apparatus, the current is supplied to the contact studs or members substantially in the following manner. The track used with the car, beyond the braking apparatus, is divided into a plurality of insulated sections and each section comprises a track relay whose armature is adapted to close a circuit when the stopped cars begin to occupy this section and to supply thereby current to one of the contact studs or members of each of the aforesaid delayed action relays. The connections between the track relays and the time-retarded relays are so devised that as the storing section of the track receives more and more cars, the contact studs supplied with current get nearer and nearer to the starting point of the armature in the time retarded relays; consequently the delay in the operation of the motors controlling the brake shoes, i. e. the delay for the side-tracking of said brake shoes gradually decreases so that the successive cars undergo stronger and stronger braking. A suitable apparatus,

hereinafter termed "controller" or "selecting means", may be manually operated to select a number or a group of said connections, placing the remaining connections out of action; this group can be varied through this controller and the arrangement is so devised that each group of connections corresponds to particular atmospheric conditions. Accordingly, the delays in side-tracking the brake shoes, that is the importance of the braking actions can be varied so as to account for the atmospheric conditions.

The present invention has for an object, among others, to improve the said electric installation. Another object of the invention is to prevent a car, which is to pass over a track section without stopping upon it, from instantly actuating the delayed action relay corresponding to the given track section.

Another object of the invention is to determine in an automatic manner, and according to the time required by the car to clear this section, the substitution if necessary, for the group of delays for the side-tracking of the various brake-shoes, corresponding to the occupation of the track by the cars which are already stopped, of the group of delays corresponding to the occupation of the track section on which the car under consideration is to stop of its own accord.

In this manner each car is braked, not according to the position of the preceding car, but according to the normal and eventual stopping point of the said preceding car, and hence the function of this arrangement is particularly important when the cars are obliged to follow one another in close succession.

These objects are obtained for instance by inserting, between each track relay associated with an insulated section of the track storing portion following the braking section, and the sets of contact studs of the controller, a relay adapted for delayed action such as has been above indicated. This relay will be designated as an auxiliary delayed action relay.

Another object of the invention consists in the provision of an electric apparatus of such nature that the definite occupation of the track as far as section ($n-3$) inclusive will break the energizing circuit of the track relay of section n and the succeeding sections, thus obviating a useless consumption of current in the occupied sections.

Another object of the invention is to provide an electric apparatus of such nature that the indications given by the travel of a car upon the section n will only disappear when it has reached

the section $n+2$, if the section $(n+1)$ is to be cleared without stopping, or when the car is stopped upon section $(n+1)$, that is, after the complete recording of the indications given by this upon car the section $(n+1)$.

A further object of the invention is to provide an electric apparatus such that the time of functioning of the armature or movable element of the auxiliary delayed action relay will be exactly the time during which the first axle of the car is situated upon the corresponding track section, in such manner that the time of functioning will depend solely upon the speed of the car, and is independent of its length and wheel base.

Other objects of the invention will be specified in the following description with reference to the accompanying diagrammatic drawings which are given by way of example.

Figures 1a, 1b, and 1c are the three portions of a diagrammatic view of the electric installation, corresponding wires in the three portions being denoted by the same reference characters.

Figures 2 and 3 are, respectively, a plan view and an elevational view showing, diagrammatically, a detail of the device shown in Figs. 1a, 1b and 1c.

Figure 4 is a diagrammatical view of another detail of the device shown in Figs. 1a, 1b, and 1c.

Figure 5 is a partial view showing one of the relays RCR of Figure 1c in the energized position.

Fig. 6 is a diagrammatic view showing the means whereby the retarded switches Rot are returned to normal position after having been operated by a car.

Figures 7a, 7b, and 8 show two modified constructions of improved combination means according to the invention.

According to my invention, in a railroad yard, each track is divided into two parts: a storing section for receiving the cars to be stored thereon, and a braking section, preceding said storing section, and provided with a plurality of sub-sections each having a braking element or braking device. In Fig. 1c, it has been assumed by way of illustration that the braking-section is divided into six braking sub-sections referenced BS1, BS2 . . . BS6 on which the cars travel from right to left. The arrangement in each braking sub-section will be hereinafter described; suffice it to notice that each braking sub-section has two pedals or movable rails adapted to be depressed by a passing car to close suitable contacts; according to Fig. 1c, sub-section BS1 is provided with pedals $q1$, $q2$, sub-section BS2 is provided with pedals $q2$, $q3$ (pedal $q2$ being thus common to two successive sub-sections) and so on, the last sub-section BS6 being provided with pedals $q6$ and $q7$.

According to my invention, each car, when leaving the braking section of the track, will have exactly the speed that is necessary for bringing it to a stop immediately adjacent the position in which the preceding car on the storing section of the track is actually stopped or will finally stop. This result is obtained by causing the successive braking elements of this braking section to act on said car until they have reduced its speed to the required value (which, it is important to notice, is a function of the position of the preceding car on the storing section of the track).

Each braking element comprises, for instance, a braking shoe normally disposed on the track, but adapted to be side tracked therefrom through

the action of an electric motor. Said motor is controlled through a switch. A contact member disposed on the track at a certain distance before the brake shoe, and adapted to be actuated by the passing of a car wheel thereon, serves to close the electric circuit that operates said switch. The switch is such that between the time of its being operated by the closing of said contact member and the time of its starting the electric motor, there is a certain delay (which may be adjusted through certain means hereinafter described). For that reason, said switch will be hereinafter referred to as the "retarded switch" or delayed action relay.

Therefore, if the time necessary for the car wheel to move from said contact member to the normal position of the brake shoe is smaller than that delay, (that is to say, if the speed of the car is greater than a given value,) said car wheel will arrive in that position before the retarded switch or delayed action relay has started the electric motor, and the car wheel will meet the brake shoe. The car will accordingly be braked. On the contrary, if the time necessary for the car wheel to move from said contact member to the normal position of the brake shoe is equal to or greater than said delay (that is to say if the speed is equal to or smaller than a given value), the switch or delayed action relay will have started the electric motor, which will have side tracked the braking shoe before the car wheel reaches the normal position thereof, and the car will not be braked.

It will therefore be readily understood that the value to which the speed of a car is reduced during its passage through the braking section of the track depends directly on the value of the delay of the retarded switch or delayed action relay. The present invention relates to a system for automatically adjusting the delays of all the retarded switches or delayed action relays of the braking section of the track, according to the above mentioned conditions which may be briefly summed up as follows:

The speed of a car on the braking section of the track will be reduced to a value such that:

If the preceding car is stopped on the storing section of the track, the car in question will stop adjacent the position of said preceding car;

If the preceding car is moving on the storing section of the track, the car in question will stop adjacent the position that will finally be occupied by said preceding car when the latter stops.

The adjustment of the delays of the retarded switch is automatically effected through electrical circuits controlled by the position of the cars on the storing section of the track, said circuits comprising the following elements:

1. One of the two lines of rails of the storing section of the track is divided into a plurality of insulated sections numbered 0, 1, 2, . . . 5. Beyond the insulated sections is a complementary section SC. The second pedal $q7$ of the last braking sub-section BS6 of the track may also operate as a section of the storing track. The apparatus according to my invention must be so devised that whenever a car is travelling on any one of the insulated track sections, an electric connection is established between continuous rail 105 and said insulated track section. The best way of obtaining this result is to make use of the car axles for establishing the desired electric connections. Instead of directly using the insulated sections of the rail, mechanical pedals adapted to close an electric contact when the car

passes a given point of the track might also be used. In practice, any suitable number of insulated sections may be employed, and the number of insulated sections on the drawing is merely given by way of example.

2. Each insulated section of the track (or pedal) is provided with the following devices:

- (a) a track relay RV;
- (b) two auxiliary track relays RVA and RVA';
- (c) a relay for delayed action or auxiliary circular switch RC comprising a driving relay RM, three sets of contact members or studs *Cp1*, *Cp2*, *Cp3*, and three contact arms *FrI*, *FrII*, *FrIII*, mounted on a common shaft *S* (see Figs. 1a and 1b) and adapted to move forward along said contact members or studs simultaneously and by successive steps at each current impulse sent into the driving relay RM (the various driving relays being referenced RM, RM0...RM5).

The mechanism adapted to produce that advance of arms *FrI*, *FrII*, *FrIII* along sets of contact studs *Cp1*, *Cp2* and *Cp3* respectively is the impulse device diagrammatically shown in Figs. 2 and 3. It comprises a ratchet wheel *a* adapted to cooperate with a pawl *b* carried by a bent lever *c* pivoted at *d*. The extremity of said lever comprises an armature *e* subjected to the action of relay RM, so that it will be readily understood that each current impulse sent through relay RM causes ratchet wheel *a* to rotate through a certain angle corresponding to the passage of the extremities of arms *FrI*, *FrII*, *FrIII*, carried by shaft *S*, from one contact stud of sets *Cp1*, *Cp2*, *Cp3*, respectively, to the adjacent contact stud. As will be seen on Fig. 1b, referring more particularly to relay RM2, the bent lever *c* is also adapted when armature *e* is attracted, to push a contact piece *111* apart from a contact piece *112* so as to break an energizing circuit for winding RM2, comprising the said contact pieces, as will be hereinafter described.

From Figs. 1a and 1b, it is apparent that all the contact studs or members in each set *Cp3* are interconnected; that in each set *Cp2*, the contact stud or members are separate from one another but that one contact stud or member in each set is connected electrically through wire *114* with the negative pole of battery *101*; and that in each set *Cp1*—some contact studs or members are interconnected into groups, and that a number of contact studs or members or groups of the same are connected as shown with the movable contact arms *Fr* of a multiple controller *C* to be hereinafter described.

3. For the entire track, a multiple controller *C* comprising as many controller elements *Bc0*, *Bc1*, *Bc2*, *Bc3*, *Bc4*, *Bc5*, *Bc6* as there are insulated track sections plus one. It has been supposed, although it is not necessary, that controller element *Bc0* corresponds to both pedal *q7* of the last braking sub-section BS₆, located before the first insulated track section (section 0), and to section 0.

It should be well understood that, in Figs. 1a and 1b, I have shown controller elements, or sets of contact studs *Bc0*, *Bc1*, *Bc2*, *Bc3*, *Bc4*, *Bc5*, *Bc6* side by side for the sake of clearness, but, that said elements are located one above the other in the same manner as elements *Cp1*, *Cp2*, *Cp3* of RC5 for instance.

Each controller element *Bc* comprises the following parts:

- (a) a movable contact arm *Fr* (*Fr0*, *Fr1*, *Fr2*, *Fr3*, *Fr4*, *Fr5* or *Fr6*) electrically connected to

certain contact members of sets *Cp1*, as shown in the drawings:

(b) a circular row *P* (*P0*, *P1*, *P2*, *P3*, *P4*, *P5*, *P6*) of insulated contact members or studs. Each of these contact members is connected to the winding *w* (*w1*, *w2*, *w3*, *w4*, *w5* or *w6*) of one of the delay controlling relays RCR (*RCR1*, *RCR2*, *RCR3*, *RCR4*, *RCR5*, *RCR6*) which will be hereinafter described. Taking, for instance, circular row *P6*, each of the contact members or studs of said row is connected to one of the windings *w1*, *w2*, *w3*, *w4*, *w5*, *w6*. As the number of contact members of *P6* is greater than the number of relays RCR, i. e. six, several of said contact members may be electrically connected together and to the same relay. In the accompanying drawings, arms *Fr0*, *Fr1*, *Fr2*, *Fr3*, *Fr4*, *Fr5*, and *Fr6* (which are all keyed to a common shaft) are shown in contact with contact member *L* of each of circular rows *P0*, *P1*, *P2*, *P3*, *P4*, *P5*, and *P6*. For the sake of clearness, Figs. 1a and 1b only show in solid lines the electric connections between contact members *L* of the different rows *P0* to *P6* and relays RCR to RCR6. For instance, contact member *L* of *P6* is connected to winding *w1* of *RCR1*; contact member *L* of *P5* is connected to winding *w2* of *RCR2*. I have also shown in dotted lines the connections corresponding to contact members *M* of the different rows *P0* to *P6*; for instance, the contact members *M* 30 of *P6*, *P5*, and *P4* are connected to the windings *w2*, *w3*, *w4* of *RCR2*, *RCR3*, and *RCR4* respectively, while the contact members *M* of *P3*, *P2* and *P1* are connected to the winding *w5* of *RCR5* and, finally, the contact member *M* of *P0* is connected to the winding *w6* of *RCR6*.

It should be well understood that the circular rows of contact members *P0*, *P1*, *P2*, *P3*, *P4*, *P5*, and *P6* which, for the sake of clearness, have been shown side by side in Figs. 1a and 1b, are, in fact, disposed above one another (in the same manner as rows *Cp1*, *Cp2* and *Cp3* shown in Fig. 3), all of the arms *Fr0*, *Fr1*, *Fr2*, *Fr3*, *Fr4*, *Fr5*, *Fr6* being rigidly mounted or keyed on a common shaft so as to be simultaneously controlled. Said shaft can be manually actuated so as to bring the whole of the arms into any desired position.

4. A plurality of relays RCR (*RCR1* to *RCR6*) serving to determine the exact time at which the braking devices are to work.

It has already been explained that the braking devices disposed along the braking section of the track are controlled through retarded switches which side-track the brake shoes a certain time after the cars have operated corresponding contact members placed on the braking section of the track. These retarded switches are shown at *Rot* (*Rot1* to *Rot6*) in Fig. 1c, and they are controlled through said relays RCR (*RCR1* to *RCR6*).

In order to more satisfactorily explain the function of said relays I will first briefly described the operation of the braking device controlling arrangement in any one of the braking sub-sections diagrammatically illustrated by Fig. 4.

This figure shows a rotary switch *Rot* (any of switches *Rot1* to *Rot6*) including a circular row of contact studs and an arm *Ca* integral with a ratchet wheel *g* cooperating with a pawl *h* carried by a bent lever *i* pivoted at *j* and actuated by a winding *o* inserted in the electric circuit *l*. Said circuit is provided with a battery *m*, a contact *n* periodically opened and closed by electric motor *k*, and a contact member *p* adapted to close said circuit *l* when a car *Wa* passes on a movable rail or pedal *q* provided in the braking section of the

track. This contact member is the one above referred to and it will readily be understood that, as soon as said contact member p has closed circuit l , ratchet wheel g begins to rotate step by step so that arm Ca is caused to pass successively upon the contact-studs of Rot . On the other hand, arm Ca is electrically connected with a circuit f including a relay BR for actuating the braking device (as diagrammatically shown in Fig. 4), one end of said circuit f being connected with the positive pole of battery 101 . The contact studs of rotary switch Rot are connected to the contacts 1 to 6 of relays RCR as will be hereinafter described and when one of said relays establishes a connection between the negative pole of battery 101 and a contact stud of Rot , and when arm Ca passes onto said contact stud, the positive and negative poles of said battery 101 are connected through circuit f and the braking device is caused to act, in other words, the corresponding brake-shoe is side-tracked. It will readily be understood that the interval of time, or delay, elapsing between the closing of circuit l (that is the closing of contact p by the passing of a car onto the corresponding contact member q) and the operation of the corresponding braking device depends on which of the contact studs of Rot is connected with the negative pole of battery 101 . The connections between said contact studs of Rot and the negative pole of battery 101 are controlled through relays RCR which are therefore called "delay controlling relays" and are themselves energized through controllers Bc ($Bc0$ to $Bc5$). The contact members p , the movable rails or pedals q , the relays BR in the various braking sub-sections $BS1$, $BS2$. . . $BS5$ are referenced $p1$, $p2$. . . $p5$; $q1$, $q2$. . . $q5$; $BR1$, $BR2$. . . $BR5$ respectively in Fig. 1c.

Means are provided whereby the arms Ca ($Ca1$, $Ca2$, . . . $Ca5$) of the various rotary switches Rot ($Rot1$, $Rot2$, . . . $Rot5$) are returned individually to normal positions, i. e. the positions shown on Fig. 1c after they have been operated as above described. Those means, described in applicant's French Patent No. 663,039, will now be set forth with reference to diagrammatic Fig. 6 which, for the sake of convenience, shows the means provided for braking sub-section $BS5$; it should be understood that similar means are provided for the other braking sub-sections.

An additional arm Ca^6 keyed to the same shaft as arm $Ca5$ (as indicated by a dotted line connection) is adapted to move over a row of contact members which are interconnected except for the extreme ones 301 , 302 , the latter being insulated electrically from the interconnected members 304 ; the interconnected contact members 304 are connected with one pole of battery m , while the additional arm Ca^6 is connected with the other pole through a contact member $p5^1$ actuated from pedal $q5$ simultaneously, with contact member $p5$, and another contact 300 adapted to be opened by the bent lever i^6 . Between contact p^6 and the winding 0^6 is inserted a further contact 303 adapted to be opened when $BS6$ is energized.

When a car depresses pedal q^6 , thus closing contact p^6 and opening contact $p5^1$, the arm $Ca5$ is moved step by step as above explained until it reaches a contact member or stud of $Rot6$ which is actually connected with the negative pole of battery 101 , and it drives with it the arm Ca^6 over the interconnected contact members 304 ; when Ca^6 reaches said contact member, or stud, $BS6$ becomes energized and the energizing

circuit for the winding 0^6 is opened since contact 303 is opened by $BS6$, so that the arms $Ca5$ and Ca^6 stop. However, as soon as the car releases pedal q^6 , the contacts p^6 and $p5^1$ resume the position shown on Fig. 6 so that the following energizing circuit for winding 0^6 is closed:

Battery m , row of contact studs 304 , arm Ca^6 , contact $p5^1$, contact 300 , winding 0^6 , battery m .

Thus bent lever i^6 is caused to rock as above explained and thereby to rotate ratchet wheel 10 g^6 by one tooth, but simultaneously to open contact 300 ; winding 0^6 is deenergized so that lever i^6 resumes its former position; then contact 300 falls, thus completing the energizing circuit for winding 0^6 and the operation continues until arm Ca^6 reaches contact members 301 , 302 which are insulated from contact members 304 ; the energizing circuit is opened. It is remarked that both arms have resumed their initial position.

Each of said relays RCR ($RCR1$ to $RCR5$) comprises a plurality of contacts 25 , 23 , 1 , 2 , 3 , 4 , 5 , 6 , and a winding w ($w1$, $w2$, $w3$, $w4$, $w5$, or $w6$) for controlling said contacts. Delay controlling relays RCR ($RCR1$ to $RCR5$) are connected, through their windings w ($w1$ to $w6$), on the one hand to controller devices Bc ($Bc0$ to $Bc5$) as above described, and, on the other hand to the negative terminal of battery 101 through contacts 23 , 25 of relays RCR of higher index number (for instance, relay $RCR1$ is connected to the negative terminal of battery 101 through contacts 23 , 25 of relays $RCR2$, $RCR3$, $RCR4$, $RCR5$, and $RCR6$; relay $RC2$ is connected to the negative terminal of battery 101 through contacts 23 , 25 of relays $RCR3$, $RCR4$, $RCR5$ and $RCR6$, and so on).

The different contacts 1 , 2 , 3 , 4 , 5 , and 6 of relays RCR ($RCR1$ to $RCR6$) are connected to the different contact studs of switches Rot ($Rot1$ to $Rot6$) according to a determined arrangement as shown in Fig. 1c. It will be seen that contact 1 of relay $RCR1$ is connected to the contact stud named $RCR1$ of switch $Rot1$. Contact 1 of relay $RCR2$ is connected to the contact stud named $RCR2$ of switch $Rot1$ and so on, the contacts 1 of the respective relays RCR ($RCR1$ to $RCR5$) being connected respectively to the contact studs of switch $Rot1$ that bear the corresponding designations. In a likewise manner the contacts 2 of all the relays RCR ($RCR1$ to $RCR6$) are respectively connected to the contact studs of switch $Rot2$, said contact studs being named after the relay to which they are respectively connected, and so on, the respective contacts 6 of relays RCR ($RCR1$ to $RCR6$) being connected to the contact studs of switch $Rot6$ respectively. This arrangement is clearly shown in the drawings and need not be further explained.

Now, as shown in Fig. 5, when a relay RCR (any of relays $RCR1$ to $RCR6$) is energized, that is when current is caused to flow through its winding w , movable piece 23 is caused to pivot away from piece 25 and it pushes contacts 1 , 2 , 3 , 4 , 5 and 6 toward the right hand side of the figure so that all these contacts touch each other. The current from winding w is then allowed to flow through piece 23 in parallel through said contacts 1 to 6 to the corresponding contact studs of switches $Rot1$ to $Rot6$ respectively, thus determining a given set of delays for the operation of the braking devices respectively connected to said switches $Rot1$ to $Rot6$. Each delay controlling relay RCR ($RCR1$ to $RCR6$) corresponds to a determined set of delays, and, as it

will be hereinafter explained, only one of said relays can be energized at a time.

Obviously any suitable number of retarded switches *Rot* can be employed and six of these have been herein represented by way of example.

The apparatus comprises as many delay controlling relays *RCR* as there are different time delays employed for said retarded switches *Rot*.

Obviously, delay controlling relays *RCR* might as well (in different applications of my invention) serve to control the operation of lamps, electric bells, signal devices or the like, which might require operation in well determined conditions.

5. A motor *K*₁ running at constant speed closes a contact *CI* at regular intervals through the action of one cam of suitable shape.

Referring now to Figs. 7a and 7b, the arrangement comprises, in that case by way of example, 13 track sections: *RC*5 in the circular switch of the sixth track section which has been chosen by way of example, and this switch comprises three contact arms and is constructed on the aforesaid principle.

The contact stud 1 of the row *Cp*1 of circular switch *RC*5 is not connected as it would be according to Fig. 1a (according to this figure it would be connected with the centre of the last controller element *Bc* on the left of Fig. 1a, i. e. an element that would bear reference character *P*14). It is connected with an additional controller element *Bc*'6; contact stud 2 is connected with another additional controller element *Bc*'6 and so on. The controller elements are similar to the elements *Bc* of the preceding figure, and the central arms are mounted on a common driving shaft. As observed the corresponding contact studs of said controller elements are connected to relays *RCR* etc. In the example shown the storing section of the track comprises 13 insulated sections; the remainder of the track forms the complementary section and the whole arrangement hence includes 14 groups of additional controller elements the number of controller elements or rows of contact studs diminishing in each group when proceeding from the first to the last track sections.

Referring now to Fig. 8, the number of elements in the controller remains the same as in Figs. 1a, 1b, and 1c but herein each auxiliary switch, corresponding to a track section, has, besides the two rows of contact studs *Cp*2, *Cp*3 and in lieu of the row *Cp*1 (such a row *Cp*1 being visible on Figs. 7a and 7b) a number of rows of contact studs; there are as many supplemental rows of contact studs with corresponding rotary arms, as the controller arms may assume different positions on the studs of its elements. In Fig. 8, the supplemental rows have been termed *Cp*'1, *Cp*'1' . . . *Cp*'(n-1), *Cp*'(n). For each circular switch *RC*, the rotary arms *Fr*I', *Fr*I'' . . . *Fr*I'(n-1), *Fr*I'(n) associated with the supplemental rows of contact studs are mounted on the same shaft (not shown) as the rotary arms for *Cp*2, *Cp*3 and move concurrently with them. On the other hand, the center of each supplemental row, i. e. the corresponding rotary arms, is connected with a contact stud of the controller element of the track section that is being considered, for instance *Bc*6.

It is reminded that the cars, before entering the storing section of the track, are first subjected, in the braking section of the track, to braking actions so controlled by the apparatus

according to the invention (as will be hereinafter set forth) that they will stop as near as possible to one another without risking being deteriorated by bumping against one another. Accordingly it is assumed that the cars move from right to left on Figs. 1a, 1b, and 1c.

It will be supposed, as shown in the drawings, that the contact arms of controllers *Bc* are on the contact pieces numbered *L*, and the case will be considered in which the track is entirely free, 10 or is occupied only in the part designated as section *SC*.

Case I.—In this case the relay *RCR*1 is energized by the following circuit: positive terminal of battery 101, wires 102, 103, 115, 104, contact 15 arm *Fr*6 of controller *Bc*6, contact piece *L* of said controller winding *w*1 of relay *RCR*1, contact members 25, 23 of successive relays *RCR*2, *RCR*3 . . . *RCR*6, wire 116 and negative pole of battery 101. As current passes through said winding *w*1, the armature 23 of the relay is energized and rotated toward said winding, thus pushing contacts 1, 2, 3, 4, 5, and 6 toward the right hand side of the figure so that contact 23 and contacts 1, 2, 3, 4, 5, and 6 are all in contact with one another (position shown in Fig. 5) and are also electrically connected with the negative pole of battery 101 through contact members 25, 23 of successive relays *RCR*2, *RCR*3 . . . *RCR*6 and wire 116. Now, each of these contact pieces 1, 2, 3 . . . 6 of relay *RCR*1 is respectively connected to the contact studs numbered *RCR*1 of the above mentioned time retarded switches *Rot*. For instance, it can be seen in the drawing that contact piece 1 of relay *RCR*1 is connected to contact stud numbered *RCR*1 of switch *Rot*1. Likewise, contact piece 2 is connected to the contact stud numbered *RCR*1 of retarded switch *Rot*2, and so on. Under these conditions it will be readily understood that, when relay *RCR*1 is energized as above explained, the negative pole of battery 101 is connected through wire 116 and contact pieces 1, 2, 3 . . . 6 to the contact studs numbered *RCR*1 of all the switches *Rot*1, *Rot*2, *Rot*3, . . . *Rot*6 respectively.

Case II.—The case will now be considered of a car entering upon track section 5 and stopping upon this section (the effect produced by this car upon the preceding track sections 0 to 4 will be further studied).

When the first axle of this car enters section 5 the corresponding track relay *RV*5 is energized by the circuit comprising the positive terminal of battery 110, the common rail 105, the axle of the car, the insulated section of rail 5, the winding of relay *RV*5, the wire 227 (Figs. 1a and 1b), the contacts 15, 16 in series of relays *RVA*'2, *RVA*'1, *RVA*'0 and *RVA*', and the negative terminal of battery 110. When said relay *RV*5 is energized, its local contacts are closed, and the auxiliary relay *RVA*5 is energized by the following circuit: positive pole of battery 101, wire 117, contacts 5, 4 of relay *RV*5, winding of *RVA*5, wire 113, wire 106, and negative pole of battery 101. Accordingly, every time contact *CI* is closed by constant speed motor *K*1, current flows through the following circuit: positive pole of battery 101, wire 102, wire 103, winding of electric relay *RM*5 (of auxiliary circular switch *RC*5), contacts 3, 11 of relay *RVA*5, normally closed contacts 10', 10 of relay *RVA*'5, wire 118, contact *CI*, and negative pole of battery 101. Every impulse of the current (produced by a closing of contact *CI*) will cause the three arms *Fr*I, *Fr*II and *Fr*III of circular switch *RC*5 to move one step forward

under the action of electric relay RM5 (see Figs. 2 and 3).

When the contact arm FrI of circular switch RC5 has reached the first contact piece of set CpI to which is attached a connection, namely contact stud 1, current is set up in the following circuit: positive pole of battery 101, wire 107, contacts 17, 18 of relay RVA5, arm FrI, contact stud 1 of CpI, wire 104, contact arm of the set of contacts Bc6 of the controller, and (for the position of this contact arm shown in the drawing) contact piece L of the set of contacts Bc6, wire 218, winding w1 of RCR1, normally closed contacts 25, 23 of successive relays RCR2, RCR3, RCR4, RCR5 and RCR6, wire 116 and the negative pole of battery 101. As previously explained, current was already supplied to the winding w1 of relay RCR1, as a result of the occupation of track section SC through the following circuit: positive terminal of 101, wires 102, 103, 115, 104, contact arm Fr6 of controller Bc6, contact piece L of said controller, winding w1, contact members 25, 23 of the successive relays RCR2, RCR3 . . . RCR6, wire 116, and negative pole of 101. Therefore, from the mere view-point of the energizing of relay RCR1, the presence of a car on section 5 of the storing portion of the track has not changed anything. However, I have deemed it necessary to fully describe how the presence of a car on said section 5 of the storing portion of the track causes the closing of a circuit which would energize relay RCR1 if the latter were not already energized because first the closing of said circuit brings certain pieces into position that they did not occupy when no car was present on section 5 of the storing portion of the track, and secondly as the energizing of the other relays RCR2 to RCR6 takes place in a manner similar to that described for RCR1, it will not be necessary to repeat the description of the energizing of said relays RCR2 to RCR6.

Relay RCR1 being thus energized, all the contact studs marked RCR1 of the different rotary switches Rot (Rot1 to Rot6) are connected to the negative terminal of battery 101. Therefore, when a second or subsequent car moving on the braking section of the track passes on one of the pedals q, it closes, through corresponding contact member p, the circuit l of the rotary switch that corresponds to said contact member, and causes the arm Ca of said rotary switch to move along the contact studs of the switch. As soon as said arm Ca comes onto the contact stud named RCR1 (see Fig. 4), current is allowed to pass from the negative terminal of battery 101, wire 116, contacts 23 and 25 of relays RCR6, RCR5, . . . RCR2, contact 23 and one of the contacts 1 to 6 of RCR1, through said contact stud RCR1, arm Ca, the relay BR of the corresponding braking device, and wires 119 and 102 (Figs. 1c and 1b) to the positive terminal of battery 101, thus causing said braking device to operate a predetermined time after said car has engaged pedal q. It should be borne in mind that the operation of the braking device as hereinbefore stated results in a side-tracking of the corresponding braking shoe, the latter being thus rendered inoperative. The operation is the same for all the braking devices that are distributed along the braking section of the track, the delay elapsing between the passage of the car on the pedal and the action of the corresponding braking device being determined for each of them by the fact that the contact stud marked RCR1 of each of the rotary switches is

connected to the negative terminal of battery 101.

The aforesaid connections between the contact studs RCR1 of the rotary switch and the negative terminal of battery 101 will remain established as long as the contact arm FrII of the auxiliary circular switch RC5 is not in contact with the only contact piece of the set of contacts that carries a connection (in the drawings said contact piece is numbered 22).

The distance between the first stud met by the contact arm of FrII, and the stud 22 that is provided with a connection has been so chosen that the step-by-step movement of arm FrII from said first stud to stud 22 takes a time longer than the maximum time necessary for a car moving merely under the effect of a previous impulse for travelling throughout the section and stopping beyond said section. In other words, this distance has been so chosen that whenever stud 22 is reached by arm FrII owing to the presence of a car upon section 5, one is sure that the car can no longer leave the section but has stopped thereon. This is now the case in view of the above stated assumption that the car entering track section 5 is one that stops on said section.

At this time, relay RVA5 is energized by the following circuit: positive pole of battery 101, wire 117, contacts 5, 4, 3 of relay RV5, winding of RVA5, contact arm FrII of circular switch RC5, contact piece 22 of said switch, wire 114, and negative pole of battery 101. Therefore, the electric relay RM5 of said circular switch no longer receives current impulses controlled by motor K1, as the above described circuit of said electric relay RM5 is opened at 10, 10' of RVA5 (relay RVA5 being energized) and the three contact arms Fr stop in the position corresponding to contact piece 22.

Since contact arm FrI is stopped on contact piece 22, the following circuit is established: positive pole of battery 101, wire 107, contacts 17, 18 of RVA5, contact arm FrI, contact 22 of CpI, wire 120, contact arm Fr5 of Bc5 of the controller, contact piece L of P5, wire 217, winding w2 of RCR2, contacts 25, 23 of successive relays RCR3, RCR4, RCR5 and RCR6, wire 116, and negative pole of battery 101. Therefore relay RCR2 is energized; its local contacts 23, 25 and 1 to 6 are closed and the negative pole of battery 101 is connected through wire 116 and said contacts 1 to 6 to the contact members corresponding to RCR2 of retarded switches Rot, as explained in the preceding case when relay RCR1 was energized.

It is very important to remark that, when relay RCR2 is energized, this opens the contacts 23, 25 of this relay and hence breaks the circuit connecting the local contacts of relay RCR1 to the negative pole of battery 101. Therefore, in the retarded switches Rot, the contact studs corresponding to RCR1 are no longer connected to the negative pole of battery 101. Instead of them the contact studs marked RCR2 of all the rotary switches Rot, (Rot1 to Rot6) are connected to the negative terminal of battery 101. In this case the time elapsing (a) between the depression or engagement of any one of the pedals q by a car running on the braking section of the track, and (b) the actuation of the corresponding braking devices (i. e. the side tracking of the corresponding braking shoes) is equal to the time taken by the arm Ca of each rotary switch Rot (Rot1 to Rot6) for passing from its zero position, to the position in which it is in contact with the con-

tact stud marked RCR2. As a rule, these time delays are greater than those corresponding to studs RCR1. However in some particular cases the contact stud marked RCR2 of a rotary switch Rot may be electrically connected to the contact stud RCR1 thereof and the delay is then the same as if stud RCR1 was directly connected to battery 101.

Thus, when section 5 is occupied by one or several cars either stopped or about to stop on said section as above assumed the minimum speed for which the following cars present on the braking section of the track will be braked will be lower than when the storing section of the track was free or was occupied only in section SC.

The preceding explanations clearly set forth the essential feature of the present invention which is the following:

Each car passing on the braking section of the track starts, through pedal *q* and contact member *p*, the movement of the rotary switch Rot corresponding to said contact member, but the delay imposed by said rotary switch (between the passage of said car on pedal *q* and the side tracking of the braking device) is controlled, through one of the RCR relays by the preceding car (the last of those present on the storing section of the track) according to the position of the point at which the said preceding car is stopped or will stop, it being again reminded that said last car is supposed to be incapable of travelling beyond track section 5.

Case III.—For any track section preceding section 5 (for instance for section 4) a car that enters this section by its front axle and is assumed to stop in said section will cause, as in the case of section 5, the energizing of the corresponding track relay RV4 and hence the functioning by successive steps of the auxiliary circular switch RC4. But the feed circuit of the electric relay RM of a circular switch RC will differ according as the following section (5 in the example chosen) is occupied, or not, by one or more preceding cars that have stopped on said section.

Case A.—Section 5 is not occupied

In that case, as above noted, the relay of track RV5 is not energized, and the same is true for the auxiliary track relays RVA5 and RVA'5. On the other hand, since RV4 is energized owing to the presence of the car assumed to stop on section 4, RVA4 will also be energized, the electric circuits being analogous to those above described concerning RV5 and RVA5.

Under these conditions, the feeding circuit of the electric relay RM4 of the auxiliary circular switch RC4 is closed through the following circuit: positive pole of battery 101, wire 102, wire 103, winding of RM4, contact pieces 3, 11 of RVA4, contact pieces 6, 5 of RVA5, contact pieces 10', 10 of RVA'4, wire 118, contact CI, operated by motor KI, and negative terminal of battery 101. Thus the switch RC4 is rotated. Its three arms move forward synchronously and step by step every time the circuit is closed through contact CI (see Figs. 3 and 4). As above noted, the displacement of the arm FrI of RC4 produces in particular the following effects:

1. Relay RCR1 is energized when said arm is on the contact pieces 1 to 6 of Cp1, the circuit being as follows: positive terminal of battery 101, wire 107, contacts 17, 18 of RVA4, arm FrI of RC4, contact studs 1 to 6 (which are electrically connected together) of Cp1, wire 104, arm Fr6 of controller Bc6, contact member L of

P6, wire 218, winding w1 of RCR1, contacts 25—23 of RCR2, RCR3, RCR4, RCR5 and RCR6, wire 116, and negative terminal of battery 101.

2. Relay RCR2 is energized when the arm in question is on one of the contact pieces from 7 to 17 of Cp, the circuit being similar and including wire 120.

Therefore, the negative pole of battery 101 is connected successively to the contact studs corresponding to RCR1 of all the switches Rot, and to the contact studs corresponding to RCR2 of all the switches Rot.

When the arm FrII reaches the only contact piece 18 of its set of contacts that is provided with a connection (and this takes place, owing to the arrangement of the set of contacts as above set forth concerning the set Cp2 of RC5, when the car has remained for such a time upon section 4 that it has already stopped or is about to stop on said section), the following will occur, in a similar manner to what has been already explained concerning the occupation of section 5:

(a) Relay RVA'4 is energized through a circuit including negative terminal of battery 101, wire 114, contact stud 18 of Cp2 in RC4, arm FrII of Cp2, contacts 3, 4, 5 of RV4, wire 117, wire 102 and positive terminal of battery 101.

(b) Electric relay RM4 no longer receives the impulses and the auxiliary switch RC4 stops.

(c) Relay RCR3 is energized.

(d) The negative pole of battery 101 is connected to the contact studs corresponding to RCR3 of the retarded switches Rot of all the braking sub-sections.

In this manner, a new group of delays will be employed for all these braking elements, and due to the constructive factors, these delays will exceed or at least be equal to those produced by RCR2.

Case B.—Section 5 is occupied by one or several cars already stopped or about to stop on said section

In that case, relay RV5 is energized, as well as auxiliary relay RVA'5. On the other hand, relays RV4 and RVA4 are energized.

Under these conditions, the energizing circuit of relay RM4 of the auxiliary switch RC4 is closed as follows: positive pole of battery 101, wire 102, wire 103, winding of RM4, contact pieces 3, 11 of RVA4, contact pieces 7', 7 of RVA'5, contact pieces 10', 10 of RVA'4, wire 118, contact CI of motor KI and negative pole of battery 101.

It will result therefrom, as in the preceding case, that the switches Rot of all the braking elements will be connected to the negative pole of battery 101, through the contact studs corresponding to the following relays RCR, given 60 in their order:

RCR1 during the travel of the arm FrI of RC4 upon contact pieces 1 to 6, the circuit having already been described.

RCR2 during the travel of the arm FrI of RC4 upon contact pieces 7 to 17.

RCR3 when the arm FrI of RC4 comes upon contact piece 18. The circular switch stops at this time, since as just above set forth the car has been upon the section for such a time that it has stopped or is about to stop thereon, and since the distance between the first stud on Cp2 and the stud 18 has been chosen exactly as above explained with reference to stud 22 on Cp2 in the rotary switch RC5.

Since the energizing of one relay RCR, due to its construction, will cut off the connection with the negative pole of battery 101 of the relays RCR which precede it (RCR₂ cuts off that connection for RCR₁, RCR₃ for RCR₂ and RCR₁, and so on) and since the delays have increasing values from RCR₁ to RCR₆, the following will occur, considering for the present time only the action of a car upon a track section upon which it is stopped or is about to stop:

1. The device will automatically vary the delays elapsing between the depression of pedals *q* by subsequent cars on the braking section and the operation of the braking devices BR in accordance with the state of occupation of the storing section of the track since those delays depend upon those relays RCR which are connected with the negative pole of battery 101.

2. The delays employed become greater as the track is being filled up. The brake shoe of each braking element will be side tracked from before the cars only for smaller and smaller speeds of said cars, or otherwise stated, the car will be more likely to be braked by the shoe of each element as a longer portion of the storing section of the track is being occupied and as the space between the braking section of the track and the stopped cars becomes smaller.

3. If all the track sections are not occupied, it is in all cases the track section nearest to the braking section of the track that determines the range of delays of the retarded switches of the different braking elements as might be easily shown by repeating the above explanations in connection with the other track sections, and as may be inferred from what has been just above specifically described.

In all that precedes, the case relates to a car entering a determined track section and stopping upon this section.

Case IV.—If a car only clears the said determined track section without stopping, it is observed in the figure that for any given section, for instance section 2, the track being entirely free, or occupied on the last section such as section 5 (i. e. the relay RCR₂ being energized). As soon as the first axle of the car comes upon track section 2, relay RV₂ is energized, thus energizing relay RVA₂; the circuit relay of RC₂ is closed through (+) of battery 101, wires 102, 103, winding RM₂ of RC₂, contact pieces 3, 11 of RVA₂, wire 204, contact pieces 6, 5 of RVA₃, wire 203, contact pieces 10', 10 of RVA₂, wire 118, contact CI of the motor K₁, and the (—) terminal of battery 101.

When the first axle of the same car reaches the next track section, for instance the section 3 in the present example, the relay RV₃ is energized, thus energizing the relay RVA₃, and the circuit of the relay RM₂ of the auxiliary switch RC₂ is cut off at the points 6, 5 of RVA₃. The auxiliary circular switch RC₂ is thus stopped, and its three arms remain in the position which they occupied when the first axle of the car entered the track section 3.

It is to be further noted in view of the foregoing explanations that the auxiliary circular switch RC of a track section is set in movement when the first axle of a car enters this section, and that it stops when the same axle leaves the section; thus, as concerns the functioning of the plant, the time during which the car controls the auxiliary circular switch RC corresponding to the said section is the time during which the

first axle of the car is situated upon this section. This time depends solely upon the speed of the car, and is quite independent of the length of the car and of the distance between axles.

In any case, the circular switch RC₂ being stopped, its arms FrI and FrII will not have reached the contact piece 18 which, due to the construction as above explained, is only reached when the car has remained for such a time upon the track section that it has stopped or is about to stop thereon. From Fig. 1b, it is apparent that the intermediate contact pieces between 1 and 18 on CpI are so interconnected as to form four groups for the particular relay RC₂ that is being considered. It is also clear from Figs. 1a and 1b that the first group (including contact piece 1) is connected with Bc6, the second group with Bc5, the third group with Bc4 and the fourth group with Bc3, while none of these groups is connected with either Bc2, Bc1 or Bc0. In view of the connections just above set forth, while neither RCR₅ nor RCR₆ can be energized, one of the relays between RCR₁ and RCR₄ is energized, the choice of the relay thus energized depending on the group of contact pieces over which the arm FrI of RC₂ has stopped. In view of the fact that FrI is moved step by step in the clockwise direction so that it meets the groups in the order above stated, it is clear that the relays RCR are energized in the order RCR₁, RCR₂, RCR₃, RCR₄, either of which is finally energized according as whether FrI moves for a shorter or longer time i. e. according to the time for which the car shall have travelled over the section or in other words according to the speed of the car.

If this speed is such that the car cannot proceed beyond a section *n* (for instance section 4) the arrangement will be such that while the car is upon section 2 under consideration, the arms, and in particular the arm FrI, will have reached contact piece 7 of CpI (in the present example), which energizes the relay RCR₃ by means of the controller Bc4 corresponding to section 4, as if this section were already occupied.

Thus the group of delays that relay RCR₃ is adapted to cause as concerns the side-tracking of the brake-shoes in the various braking subsections, is substituted for the group of delays that relay RCR₂ is similarly adapted to cause (the latter delays being brought into play when track-section 5 considered by way of example is occupied).

In these conditions, a car travelling upon the braking apparatus before the preceding car is stopped, will be braked, not according to the actual occupation of the track, to wit:

(a) section 5 for the cars already stopped according to the present example;

(b) section 2 for the car in movement; but according to the point at which the preceding car will stop (section 4).

To recapitulate, when the cars are still travelling on the track, the succeeding cars are not braked according to the point at which these cars are situated, but according to the points which they will reach, each time that these cars, for any reason, have not a sufficient speed to reach and make contact with the set of stationary cars gathered upon the track.

The electric device corresponding to each track section will return to the inoperative position in the following conditions for the different cases which may arise. Two cases may occur:

Case A.—The car clears a track section without stopping.

(a) The succeeding section is occupied by a stopped car.

By way of example, the case will be considered in which the track section 2 is cleared by a car while the section 3 is occupied by a stopped car.

In these conditions:—

1. The relay RV₂ and hence the relay RVA₂ are no longer energized when the last axle of the car in movement has left the section 2.

2. The contact arms of the circular switch RC₂ have been brought, as stated, upon one of the contact pieces 1 to 17. It is reminded that said arms Fr of the circular switch RC₂ cannot reach contact stud 18 in view of the assumption that the car does not stop upon section 2 and of the fact that the switch has been so designed that only those cars which cannot travel beyond section 2 are adapted to bring the arms Fr of RC₂ onto contact studs 18.

3. The relays RV₃ and RVA₃ are energized since section 3 is occupied by a stopped car; this closes the circuit: (+) of battery—101, wire 103, winding of the electric relay RM₂, contact pieces 3, 4 of RVA₂, contact pieces 111, 112 of relay RM₂ of switch RC₂, arm Fr_{III} of RC₂, set of contact pieces Cp₃ used with said arm Fr_{III}, contact 7 of Cp₃, wire 207, contact pieces 19, 20 of RVA₃, wire 113, and the (—) terminal of battery 101. The relay RM₂ is energized; its armature *e* is attracted, and the arms are moved forward by one contact piece (by lever *c* as described with reference to Figs. 2 and 3), but at the same time the energizing circuit of the relay is broken at *x* because contact piece 111 is pushed apart from contact piece 112 by the arm *c* movable with the armature *e*, so that the armature *e* of RM₂ again returns to the inoperative position. At this time, the energizing circuit of RM₂ is again closed, and so on, as long as the arm Fr_{III} is in contact with a contact piece of its series Cp₃ and has not returned into the inoperative position as shown in the figure. In this position, the energizing circuit of RM₂ is definitely broken at *y*, and the apparatus is again ready to operate.

(b) The succeeding section is not occupied. In this case, and in the same example, it will be remarked that, contrary to the preceding case, the relay RVA₃ is not energized except in the case where the car which has left the section 2 has stopped upon section 3. It is only at this time that the energizing circuit of RM₂ will be closed and that the motor relay corresponding to section 2 may resume its inoperative position, as above stated. If, on the contrary, the car which leaves the section 2 does not stop upon section 3, it will reach the section 4, and the following conditions will prevail:

1. The relay RV₂ and hence the relay RVA₂ are no longer energized.

2. The contact arms Fr_I and Fr_{II} of RC₂ are upon one of the contact pieces 1 to 17.

3. The relay RVA₃ is not energized.

4. The relays RV₄ and RVA₄ are energized. Hence the following circuit is closed: (+) of battery 101, wire 103, winding RM₂, contact pieces 3, 4 of RVA₂, contact *x* (contact pieces 111, 112) of RM₂, arm Fr_{III} of RC₂, contact 7 of Cp₃, wire 207, blade 19 of RVA₃, contact pieces 8, 9 of RVA₄, wire 113, and (—) terminal of battery 101. The contact arms of RM₂ move forward step by step as in the preceding case, and the switch RC₂ resumes the inoperative position.

It will be observed in this case (i. e. in the case

where a car in movement on section 2 is assumed not only to clear said section but to clear subsequently the following section, to wit, section 3) that the switch RC₂ cannot return to the inoperative position until the car has reached the section 4 and has therefore cleared the section 3; consequently the arms of RC₂ will remain in the position which they have assumed when the car leaves the section, and the corresponding relay RCR that has been brought into play according to the position of Fr_I on Cp₁ in the switch RC₂, remains energized until the arm Fr_I of the switch RC₃ (which, as soon as the car enters track section 3, is moved step by step bringing into play successive relays RCR in the sequence RCR₁, RCR₂ . . . as hereinbefore explained) stops on a stud of Cp₁ which depends upon the speed of the car on section 3, said arm Fr_I of RC₃ being stopped when the first axle of the car enters section 4 as above explained. Thus it may be said that the definitive control of the relays RCR from the switch RC corresponding to a given section (for instance section 2) after a car has cleared said section can be replaced by a new control of said relays RCR (due to the car running or coming to a stop beyond section 2) only when the car has caused the switch RC corresponding to the following section (section 3) to reach the definitive position in which in its turn it will impose a definitive control on relays RCR.

Case B.—The car enters a track section for instance section 2 and stops upon said section. As soon as it enters section 2, the arms Fr_I, Fr_{II}, Fr_{III} of the circular switch RC₂ are set in motion as just above described but, since the car is assumed to stop on section 2, arm Fr_{II} can step as far as the stud 18 of Cp₂. When it reaches said stud 18, the winding of the auxiliary relay RVA₂ is energized and the winding of RM₂ is accordingly de-energized, as already explained. Hence the three arms Fr_I, Fr_{II}, Fr_{III} of switch RC₂ stop and remain there, if the car remains on section 2. Should the car be brought on to next section (section 3) by any means, then it is clear that the three arms will return to the inoperative position, the action taking place as above stated for the case of a car in motion which clears a track section without stopping.

It should be observed that as the marshalling of cars goes on, the storing section receives more and more cars, so that successively section SC, section 5, section 4 and so on are occupied by stopped cars; every time a new section is occupied by a stopped car it is clear from the foregoing explanations that new relays RV, RVA, RVA' are and remain permanently energized.

To obviate the energizing of an excessive number of relays, and in order to economize electric current, it is observed according to the diagram that the occupation of a section, for instance section 2, will break the energizing circuit of relay RV₅ (and therefore of relays RVA₅ and RVA'₅) as will be apparent from the hereinafter explanations.

In fact if the section 2 is occupied by a stopped car, the auxiliary relay RVA₂ is energized, and the energizing circuit of the track relay RV₅, that is: positive terminal of battery 110, common rail 105, insulated rail 5, winding of the track relay RV₅, wire 227, contact pieces 15, 16 of all the auxiliary relays RVA' of section 2 and all the preceding ones (RVA'₁, RVA'₉, RVA') wire 228, and negative terminal of battery 110, is broken at 15—16 of auxiliary relay RVA₂. Since track relay RV₅ 75

is de-energized, relays RVA5 and RVA'5 are also de-energized. Similarly, if section 1 is occupied by a stopped car, it will be seen that since RVA'1 is energized and accordingly contact pieces 15, 16 thereof are spaced apart, not only track relay RV4 and consequently relays RVA4 and RVA'4 are de-energized but also track relay RV5 (whose winding is connected to contact piece 15 of RVA'1 through wire 227 and contact pieces 15, 16 of RVA'2) is no longer energized.

In other words, generally speaking, the presence of a stopped car on any section S_x will result in breaking the energizing circuit of relays RV_{x+3} , RVA_{x+3} , RVA'_{x+3} and of the relays of preceding sections.

In the preceding considerations, it has been supposed that all the contact arms of the controller C are in the position L, and it has been observed that in these conditions, the groups of delays in use will vary from the group produced by relay RCR1 to the group produced by relay RCR6, according to the occupation of the track.

If the controller is operated by hand in such manner as to bring all the movable arms Fr thereof into the position M, for instance, it is observed that the retarding relay RCR1 is no longer electrically connected to any of the single controllers, and that the relays RCR2 to RCR6 are alone connected to such controllers, according to the dotted lines.

In this manner, according to the occupation of the track, and for the said position of the controller (position M) the groups of delays employed will vary between that corresponding to relay RCR2 and that corresponding to relay RCR6.

For other positions of the arms of the controllers, the groups of delays will vary from RCR3 to RCR6, from RCR4 to RCR6, etc.

Finally, for a certain number of positions of the contact arms of the controllers, the groups of delays employed will indeed vary between those due to the relay RCR1 and those due to the relay RCR6, but they can only be controlled by the track sections nearest the braking section of the track; thus, in this instance, the operation is the same as if the other sections were incorporated into the so-called complementary sections SC, which have neither track relay, nor auxiliary relays. In this manner, and according to the position of the contact arms of the controller, the delays that relays RCR1 to RCR6 assign to the braking apparatus, i. e., the delays for the side-tracking of the braking shoes in front of a car running on the braking section, are controlled by the 5, 4, 3 etc. track sections that are nearest to the braking section of the track.

The combinations thus afforded are established once for all, but the variation of their relations to the other constants of the apparatus, depending upon the atmospheric conditions, must be preliminarily calculated.

Assuming that the various arms Fr of the controller are positioned on studs L of corresponding banks of studs P0, P1, P2 etc. when the atmospheric conditions are normal, it has been explained that the delays for the side-tracking of the braking shoes in the braking section are given by one or the other of the relays RCR1 to RCR6, according to the actual state of occupation of the storing section by stopped cars. Relay RCR6 corresponds to the strongest braking action (the storing section is full) i. e. any car passing in the braking section is so braked as to

run at the lowest possible speed when leaving said braking section. Relay RCR1 corresponds to the storing section being empty and the speed left to a car, in this case, is such that the latter may run as far as the end of complementary section SC.

Let us now assume that the atmospheric conditions are no longer normal:

(1) When, for instance, wind interferes with the movement of cars, the latter should have on leaving the braking section a higher speed than in case of normal conditions and the delays for side-tracking the braking shoes should be less (except when the storing section is full; in this case, relay RCR6 is used which gives the strongest braking action). Accordingly, instead of the delays given by relay RCR2, use should be made for instance of the delays given by relay RCR1. For an intermediate occupation of the storing section, use should be made for instance of the delays given by relays RCR2 to RCR6, instead of the delays given by relays RCR3 to RCR6.

(2) If wind pushes the car, use is still made, when the storing section is full, of relay RCR3 since it is the relay giving the strongest braking action. However assuming a given section to be occupied by cars, longer delays should be brought into play than in the foregoing instance, since wind pushes the cars. In this case, while relay RCR6 is still used when the track section nearest to the braking section is occupied, one should use for instance relay RCR2 or even relay RCR3 instead of relay RCR1 when the storing section is empty.

Reverting now to Figs. 1a, 1b, and 1c it will be seen, as indicated by the full lines and dotted lines extending between banks P0, P1, P2, etc. of the controller and relays RCR1, RCR2, etc. that indeed the relay RCR on use in each instance can be varied, for a given section, according to the position of the arms Fr of the controller, i. e. according to atmospheric conditions. For instance assuming track section 4 to be occupied by stopped cars, relay RCR3 is used when arm Fr4 of the controller is placed on stud L (the connection is shown in full line between contact stud L of P4 and winding w_3 of RCR3), while RCR4 is used when the arm Fr4 of the controller is placed on stud M (the connection between the stud M of P4 and winding w_4 of RCR4 being shown in dotted line) the various positions L, M etc. of arms Fr of the controller corresponding to different atmospheric conditions.

Thus it is clear that the arrangement of Figs. 1a, 1b, and 1c allows of the atmospheric conditions being taken into account in the control of the braking apparatus, provided however that the storing section of the track is occupied by stopped cars. As will be hereinafter apparent, the arrangement shown in Figs. 1a, 1b, and 1c does not permit this, when the cars are in movement on the storing section.

Let us consider a car having just left the braking section, running for instance on section 1 at a speed V and taking a time t for travelling over said section; when time t has elapsed the arm Fr1 of circular switch RC1 has reached a determined stud of Cp1, say stud 4.

Accordingly the following circuit is closed: positive terminal of battery 101, wire 107, contacts 17, 18 of relay RVA1 which is energized (since the presence of the car on section 1 results in energizing track relay RV1 and consequently auxiliary track relay RVA1), arm Fr1 of switch

RC1, stud 4 of RC1, wire 121, arm Fr4 of controller bank Bc4 and:

Either stud L (if the controller arms are in position L) winding w_3 of RCR3 and negative terminal of battery 101, through contacts 25, 23 of RCR4, RCR5 and RCR6, and wire 116 so that relay RCR3 is energized,

Or stud M (if the controller arms are in position M), winding w_4 of RCR4 and negative terminal of battery 101 through contacts 25, 23 of RCR5 and RCR6, and wire 116 so that relay RCR4 is energized.

Thus the car passing on track section 1 at speed V controls either relay RCR3 for position L of the controller, or relay RCR4 for position M.

But, as above described, cars having stopped on track section 4, bring into play the following relays:

RCR3 if arms Fr of the controller are positioned on studs L

RCR4 if arms Fr of the controller are on studs M.

Consequently, with an arrangement as shown in Figs. 1a, 1b, and 1c and in the case that is being considered, a car travelling over track section 1 at a speed V brings into play, for different atmospheric conditions, the same delay controlling relays as if it should stop on section 4. Now if the car moving at speed V is capable of reaching section 4 and stopping thereon when atmospheric conditions correspond to position M of the controller, it is quite possible that it will not stop on the same section 4 when, assuming it has the same speed V upon section 1, it is exposed to different atmospheric conditions (for instance those corresponding to position L) while it is moving from section 1 towards section 4. Thus RCR5 should not be brought into play in this case since RCR3 is the relay to be used when a car has stopped on section 4.

In other words, with the arrangement according to Figs. 1a, 1b, and 1c, the fact that a car passes on any section, say section 1, without stopping thereon means that, whatever be the atmospheric conditions, this moving car is equivalent to a fictive car that would be at a standstill at the place where said moving car will stop if the atmospheric conditions are normal.

Thus, if it is desired that the braking shoes should be side-tracked after strictly correct delays when the atmospheric conditions are no longer normal, the arrangement must be completed so that, for abnormal atmospheric conditions, the position of this fictive car is modified, in the correct direction and by the suitable distance, for instance from section 4 to either section 3 or section 5, according to circumstances.

These requirements may be met by providing the arrangement shown in Figs. 7a and 7b.

From Figs. 7a and 7b and from the foregoing explanations, it is clear that the new arrangement results in the provision of a much greater number of possible connections between the various switches RC and the various delay controlling relays RCR through the controller, the group of connections actually used for given atmospheric conditions being determined by the arms of the controller according to the position in which said controller has been set. With the arrangement shown on Figs. 7a and 7b, according to the time during which a given section has been occupied, the desired relay RCR is brought into play, account being taken, on the one hand, of the section upon which will stop the car moving with a given speed (the latter depending upon the pre-

vailing atmospheric conditions) and on the other hand of the braking which must be effected upon the succeeding car in order that it may be stopped upon the same section, taking account of the said atmospheric conditions. The arrangement thus comprises as many controller elements as there are contact studs having separate connections in the whole number of the said circular switches (for example circular switch Rc5 has been shown as including 8 connected contact studs). In each controller element, the arm is therefore electrically connected to a connected contact stud of a given circular switch, and the row of contact studs of said controller element is connected to suitable delay controlling relays RCR.

For given atmospheric conditions, the occupation of a given section results in a group of delays being used for the side-tracking of the various brake shoes in the braking section, said group depending upon which delay controlling relay RCR is brought into play. Considering any track section n , the delay controlling relay that is brought into play for given atmospheric conditions when said section is occupied may be called RCR $_n$. In like manner, the occupation of the section adjacent to the so-called complementary section will result in a relay RCR $_x$ being brought into play. Generally speaking, x and n will vary when the atmospheric conditions vary.

Hence the first connected contact stud of the circular switch corresponding to the section S should, irrespective of atmospheric conditions, cause the functioning of the relay RCR $_x$ inasmuch as its functioning shows that the car will travel to the end of the storing section of the track and as, according to what has been assumed above, RCR $_x$ is the relay brought into play when the most remote track section is occupied.

The last contact stud provided with a connection in the same circular switch of section S should also, irrespective of atmospheric conditions, be connected through the controller with relay RCR $_n$, for the following reason; as above explained, the switches are so devised that when the last contact stud provided with a connection is reached by the corresponding rotary arm, this means that the car causing this movement of the arm has stopped or is about to stop on the corresponding section; therefore as it has been assumed that the operation of RCR $_n$ corresponds to section S being occupied, the last contact stud in the circular switch of section S should always provide a connection with RCR $_n$.

Any intermediate contact stud between the first and the last studs above considered, said intermediate stud being called for instance the t th stud, will cause the operation of a delay controlling relay which may be termed RCR ($n-p$); the quantity $n-p$ cannot be less than the value x , and p is a constant as long as t is constant (while, as above stated, n varies when the atmospheric conditions vary).

Like results can be obtained by other arrangements than the aforesaid. Another such arrangement is shown in Fig. 8, by way of example, which is not of a limitative nature. It is readily apparent as a consequence of the description above given with reference to Fig. 8 that each controller element allows of bringing into play for any one of the atmospheric conditions provided for by the controller (fifteen conditions in the present example) a particular supplemental row of contact studs; in each row the contact studs correspond to various times for a car to 75

travel over the section, the circular distance between the studs that have different connections varying from one row to another row. The controller is thus disposed, as concerns the electric connections, between the auxiliary relays RVA and the rows of contact studs. As already set forth, the contact studs of the various supplemental rows are connected directly with the delay controlling relays RCR.

Obviously, the aforesaid electric installation is susceptible of various modifications in detail without departing from the spirit of the invention, as comprehended within the scope of the appended claims.

In order to avoid any misunderstanding, I will again define the terms employed in the following claims: The braking sub-sections are the sections, numbered BS₁, BS₂, etc. in Fig. 1c, that are provided with respective pedals q_1 , q_2 , etc. The delayed action relays of the braking sub-sections are the rotary switches or impulse devices Rot that are shown at the bottom of Fig. 1c and in Fig. 4. The delayed action relays of the track sections or auxiliary delayed action relays are the rotary switches or auxiliary circular switches RC. The selecting means for rendering inoperative a number of connections is the controller having elements Bc. The driving relays are the electric relays RM.

What I claim is:—

1. In a braking apparatus of the type described comprising retarded switches, delay controlling relays each of which determines a certain delay for each retarded switch, said delay controlling relays being so mounted that the energizing of one of them will automatically cut off the energizing circuit of the precedingly operating relay, rotary switches adapted to successively energize said relays, driving relays for operating the last mentioned switches, a railway track, a plurality of insulated portions along one of the rails of the track, a source of current having one pole connected to the other rail of the track, electric relays connected to the other pole of the last mentioned source, and means, operated by the last mentioned relays, for operating said driving relays.

2. In a braking apparatus of the type described comprising retarded switches having adjustable delays, a series of delay controlling relays each of which determines the delay of each retarded switch, each relay of the series determining delays whose values are greater than those determined by the preceding relay of the series, rotary switches adapted to successively energize said relays, means for deenergizing each relay as soon as the following one of the series is energized, driving relays for operating the last mentioned switches, a railway track, a plurality of insulated portions along one of the rails of the track, a source of current having one pole connected to the other rail of the track, electric relays connected to the other pole of said source whereby the axle of one car located on one track insulated section operates the corresponding last mentioned relay, and means, operated by the last mentioned relays, for operating said driving relays.

3. In a braking apparatus of the type described comprising retarded switches having adjustable delays, a series of delay controlling relays each of which determines the delay of each retarded switch, each relay of the series determining delays whose values are greater than

those determined by the preceding relay of the series, rotary switches adapted to successively energize said relays, driving relays for operating the last mentioned switches, a railway track, a plurality of insulated portions along one of the rails of the track, a source of current having one pole connected to the other rail of the track, electric relays connected to the other pole of said source whereby the axle of one car running on a track insulated section operates the corresponding last mentioned relay, means, operated by the last mentioned relays, for operating said driving relays, and means for cutting off the circuit of said driving relays when the axle of said car passes to the next insulated track section.

4. In a braking apparatus of the type described comprising retarded switches having adjustable delays, a series of delay controlling relays for determining each the delay of each retarded switch, each relay of the series determining delays whose values are greater than those determined by the preceding relay of the series, rotary switches adapted to successively energize said relays, driving relays for operating the last mentioned switches, a railway track, a plurality of insulated portions along one of the rails of the track, a source of current having one pole connected to the other rail of the track, electric relays connected to the other pole of said source whereby the axle of one car running on a track insulated section operates the corresponding last mentioned relay, means, operated by the last mentioned relays, for operating said driving relays, means for cutting off the circuit of said driving relays when the axle of said car passes to the next insulated track section, and a controller element for connecting said switches to said delay controlling elements in a suitable order.

5. In a braking apparatus of the type described comprising a plurality of braking elements, adjustable switches, each associated with one of said braking elements for operating the same, whereby the braking action of one element depends on the adjustment of the corresponding switch, a series of controlling relays each adapted to produce a determined adjustment of said switches, each relay of the series producing an adjustment that corresponds to a stronger braking action of the braking elements than that resulting from the adjustment produced by the preceding controlling relay of the series, rotary switches adapted to successively energize said relays, driving relays for operating the last mentioned switches, a railway track, a plurality of insulated portions along one of the rails of the track, electric relays connected to the said portions respectively, a source of current having one pole connected to the other rail of the track and the other pole to said relays, whereby the axle of one car located on an insulated position of the track will operate the corresponding last mentioned relay, means, operated by the last mentioned relays, for operating said driving relays, and means for cutting off the circuit of said driving relays when the axle of said car passes to the next insulated section.

6. In a braking apparatus of the type described comprising a plurality of braking elements, adjustable switches, each associated with one of said braking elements for operating the same, whereby the braking action of one element depends on the adjustment of the corresponding switch, a series of controlling relays each adapted

ed to produce a determined adjustment of said switches, each relay of the series producing an adjustment that corresponds to a stronger braking action of the braking elements than that resulting from the adjustment produced by the preceding controlling relay of the series, rotary switches adapted to successively energize said relays, driving relays for operating the last mentioned switches, a railway track, a plurality of insulating portions along one of the rails of the track, electric relays connected to said portions respectively, a source of current having one pole connected to the other rail of the track and the other pole to said relays, whereby the axle of one car located on an insulated portion of the track will operate the corresponding last mentioned relay, means, operated by the last mentioned relay, for operating said driving relays, means for cutting off the circuit of said driving relays when the axle of said car passes to the next insulated section, and a controller element for connecting said switches to said delay controlling relays in a suitable order.

7. In a system comprising a plurality of moving bodies, a given path of travel for said bodies including a storing section where said bodies come to stop and another section located ahead of said storing section, and a plurality of devices adapted to work in connection with said second section of the path of travel, an apparatus for controlling said devices which comprises in combination, a plurality of electric circuits, a plurality of contacts in said circuits disposed along said storing section of the path of travel, contacting means controlled by the bodies present on said storing section for closing said contacts, and means, operatively connected with said circuits, for controlling the action of said device according to the position of the stopping point of the last body on the storing section of the path of travel.

8. In a storing section for railway cars including a track divided into a storing section and a braking section located before said storing section, and devices adapted to be used in connection with said braking section of the track, a system for controlling said devices which comprises in combination, a plurality of electric circuits, a plurality of contacts in said circuits disposed along said storing section of the track, contacting means, controlled by the cars present on said storing section of the track for closing said contacts, and means, operatively connected with said circuits, for controlling the action of said devices according to the position of the stopping point of the last car on the storing section of the track.

9. In a storing station for railway cars including a track divided into a storing section and a braking section located before said storing section, and braking devices disposed along said braking section of the track, a system for controlling said braking devices, which comprises in combination, a plurality of electric circuits, a plurality of contacts in said circuits disposed along said storing section of the track, contacting means controlled by the cars present on said storing section of the track for closing said contacts, and means, operatively connected with said circuits, for controlling the action of said braking devices on the cars moving along the braking section of the track according to the position of the last car on the storing section of the track.

10. In a storing station for railway cars in-

cluding a track divided into a storing section and a braking section located before said storing section, and braking devices disposed along said braking section of the track, a device for controlling said braking devices which comprises in combination, a plurality of relays for controlling the action of said braking devices on said cars, a plurality of switches for energizing said relays one at a time, a plurality of driving relays for operating said switches, a plurality of electric circuits for said driving relays, a plurality of contacts in said circuits disposed along said storing section of the track and contacting means, controlled by the cars present on said storing section of the track, for closing said contacts.

11. In a storing station for railway cars including a track divided into a storing section and a braking section located before said storing section and a plurality of braking devices disposed on said braking section of the track, a system for controlling said braking devices which comprises in combination, a retarded switch for operating each of said braking devices, a plurality of delay controlling relays for determining each a certain relay for said switches, a plurality of electric circuits, a plurality of contacts in said circuits disposed along said storing section of the track, contacting means controlled by the cars present on said storing section of the track for closing said contacts, and means, operatively connected with said circuits, for selectively energizing one of said delay controlling relays according to the position of the stopping point of the last car on the storing section of the track.

12. In a storing station for railway cars including a track divided into a storing section and a braking section located before said storing section, and a plurality of braking devices located on said braking section of the track, a system for controlling said braking devices which comprises in combination, a retarded switch for operating each of said braking devices, delay controlling relays for determining each a certain delay for said switches, a plurality of electric circuits for energizing said relays respectively, said circuits being so connected that the energizing of one of said relays will automatically cut off the energizing of the preceding operating relay, a plurality of switches adapted to close said circuits, driving relays for operating the last mentioned switches, a plurality of electric circuits for said driving relays respectively, a plurality of contacts in the last mentioned circuits disposed along said storing section of the track, and contacting means, controlled by the cars present on said storing section of the track for closing said contacts, whereby the action of the braking devices is adjusted according to the position of the stopping point of the last car on the storing section of the track.

13. In a railroad, a railway track divided into track sections; a braking section located before the track sections, divided into braking sub-sections; a braking device in each sub-section; a delayed action relay associated with each braking device for controlling the same, said relay being adapted to assume a plurality of successive positions; means in each braking sub-section, responsive to the presence of a car in said braking sub-section, for operating the corresponding delayed action relay; an auxiliary delayed action relay associated with each track section, said relay being also adapted to assume a plurality of successive positions; means in each track section responsive to the presence of a car

in said section, for operating the corresponding auxiliary delayed action relay; a source of voltage; means for connecting the source of voltage with the auxiliary delayed action relays; and means for connecting the auxiliary delayed action relays in their various positions with the delayed action relays of the braking devices in their various operative positions, whereby the source of voltage may be operatively connected with the delayed action relays of the braking devices.

14. In a railroad, a railway track divided into track sections; a braking section located before the track sections, divided into braking sub-sections; a braking device in each sub-section; a delayed action relay in each sub-section, comprising a movable element and a plurality of contact members for controlling the corresponding braking device, adapted to be engaged operatively and successively by said element; means in each braking sub-section, responsive to the presence of a car in each braking sub-section for moving said movable element during the presence of the car in said braking sub-section; a source of voltage; an auxiliary delayed action relay in each track section, comprising a plurality of contact members and a movable element adapted to connect successively the last mentioned members with said source of voltage; means in each track section for moving the movable element of the corresponding auxiliary delayed action relay in response to the presence of a car in said track-section; a multiplicity of connections from the contact members of the various auxiliary delayed action relays to the contact members of the delayed action relays of the braking sub-sections; and manually controlled means for rendering inoperative a number of said connections, whereby atmospheric conditions may be taken into account.

15. In a railroad, a railway track divided into track sections; a braking section located before the track-sections; a plurality of braking devices in said braking section; a delayed action relay associated with each braking device, said relay comprising a plurality of contact members and a movable element adapted to engage said contact members in predetermined sequence and to operate said braking device when engaging a contact member supplied with voltage; a source of voltage; a plurality of delay control relays connected with the contact members of the various delayed action relays according to a predetermined arrangement; an auxiliary relay adapted for delayed action, associated with each track section and comprising a plurality of contact members and a movable element adapted to engage said members in a predetermined sequence, also adapted to be connected with said source of voltage; means associated with each track section, for operating the corresponding auxiliary relay in response to the presence of a car upon said section; a multiplicity of connections between the contact members of said auxiliary relays and said delay control relays, said connections forming a number of groups each comprising one connection from each contact member to each delay control relay; and selecting means manually operable, for rendering inoperative all the groups of connections but one, in each position of said selecting means.

16. In a railroad having a plurality of delay control relays each of which is capable of causing predetermined delays in the operation of brake control devices, the delays having gradu-

ally increasing values from one relay to another, the combination of a railway track divided into track sections; a source of voltage; a movable element in each track section adapted to be connected with said source of voltage; means in each track section for operating said movable element in response to the presence of a car in the section; a plurality of contact members in each track section, adapted to be engaged operatively by the movable element of said section; and a multiplicity of connections from the various contact members to the delay control relays, so established that in each section the contact members engaged successively by the movable element are connected with delay control relays corresponding to progressively decreasing delays.

17. The railroad of claim 16, in which the connections form a number of groups each comprising one connection from each contact member to each delay control relay, said railroad further comprising manually operated selecting means, for rendering inoperative all the groups of connections but one, in each position of said selecting means.

18. In a railroad having a plurality of delay control relays each of which is capable of causing predetermined delays in the operation of brake control devices, the combination of: a railway track divided into track sections; an impulse device associated with each track section; means in each track section, responsive to the presence of a car in said section, for starting the impulse device of said section; means in each track section responsive to the presence of a car in said section, for stopping the impulse device associated with the preceding track section; a source of voltage, adapted to be connected with the various impulse devices; a plurality of contact members in each track section, adapted to be operatively and successively engaged and thus to be connected with the source of voltage, by the corresponding impulse device; a multiplicity of connections between the contact members in the various track sections and the delay control relays, said connections forming groups each of which comprises one connection from each contact member to each delay control relay, and manually operated selecting means, for rendering inoperative all the groups of connection but one, in each position of said selecting means.

19. In a railroad having a plurality of delay control relays each of which is capable of causing predetermined delays in the operation of brake control devices, the combination of: a railway track divided into track sections; an impulse device associated with each track section; means in each track section responsive to the presence of a car in said section, for starting the corresponding impulse device; means in each track section responsive to the presence of a car in said section, for stopping the impulse device associated with the preceding track section; delayed action means in each track section responsive to the presence of a car in said section for restoring to inoperative position the impulse device associated with the preceding track section, said means being effective after a predetermined time; a source of voltage, adapted to be connected with the various impulse devices; a plurality of contact members in each track section, adapted to be operatively and successively engaged and thus to be connected with the source of voltage, by the corresponding impulse device; and a multiplicity of

connections from the contact members of the various track sections to the delay control relays.

20. In a railroad having a plurality of delay control relays each of which is capable of causing predetermined delays in the operation of brake control devices, the combination of: a railway track divided into track sections; an impulse device associated with each track section; means in each track section responsive to the presence of a car in said section, for starting the corresponding impulse device; means in each track section responsive to the presence of a car in said section, for stopping the impulse device associated with the preceding track section; means in each track section responsive to the presence of a car in said section, for restoring to inoperative position the impulse device associated with the penultimate track section preceding said section; a source of voltage adapted to be connected with the various impulse devices; a plurality of contact members in each track section, adapted to be operatively and successively engaged and thus to be connected with the source of voltage by the corresponding impulse device; and a multiplicity of connections from the contact members of the various track sections to the delay control relays.

21. In a railroad having a plurality of delay control relays each of which is capable of causing predetermined delays in the operation of brake control devices, the combination of: a railway track divided into track sections; means for supplying a voltage to each track section; a delayed action relay associated with each track section; means in each track section responsive to the presence of a car in said section for starting the corresponding delayed action relay; delayed action means in each track section responsive to the presence of a car in the section for cutting off the supply of voltage to the third track section after said track section, said means being effective after a predetermined time; a source of voltage adapted to be connected with the delayed action relays; a plurality of contact members in each track section, adapted to be successively connected with said source of voltage through the corresponding delayed action relay; and means for connecting said contact members with said delay control relays.

22. In a railroad having a plurality of delay control relays each of which is capable of causing predetermined delays in the operation of brake control devices, the combination of: a railway track divided into track sections; a source of voltage; a plurality of contact members in each track section; means in each track section responsive to the presence of a car in the section for connecting successively the contact members with said source of voltage; a multiplicity of connections from the various contact members to the delay control relays; and manually operable selecting means for bringing into inoperative condition all the connections but one from each contact member to each delay control relay.

23. In a railroad having a plurality of delay control relays each of which is capable of causing predetermined delays in the operation of brake control devices, the combination of: a railway track divided into track sections; a source of voltage; a plurality of contact members in each track section; means in each track section responsive to the presence of a car in the section, for connecting successively the contact members with said source of voltage; a movable selecting element for each track section, connected with at most one contact member of each track section;

a plurality of further contact members for each section adapted to be operatively engaged by the corresponding selecting element; a multiplicity of connections from the various further contact members to the various delay control relays; and manually controlled means for moving synchronously the various selecting elements over said further contact members.

24. In a railroad having a plurality of delay control relays each of which is capable of causing predetermined delays in the operation of brake control devices, the combination of: a railway track divided into track sections; a source of voltage; a plurality of contact members in each track section; means in each track section, responsive to the presence of a car in the section for connecting successively the contact members with said source of voltage; a plurality of movable selecting elements for each track section, each of them being connected with one contact member of said section; a plurality of sets of further contact members for each track section, each set corresponding to one selecting element and having its contact members adapted to be engaged by said element; a multiplicity of connections established according to predetermined arrangement from the various further contact members to the various delay control relays; and manually controlled means for moving synchronously the various selecting elements over corresponding contact members.

25. In a railroad having a plurality of delay control relays each of which is capable of causing predetermined delays in the operation of brake control devices, the combination of: a railway track divided into track sections; a source of voltage; a movable selecting element for each section; means responsive to the presence of a car in the section, for connecting said source of voltage with said movable selecting element; a plurality of contact members for each track section, adapted to be operatively engaged by the corresponding selecting element; a plurality of impulse devices for each track section, each impulse device being connected with one of the contact members of said track section; means in each track section responsive to the presence of a car in said section, for starting the impulse devices of said section; a plurality of sets of further contact members for each track section, each set corresponding to and having its contact members adapted to be engaged by one of the impulse devices of said section; manually controlled means for moving synchronously the various selecting elements; and a multiplicity of connections established according to predetermined arrangement from the various further contact members to the various delay control relays.

26. In a railroad, a railway track divided into track sections; a braking section located before said track sections and divided into braking sub-sections; a brake shoe in each braking sub-section, disposed normally to be engaged by an incoming car; control means in each braking sub-section for side-tracking said brake shoes; a plurality of contact members for each braking sub-section; means in each braking sub-section including a movable element adapted to engage successively said contact members in predetermined sequence, for energizing said control means; means in each braking sub-section, responsive to the presence of a car on said sub-section, for moving the corresponding movable element at predetermined speed; a source of voltage; a plurality of further contact members for

each track section; means in each track section responsive to the presence of a car in said section, for connecting successively according to a predetermined sequence the further contact members of said section with the source of voltage; a multiplicity of connections from the various contact members of the track sections to the

various contact members of the braking sub-sections, said connections forming a number of groups; and manually controlled selecting means for rendering inoperative all the groups but one, in each position of said selecting means.

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