

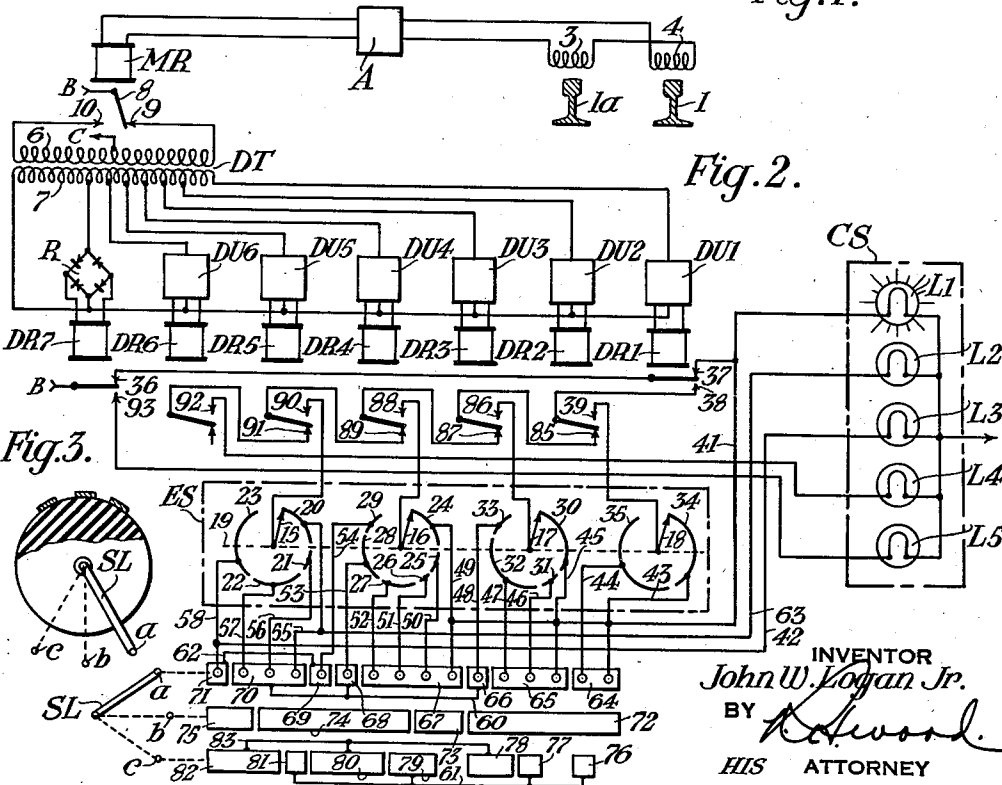
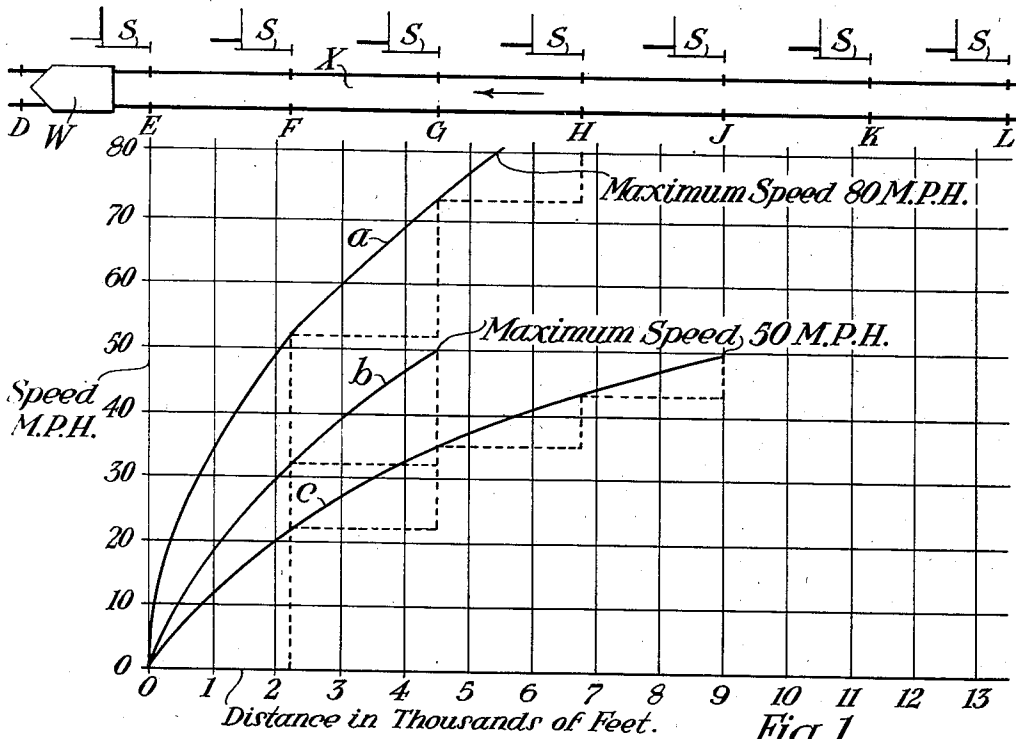
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RAILWAY TRAFFIC CONTROLLING APPARATUS

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RAILWAY TRAFFIC CONTROLLING
APPARATUS

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My invention relates to railway traffic controlling apparatus of the class wherein traffic governing means located on a locomotive or train is controlled by energy received from the trackway and the supply of energy from the trackway to the train is governed by traffic conditions in advance of the train. More particularly, my invention relates to the train-carried portion of such apparatus.

Generally speaking, train-carried apparatus of the above-mentioned class is utilized at the present time primarily to supplement wayside signals governing trains operating on a stretch of trackway by providing in the cab of such trains signal indications corresponding to the wayside signal indications. As is generally known, wayside or block signal systems are employed to maintain certain spacings or distances between successive trains on a stretch of trackway, and in the usual type of such systems, the trackway is divided into successive adjoining track sections or blocks each of which is provided adjacent its entrance end with a wayside signal. These signals are controlled by track circuits or other devices so as to display danger or "stop" signals at different points along the trackway in the rear of a train, to indicate the points beyond which a following train should not proceed, at least not without care and at a low speed. Also, such signals generally are controlled to display one or more types of cautionary indications at points some distances in the rear of the "stop" signal in order that the engineman of a following train might be warned of such "stop" signal and so be prepared to stop the train prior to reaching such signal.

It is inherent in such systems that the signals must of necessity be arranged to provide a restrictive indication at a point sufficiently in the rear of an occupied block or other danger condition to enable the brakes of a train requiring the greatest distance in which to stop, to bring such train to a stop short of the occupied block. This, then, requires that all trains be provided with a restrictive indication at the point determined by the braking distance of the train most difficult to stop, even though trains of different classes might be capable of stopping in relatively shorter distances and hence could operate safely at unrestricted speeds for considerable distances. As a consequence, the capacity of a track might be limited unnecessarily due to the spacing of trains on the track based upon the fixed and arbitrary braking distances of trains most difficult to stop, rather than upon the actual braking dis-

stances of the trains operating over the stretch.

In view of the foregoing and other important considerations, it is an object of my present invention to provide novel and improved railway traffic controlling apparatus incorporating means wherewith the spacing of trains on a stretch of track may be controlled in accordance with the actual braking distances of such trains.

Another object of my invention is the provision, in such traffic controlling apparatus, of adjustable means for enabling such apparatus to be employed for controlling each one of a plurality of different classes of railway trains in a different manner dependent upon the braking characteristics of the particular class of trains controlled.

An additional object of my invention is the provision, in traffic controlling apparatus of the class mentioned, of novel and improved means for providing a precautionary warning to advise enginemen that a brake application will be necessary unless the speed of the train is reduced prior to entering a block section in advance.

A further object of my invention is the provision of novel and improved traffic controlling apparatus of the type mentioned and incorporating speed responsive means for modifying the control of a train-carried governing device in accordance with the speed at which the train is operating.

In order to achieve the above-mentioned and other important objects and characteristic features of my invention which will become readily apparent from the following description, I provide train-carried apparatus selectively responsive to each form of trackway energy received from the track rails of a stretch of trackway to which trackway energy of distinctively different characteristics is supplied in accordance with traffic conditions in advance, a train-carried governing device controlled to one or another of a plurality of distinctive conditions by such apparatus, and means for selectively determining which of the conditions of the device shall be controlled by such apparatus in response to the different forms of energy received from the rails of the trackway, the last-mentioned means being adjustable to conform the conditions of the governing device to the different braking characteristics of various classes of trains. Additionally, I provide speed responsive means which when combined with the various elements just mentioned, cooperates with the trackway energy responsive apparatus carried by the train to modify the condition to which the governing

device is controlled in accordance with traffic conditions in advance.

The invention further consists in the parts, and in the arrangement and combination of the parts, which will be set forth more fully hereinafter.

I shall describe one form of apparatus embodying my invention, and shall then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a graphical representation showing a braking-distance curve for each of three typical classes of railway trains, and also showing the relationship of such curves to a stretch of railway track over which operate trains of each of the represented classes. Fig. 2 is a diagrammatic view illustrating a preferred form of railway traffic controlling apparatus embodying my invention. Fig. 3 is a diagrammatic view showing on an enlarged scale a portion of the apparatus represented in Fig. 2.

It is a recognized fact that trains may be classified in accordance with their authorized maximum speed and the braking distances required to bring such trains to a stop from such maximum speeds. Generally speaking, railway trains may be conveniently divided into at least the three distinct classes of passenger, short or light freight, and long or heavy freight trains. Due to the differences in braking equipment, speed, weight, length and other similar factors, trains of each of the named classes require different distances in which to be stopped from their respective maximum speeds by a full service application of the brakes.

In order better to illustrate and describe the functioning of the apparatus embodying my invention, I have represented in Fig. 1 a typical braking-distance curve for each of the classes of trains mentioned above. Curve *a* of Fig. 1 represents a typical braking-distance curve which illustrates the manner in which a full service brake application brings a passenger train from its authorized maximum speed of 80 miles per hour to a stop; curve *b* represents a typical braking-distance curve which illustrates the manner in which a full service brake application brings a short light-weight freight to a stop from its authorized maximum speed of 50 miles per hour; while curve *c* represents a typical braking distance curve which represents the manner in which a full service brake application stops a long heavy freight operating at a maximum speed of 50 miles per hour. From an inspection of these curves, it is readily apparent that a passenger train (class *a*) requires approximately 5,500 feet in which to stop; a light freight (class *b*) train requires approximately 4,500 feet to be stopped; whereas a heavy freight (class *c*) requires approximately 9,000 feet in which to come to a stop. It can be seen, therefore, that if each of the classes of trains were signaled alike, such trains would require a restrictive indication at a point some 9,000 feet in the rear of an occupied block in order to insure that all trains would be able to be brought to a stop short of an occupied block, although in reality such indication is required for but long, heavy freight trains since passenger and light freight trains could operate at unrestricted speeds for considerable distances and still be brought to a stop short of the occupied block.

Inasmuch as the distance required to stop a train by a brake application is a function of the train speed, I propose as a convenient and prac-

ticable method of signaling trains, to provide information relating to the necessity of braking such trains when such trains are operating at a speed in excess of their permissible speeds as determined by the braking-distance curve for such trains under the particular traffic conditions in the block being traversed. In a five-indication signaling system, for example, a first distinctive indication, which I shall term a "clear" indication, may be employed to indicate that no braking is necessary in the block being traversed and will not be necessary in the next block; a second distinctive indication, which I shall term a "brake next" indication, may be employed to indicate that although braking is not necessary in the block being traversed, it will be necessary in the block next in advance unless the speed of a train is reduced in the meantime to a value below that indicated as being permissible at the exit end of the next block by the braking-distance curves for such train; a third distinctive indication, which I shall term a "brake" indication, may be employed to indicate that the train is operating at a speed in excess of the speed permitted by its braking-distance curve at the exit end of the section being traversed and that braking is at once necessary to bring such train down to its permissible speed; the customary "restricting" aspect may be employed as a fourth distinctive indication to denote that the train is traversing the section next in the rear of an occupied section and should be prepared to stop prior to entering the next section; and the customary "stop" aspect may be employed as a fifth distinctive indication to indicate that the train is traversing a block occupied by another train. It can be seen that in a system of the class just discussed, the less restrictive aspects of the signal, that is, the "clear," "brake next" and "brake" aspects, are controlled not only by traffic conditions in advance of the train but also by the speed at which the train is operating, whereas the more restrictive indications, i. e. the "restricting" and the "stop" aspects, are controlled solely by traffic conditions in advance since the speed at which a train is operating ordinarily does not alter the procedure called for by the rules of operation when such aspects are displayed. It should, however, be noted that speed control of the aspects is based upon the braking-distance curves, so that if the previously mentioned classes of trains are signaled in a different manner, the control established for each of the classes of trains will vary in accordance with their respective braking-distance curves.

In order to control the spacing of trains along a stretch of trackway in accordance with the speed and braking requirements of such trains rather than in accordance with the braking requirements of the trains most difficult to stop, I provide a cab signaling system incorporating means whereby different forms of trackway energy received from the rails of the trackway may control a train-carried governing device to one or another of a plurality of different control conditions in accordance with the particular one of the different classes of trains which such device is assigned to control. Such governing devices may, for example, be cab signals of the customary and well-known form. It is contemplated to control such cab signals in a manner such that the cab signals alone function to control the movements of the trains, with wayside signals being utilized solely to mark the entrances of each signal block section and being

controlled to indicate only whether such sections are occupied or unoccupied. In other words, the wayside signals associated with the trackway no longer indicate traffic conditions in advance of the associated sections, but rather function solely as block signals to indicate whether or not the associated block is occupied.

Referring again to Fig. 1, the reference character X designates a stretch of railway track which is divided in the customary manner into a plurality of successive adjoining track sections D—E, E—F, etc., the points of division shown preferably dividing the stretch into sections or blocks each having a length indicated by the distance scale of the graph of Fig. 1. As indicated by an arrow in the drawing, traffic on track X normally operates in the westbound direction, or from right to left as viewed in the diagram.

Each of the sections represented in Fig. 1 is provided adjacent its entrance end with a wayside signal, designated by the reference character S. These signals may take any one of several suitable forms, but preferably are two-position dwarf signals.

The several signals shown in Fig. 1 are represented in the conditions to which they are controlled in response to the presence of a train W in the extreme left-hand section D—E. Signal S located along track X at E is represented as displaying its "stop" aspect, while the remaining signals are represented as displaying their "proceed" aspects. The wayside apparatus which controls the wayside signals of Fig. 1 is not illustrated in the drawing since it forms no part of my present invention, but such apparatus usually will be controlled through the medium of the customary and well-known track circuits each responsive to the presence of traffic on its associated section, to control the associated signal to a "stop" indication when such section is occupied and to a "proceed" indication when such section is unoccupied. The wayside signals of Fig. 1 accordingly function as block signals to indicate traffic conditions in the associated section only, and hence do not function as has been the customary practice heretofore, to indicate traffic conditions in advance of such sections.

Each section represented in Fig. 1 also is provided with suitable trackway apparatus for supplying in accordance with traffic conditions on the stretch, the rails of the section next in the rear with one or another of a plurality of different forms of trackway energy. Such trackway apparatus is not illustrated in Fig. 1 since it forms no part of my present invention, but such apparatus may take any one of many suitable forms such, for example, as are employed in what is termed six-block signaling, capable of supplying each of six sections lying immediately to the rear of an occupied section with a different form of trackway energy. For example, the trackway apparatus provided for each of the sections may be arranged so that under the traffic conditions illustrated in Fig. 1, the rails of section E—F are supplied with alternating trackway energy which is coded or periodically interrupted at a first distinctive rate; the rails of section F—G are supplied with alternating trackway energy coded at a second distinctive rate; and similarly the rails of sections G—H, H—J, J—K and K—L, respectively, are supplied with alternating trackway energy coded at a third, fourth, fifth and sixth distinctive rate. It is to be understood, of course, that my invention is not restricted to use in connection with coded trackway energy supplied at

different individual rates, but that composite, combined, mutilated, group, or other characteristic types of trackway energy may be employed, the characteristic features being that the six sections next in the rear of an occupied block are each supplied with a different form of trackway energy.

In connection with a stretch of railway track provided with trackway apparatus of the class mentioned, I provide suitable train-carried apparatus receiving energy from the rails of the trackway and controlling a train-carried governing device to one or another of a plurality of different conditions in accordance with the form of trackway energy received and the condition of suitable selecting means incorporated into such apparatus.

A preferred form of train-carried apparatus embodying my invention is shown in Fig. 2. Referring now to Fig. 2, the reference character MR designates a train-carried master relay which is connected through the medium of the usual amplifier A with a pair of train-carried receiving coils 3 and 4, which coils are carried as is the usual practice in front of the first pair of wheels of the locomotive and which coils are disposed in inductive relationship with the track rails 1 and 1a of the stretch of track.

The reference character DT designates a decoding transformer having the usual center tapped primary winding 6, a portion of which is supplied over contact 8—9 of relay MR with unidirectional current which flows through the winding in one direction from a suitable source, such is a battery not shown but having its opposite terminals designated by the reference characters B and C, and the remainder of the primary winding is supplied over contact 8—10 of relay MR with unidirectional current which flows through the winding in the opposite direction. Transformer DT further comprises a secondary winding 7 which supplies energy to each of a plurality of decoding relays DR1 to DR7, inclusive.

A first decoding relay DR1 is supplied with energy from secondary 7 of transformer DT through the medium of an associated decoding unit DU1, and similarly relays DR2, DR3, DR4, DR5 and DR6 are supplied with energy from secondary 7 of transformer DT through the medium of decoding units DU2, DU3, DU4, DU5 and DU6, respectively. The details of construction of the decoding units are not shown in the drawing, but such units usually comprise a rectifier and a reactor condenser tuning unit tuned to resonance at a frequency corresponding to the frequency at which it is desired that its associated decoding relay be energized. I shall assume that the decoding units DU are so designed that relay DR6 is picked up in response to energy of the form received from the rails of the block next in the rear of an occupied block; that relay DR5 is picked up in response to the energy received from the rails of the block second in the rear of an occupied block; and similarly that relays DR4, DR3 and DR2 are picked up in response to the form of energy received from the rails of, respectively, the blocks third, fourth, and fifth in the rear of an occupied block. Relay DR1 I shall assume to be energized in response to energy received from those blocks six or more blocks in the rear of the next occupied block. Each decoding relay DR1 to DR6 accordingly is energized when and only when trackway energy coded at its particular

code frequency is received from the rails of the trackway, and such relays are released whenever trackway energy of another frequency is received from the track rails.

Decoding relay DR 7 is connected to secondary 7 of transformer DT through the medium of a rectifier R and as a consequence is supplied with energy whenever master relay MR is responding to energy received from the rails of the trackway. Relay DR7 accordingly functions as a code detecting relay to detect whether or not master relay MR is following coded energy received from the trackway.

The reference character CS designates a train-carried governing device, here shown as a five-indication cab signal comprising five visual signal units L1 to L5, inclusive. Signal CS is selectively controlled, in a manner to be made clear presently, by the decoding relays DR in accordance with the form of trackway energy received from the rails of the stretch and the condition of suitable selecting means provided for the apparatus.

The reference character SL designates one form of selecting means which may be incorporated into the apparatus hereinbefore described and functions to modify, in accordance with the condition of such selecting means, the control established by the trackway energy responsive means over the governing device CS. As shown, the selecting means SL comprises an adjustable member or lever movable to one or another of three different positions one for each of the heretofore assumed three different classifications of trains. The selector lever SL is provided with contact elements which may be mounted on a rotatable drum (see Fig. 3), and which are selectively moved into circuit-controlling positions in accordance with the position of the lever, which positions are designated in Fig. 2 as *a*, *b* and *c*, respectively, to correspond to each of the three assumed classes *a*, *b* and *c* of trains.

It is to be understood, of course, that while the setting of the contact elements of the selecting means is herein shown as being controlled by a manually operable lever SL, such control may, if desired, be controlled either manually or automatically through the medium of power. For example, compressed air such as is used in the braking systems of trains might be employed under the control of a manually operable control valve to move the contact elements of the selecting device into the particular desired positions of such contact elements, or suitable control apparatus selectively responsive to different pressures might be utilized to control the movement of such contact elements automatically in response to the different brake pipe pressures such as are used in controlling freight and passenger trains. That is to say, passenger trains ordinarily have different brake pipe pressures than do freight trains, hence automatic control of the setting of the selecting means might be established through the medium of suitable pressure responsive control apparatus subjected to the brake pipe pressure and connected to move the contact elements of the selecting device to one position or another in accordance with the pressure existing in the brake pipe.

The contact elements of lever SL function to selectively interpose one or another of the signal units of signal CS in energizing circuits controlled by the decoding relays DR, in a manner

to be pointed out in detail presently. At this time, however, it might be pointed out that the contact elements of lever SL function to control the aspects displayed by signal CS by connecting together two or more terminal wires 43 to 58, inclusive, which terminal wires will be referred to in more detail presently. In the *a* position of lever SL, in which it is illustrated in Fig. 2, it can be seen that contact elements 64 to 71, inclusive, occupy a position wherein such elements are in engagement with one or another of the referred to terminal wires. Referring to Fig. 2, it is evident that when lever SL is in its *a* position, contact element 64 of lever SL engages and connects together terminal wires 43 and 44; contact element 65 engages and connects together terminal wires 45, 46 and 47; contact element 66 engages terminal wire 48 and is connected by a jumper wire 60 to contact elements 68 and 70; contact element 67 engages and connects together terminal wires 49, 50, 51 and 52; contact element 68 engages terminal wire 53; contact element 69 engages terminal wire 54 and is connected by a jumper wire 62 to contact element 71; contact element 70 engages and connects together terminal wires 55, 56 and 57; and contact element 71 engages terminal wire 58.

In the *b* position of selector lever SL, it is readily apparent that contact elements 72 to 75, inclusive, are moved into engagement with terminal wires 43 to 58, inclusive, and that contact elements 64 to 71, inclusive, of selector lever SL are moved out of engagement with such terminal wires. With selector lever SL moved to its *b* position, contact element 72 engages and connects together terminal wires 43 to 48, inclusive; contact element 73 engages and connects together terminal wires 49 and 50; contact element 74 engages and connects together terminal wires 51 to 56, inclusive; and contact element 75 engages and connects together terminal wires 57 and 58.

If, now, selector lever SL is moved to its *c* position, then contact elements 72 to 75, inclusive, are moved out of engagement with terminal wires 43 to 58 and contact elements 76 to 82, inclusive, are moved into engagement with such terminal wires. In the *c* position of selector lever SL contact element 76 engages terminal wire 44 and is connected by a jumper wire 61 to contact elements 77, 79 and 81; contact element 77 engages terminal wire 46; contact element 78 engages and connects together terminal wires 47 and 48 and is connected by a jumper wire 83 to contact elements 80 and 82; contact element 79 engages and connects together terminal wires 50 and 51; contact element 80 engages and connects together terminal wires 52, 53 and 54; contact element 81 engages terminal wire 55; and contact element 82 engages and connects together terminal wires 56, 57 and 58.

The reference character ES designates a speed responsive device such for example as a circuit controller comprising a plurality of speed controlled elements 15, 16, 17 and 18, connected in any suitable manner as through the medium of a shaft 19 indicated by a dash line, to an axle of the locomotive. The speed controlled elements 15, 16, 17 and 18 of device ES are associated respectively with decoding relays DR5, DR4, DR3 and DR2, and each speed controlled element is operated in response to the speed at which the train is travelling to engage different contact segments at different speed ranges of the train. The various speed ranges at which the several

speed controlled elements of device ES engage their associated contact segments may be designed and selected to form different circuit controlling contacts in accordance with any desired braking-distance curve or to fit any predetermined set of conditions, but in order to agree with the particular requirements of the three classes of trains hereinbefore assumed, I shall assume that the device ES is designed to provide speed control in accordance with the braking-distance curves represented in Fig. 1.

Referring once more to Fig. 1, it is apparent that if the diagram of the stretch of track X may be assumed to be of the same scale as the distance portion of the graph represented in Fig. 1, then the speed permitted at the exit end of each of the sections represented in Fig. 1 may readily be determined for each of the three classes of trains by referring to the braking-distance curves *a*, *b* and *c*. From an inspection of the curves of Fig. 1, it is readily apparent that trains of class *a* are permitted a maximum speed of approximately 52 miles per hour at the exit end of section F—G (separated from the next occupied block by one unoccupied block); that class *b* trains are permitted a maximum speed of 32 miles per hour at this point; and that class *c* trains are permitted a maximum speed of but 22 miles per hour at this point. Since, as was pointed out heretofore, speed responsive element 15 of device ES is associated with decoding relay DR5, these two are adapted to exert a control governed jointly by the speed of the train and the form of trackway energy received from the rails of the section (F—G) separated from the next occupied block by only one unoccupied section. Accordingly, the contact segments associated with element 15 of device ES are shown in Fig. 2 proportioned in accordance with the several speed ranges as determined by the curves shown in Fig. 1 at the exit end of section F—G, i. e., 0–22; 22–32; 32–52 and 52–maximum.

In determining each of the mentioned speed ranges, the higher limit of such ranges represents a speed determined by one or another of the braking-distance curves shown in Fig. 1, while the lower limit represents the next lower speed determined from such curves. Thus, the 22–32 speed range represents the range of speed of the train in which a contact segment of device ES is engaged by an associated speed responsive element of such device, and is determined by the 32 mile per hour speed permitted at the exit end of section F—G for class *b* trains (see curve *b* of Fig. 1) and the next lower speed determined from such curves or the 22 mile per hour speed permitted at the exit end of section F—G for class *c* trains (see curve *c* of Fig. 1). Hence, the contact segments associated with element 15 are represented in Fig. 2 as comprising a first segment 20 engaged by the speed responsive element 15 in the 0–22 miles per hour range, a second segment 21 engaged in the 22–32 miles per hour range, a third segment 22 engaged in the 32–52 miles per hour range, and a fourth segment 23 engaged in the 52–90 miles per hour range. A maximum speed of 90 miles per hour has been assumed in order to permit a reasonable variation of speed over the assumed maximum authorized speed of 80 miles per hour for class *a* trains.

The various speed ranges at which the contact segments associated with the other speed responsive elements 16, 17 and 18 of device ES are engaged by such speed responsive elements may be

derived from an inspection of curves *a*, *b* and *c* of Fig. 1, it being noted first that elements 16, 17 and 18 are associated respectively with decoding relays DR4, DR3 and DR2 and hence such elements are adapted to cooperate with such relays to provide speed control as well as traffic control of the aspects displayed by signal CS while the train traverses sections G—H, H—J and J—K, respectively. In addition, it should be noted that the "brake next" indication of signal CS relates to the speed permitted at the exit end of the block next in advance of the block being traversed, and as a result the various speed ranges in which the "brake next" indication is displayed while the train traverses sections G—H, H—J and J—K are determined by the speeds permitted by the braking-distance curves at the exit end of the sections next in advance of such sections, or sections F—G, G—H and H—J, respectively. As a further example of the manner of determining the speed ranges of the contact segments of device ES, it might be noted that the speed ranges of the contact segments associated with speed responsive element 16 are proportioned, in accordance with the hereinbefore assumed classes and braking-distance curves of trains, to provide speed ranges determined by the speeds permitted by the braking-distance curves represented in Fig. 1 at the exit ends of both sections F—G and G—H. Hence, such contact segments are designed to provide 0–22 and 22–32 speed ranges, determined by the permissible speeds of classes *b* and *c* trains at the exit end of section F—G; 32–34 speed range determined by the permissible speed of class *c* trains at the exit end of section G—H; 34–52 speed range determined by the permissible speed of class *a* trains at the exit end of section F—G; and 54–73 and 73–maximum speed ranges determined by the permissible speed of class *a* trains at the exit end of section G—H.

It is believed that the various speed ranges at which the remainder of the speed responsive elements of device ES engage their several associated contact segments may readily be determined from an inspection of curves *a*, *b* and *c* of Fig. 1 taken in connection with the foregoing description of the determination of such speed ranges for speed responsive elements 15 and 16. For convenience, however, I have listed the speed ranges of the various contact segments associated with the speed responsive elements of device ES in the following table:

Speed responsive element	Contact segment	Speed range
15	20	0–22
	21	22–32
	22	32–52
	23	52–90
16	24	0–22
	25	22–32
	26	32–34
	27	34–52
17	28	52–73
	29	73–90
	30	0–34
	31	34–43
18	32	43–73
	33	73–90
	34	0–43
	35	43–90

Each of the contact segments 20 to 35, inclusive, of device ES is connected to a different one of the previously mentioned terminal wires 53 to 43, inclusive, (see Fig. 2).

In explaining the operation of the apparatus embodying my invention, I shall refer to class *a*, *b* and *c* trains, indicating in each case that the

train-carried apparatus embodying my invention is conditioned by the selecting means to provide the proper signal indication for the particular class of trains named. For example, when speaking of class *a* trains it will be assumed that the selector lever SL occupies its *a* position, for class *b* trains it occupies its *b* position, and for class *c* trains it occupies its *c* position.

I shall assume first that a train provided with apparatus embodying my invention and hereinbefore described is traversing a section at least six blocks removed from an occupied section, as for example, section K—L with section D—E occupied in advance. When a train traverses such section, the train-carried coils 3 and 4 receive from the rails trackway energy of the form which causes decoding relays DR1 and DR7 to be picked up. This is the condition in which the apparatus is illustrated in Fig. 2, and in this condition of the apparatus, cab signal CS is caused to display its "clear" aspect by virtue of an energizing circuit for signal unit L1, which circuit may be traced from terminal B through front contact 36 of relay DR7, front contact 37 of relay DR1, and the filament of signal unit L1 of signal CS to terminal C. Irrespective of the speed and class of the train signaled, all trains are provided with a "clear" indication when decoding relay DR1 is picked up since, as is readily apparent from an inspection of the curves of Fig. 1, a brake application is not required in the block being traversed or in the block next in advance to bring a train moving at or below its maximum authorized speed to a stop short of the next occupied block.

When, however, the train traverses section J—K and receives the form of trackway energy which causes relays DR2 and DR7 to be picked up, then cab signal CS is caused to display its "clear" aspect to trains of classes *a* and *b* irrespective of their speed and to class *c* trains when trains of the latter class operate below 43 miles per hour, but in the event that class *c* trains operate in excess of 43 miles per hour in section J—K, then signal CS is controlled to display its "brake next" aspect.

The above-mentioned speed control of signal CS is established for the train in section J—K through the medium of device ES and selector lever SL in the following manner. With relays DR2 and DR7 picked up, if the train is operating in section J—K at a speed less than 43 miles per hour, a circuit is established from terminal B through front contact 36 of relay DR7, back contact 38 of relay DR1, front contact 39 of relay DR6, speed responsive element 18 of device ES, contact segment 34, terminal wire 43, wire 41 and the filament of signal unit L1 of signal CS to terminal C. If, however, the train operates in section J—K at a speed in excess of 43 miles per hour, then a circuit similar to the circuit just traced is completed up to speed responsive element 18 of device ES, and then passes from speed responsive element 18 through contact segment 35, terminal wire 44, contact element 64 of lever SL (which connects together terminal wires 44 and 43 in the *a* position of the lever) or contact element 72 of lever SL (which connects together terminal wires 44 and 43 as well as terminal wires 45, 46, 47 and 48 in the *b* position of the lever), terminal wire 43, wire 41, and the filament of signal unit L1 of signal CS to terminal C; or from speed responsive element 18 through contact segment 35, terminal wire 44, contact element 76 of lever SL (which engages terminal wire 44 in the

c position of the lever), jumper wire 61, contact element 81 of lever SL (which engages terminal wire 55 in the *c* position of the lever), terminal wire 55, wire 63, and the filament of signal unit L2 of signal CS to terminal C. It is readily apparent, therefore, that signal CS is controlled to display its "clear" aspect to trains of classes *a* and *b* in section J—K irrespective of the speed of such trains; and that such signal is controlled to display its "clear" or "brake next" aspect to class *c* trains according as such trains are operating at a speed below or in excess of 43 miles per hour. The class *c* trains are signaled in a manner which differs from the other classes of trains since the braking-distance curve for class *c* trains (see Fig. 1) indicates that braking will be necessary in the block next in advance of the section being traversed so that the speed of such trains may be reduced to below 43 miles per hour at the end of such advance section. In this manner, the enginemen of class *c* trains are warned in advance of a brake application if such trains operate in section J—K at a speed in excess of 43 miles per hour and hence may permit such trains to reduce speed by allowing the trains to drift under reduced power, thereby avoiding the necessity of brake applications.

If, now, the train is traversing section H—J so that relays DR3 and DR7 are picked up in response to the form of energy picked up from the rails of such section, then class *a* trains are provided with "clear" or with "brake next" aspects according as such trains are operating less than or in excess of 73 miles per hour, class *b* trains are provided with "clear" aspects irrespective of speed; and class *c* trains are provided with "clear," "brake next" or "brake" indications according as such trains are operating in the 0-34, 34-43, or 43-maximum miles per hour speed ranges, respectively.

The above-mentioned control of the various aspects displayed by signal CS is established in accordance with the speed of the train in section H—J and the position of selector lever SL by virtue of the cooperation of device ES and lever SL in setting up one or another of a plurality of control circuits which have the following circuit elements in common; terminal B, front contact 36 of relay DR7, back contact 38 of relay DR1, back contact 85 of relay DR2, front contact 86 of relay DR3 and speed responsive element 17 of device ES, but which circuits extend from element 17 to signal CS and to terminal C through one or another of a plurality of branch circuit paths controlled by the speed of the train and by the position of lever SL.

With lever SL in its *a* position and the train operating in section H—J at a speed less than 73 miles per hour, a first branch circuit path is established for illuminating unit L1 of signal CS irrespective of the particular one of the contact segments 30, 31 or 32 of device ES that is engaged by element 17, since, as is readily apparent from an inspection of Fig. 2, terminal wires 46 and 47, which are connected respectively to contact segments 31 and 32 of device ES, are connected by contact element 65 of lever SL to terminal wire 45, and terminal wire 45 not only is connected to contact segment 30 of device ES but also is connected through wire 41 to unit L1 and to terminal C. When the train operates in the 73-maximum speed range, however, another branch circuit path is set up which extends from element 17 through contact segment 33 of device ES, terminal wire 48, contact element 66 of

lever SL, jumper wire 60, contact element 70 of lever SL, terminal wire 55, wire 63, and unit L2 to terminal C. With selector lever SL in its *b* position, wherein contact element 72 connects together terminal wires 45, 46, 47 and 48, it can be seen that irrespective of the particular contact segment 30, 31, 32 or 33 engaged by element 17, a branch circuit is established for illuminating unit L1 since terminal wire 45 is connected to the other terminal wires 46, 47 and 48 and also is connected through wire 41 to unit L1 and to terminal C. When selector lever SL is moved to its *c* position, a first branch path may be established for unit L1 of signal CS extending from element 17 through contact segment 30 of device ES, terminal wire 45, wire 41, and unit L1 to terminal C; a second branch path may be established extending from element 17 through contact segment 31 of device ES, terminal wire 46, contact element 77 of lever SL, jumper wire 61, contact element 81 of lever SL, terminal wire 55, wire 63 and unit L2 to terminal C; or a third branch path may be established from element 17 through contact segment 32 or 33 and its associated terminal wire 47 or 48, respectively, contact element 78 of lever SL, jumper wire 83, contact element 82 of lever SL, terminal wire 58, wire 42 and unit L3 of signal CS to terminal C.

From the foregoing, it is readily apparent that speed responsive element ES and selector lever SL cooperate in governing the circuits controlling signal CS to signal trains operating in section H—J in accordance with the class of train signaled and the speed at which such train operates. It is further apparent that the control of the aspects displayed by signal CS to each of the three classes of trains is determined in accordance with the braking-distance curves represented in Fig. 1 for the particular class of train signaled. Thus, class *a* trains are provided with a "clear" indication in section H—J when such trains operate at a speed less than 73 miles per hour since it can be seen from an inspection of curve *a* of Fig. 1 that no braking is necessary at this speed in the block being traversed or the block next in advance, but such trains are provided with a "brake next" aspect in section H—J when such trains operate at a speed in excess of 73 miles per hour, this aspect being displayed to indicate that the train is operating in the section at a speed in excess of that permitted at the exit end of the section next in advance so that if such speed is continued, a brake application will be necessary in the advance section. Class *b* trains are provided with "clear" aspects irrespective of speed since their braking-distance curve (see Fig. 1) indicates that no braking is necessary in the section being traversed or in the section next in advance. Class *c* trains are provided in section H—J with a "brake" aspect when such trains operate at a speed in excess of 43 miles per hour since such speed is in excess of the speed permitted in such section by the braking-distance curve for such train; are provided with a "brake next" aspect when such trains operate in the 34–43 miles per hour speed range since curve *c* of Fig. 1 indicates that class *c* trains operating in that speed range will be required to brake in the section next in advance so that the speed may be reduced to below 34 miles per hour in the next section; and are provided with "clear" aspects in the event such trains operate in the 0–34 mile per hour range since it is apparent from an inspection of curve *c* that no braking will be required at that speed

by class *c* trains in the section being traversed and in the section next in advance.

Similarly, when a train is traversing section G—H and picks up the form of trackway energy from the rails which causes relays DR4 and DR7 to be energized, then class *a* trains are provided with a "clear," "brake next" or "brake" aspect according as such trains are operating in the 0–53, 53–73 or 73–maximum miles per hour speed ranges, respectively; class *b* trains are provided with a "clear" or a "brake next" aspect according as such trains are operating less than or in excess of 32 miles per hour; and class *c* trains are provided with "clear", "brake next" or "brake" aspects according as such trains are operating in the 0–22, 22–34, or over 34 miles per hour speed ranges, respectively. This control of the aspects of signal CS is established by the setting up of one or another of a plurality of circuits each of which includes the following circuit elements in common; terminal B, front contact 36 of relay DR7, back contact 38 of relay DR1, back contact 85 of relay DR2, back contact 87 of relay DR3, front contact 88 of relay DR4 and speed responsive element 16 of device ES, but which circuits traverse individual branch paths governed jointly by the speed of the train and by the position of lever SL and extending from element 16 through signal CS to terminal C.

When lever SL is in its *a* position and the train operates in section G—H at a speed less than 53 miles per hour, a first branch circuit path is established for unit L1 of signal CS. This branch path includes terminal wire 49, which is connected through wire 41 to unit L1 and to terminal C, hence it is apparent from an inspection of Fig. 2 that since terminal wire 49 is connected to contact segments 24, 25, 26 and 27 of device ES (being connected directly to contact segment 24 and being connected to the other contact segments through the medium of contact element 67 of lever SL and terminal wires 50, 51 and 52 connected to contact segments 25, 26 and 27, respectively), this first branch path is established whenever contact segment 24, 25, 26 or 27 is engaged by element 16 of device ES and lever SL is in its *a* position. A second branch path is established when the train operates in a 53–73 miles per hour speed range, this circuit path extending from element 16 through contact segment 28 of device ES, terminal wire 53, contact element 68 of lever SL, jumper wire 60, contact element 70 of lever SL, terminal wire 55, wire 63 and unit L2 of signal CS to terminal C. In the 73–maximum speed range, a third branch path is completed which extends from element 16 through contact segment 29 of device ES, terminal wire 54, contact element 69 of lever SL, jumper wire 62, contact element 71 of lever SL, terminal wire 58, wire 42 and unit L3 of signal CS to terminal C.

When selector lever SL is in its *b* position, contact element 73 of lever SL connects terminal wire 50 to terminal wire 49 so that whenever element 16 engages either contact segment 24 or 25 of device ES, a circuit path is established extending from element 16 and passing through terminal wire 49, wire 41 and unit L1 of signal CS to terminal C. Whenever element 16 engages contact segment 25, 26, 27 or 28, however, another circuit path is established since contact element 74 of lever SL connects terminal wires 51, 52, 53 and 54 (connected respectively to the named contact segments of device ES) to terminal wire 55, which wire is connected through

wire 63 to unit L2 of signal CS and to terminal C.

When selector lever SL is operated to its *c* position, a first circuit path may be completed extending from element 15 through contact segment 24 of device ES, terminal wire 49, wire 41 and unit L1 of signal CS to terminal C. Another circuit path may be completed extending from element 16 through contact segment 25 or 26 and its associated terminal wire 50 or 51, respectively, contact element 79 of lever SL, jumper wire 61, contact element 81 of lever SL, terminal wire 55, wire 63 and unit L2 of signal CS to terminal C. A still different circuit path may be established from element 15 through contact segment 27, 28 or 29 of device ES, terminal wire 52, 53 or 54, contact element 80 of lever SL, jumper wire 83, contact element 82 of lever SL, terminal wire 59, wire 42 and signal unit L3 to terminal C.

From the foregoing detailed tracing of the plurality of circuits one or another of which is set up when the train occupies section G—H, it is readily apparent that the selector lever SL and speed responsive device ES cooperate to selectively control the aspects displayed by signal CS in the manner set forth hereinbefore. The utility and meaning of these various aspects provided for the several classes of trains in section G—H are believed to be readily apparent from the foregoing description of the utility and meaning of the corresponding aspects provided for the train in section H—J.

If a train traverses section F—G so that relays DR5 and DR7 are picked up in response to the form of trackway energy received from the rails, then class *a* trains are provided with "brake next" or "brake" aspects according as such trains are travelling in the 0-52 or 52-maximum miles per hour speed range; class *b* trains are provided with "brake next" or "brake" aspects according as such trains are travelling in the 0-32 or 32-maximum miles per hour speed range; and class *c* trains are provided with "brake next" or "brake" aspects according as such trains operate in the 0-22 or 22-maximum miles per hour speed range. Signal CS is caused to display the above-mentioned aspects to trains in section F—G by virtue of the cooperative action of device ES and selector lever SL in selectively completing one or another of a plurality of circuits all of which have the following circuit elements in common; terminal B, front contact 36 of relay DR7, back contact 38 of relay DR1, back contact 85 of relay DR6, back contact 87 of relay DR5, back contact 89 of relay DR4, front contact 90 of relay DR3 and speed responsive element 15 of device ES, but which circuits are selectively completed over branch circuit paths controlled jointly by device ES and lever SL and extending from element 15 through signal CS to terminal C.

When selector lever SL is in its *a* position and the train traverses section F—G at a speed below 52 miles per hour, a circuit path is completed for unit L2 of signal CS. This circuit path includes terminal wire 55, which is connected through wire 63 to unit L2 of signal CS and to terminal C, and it follows that since terminal wire 55 is connected directly to contact segment 20 of device ES and is connected to contact segments 21 and 22 of device ES through the medium of contact element 70 of selector lever SL and terminal wires 56 and 57, which wires are in turn connected to contact segments 21 and 22, such circuit path is completed whenever element 15 of device ES engages contact segment 20, 21

or 22 of device ES. When the train operates at a speed in excess of 52 miles per hour, a branch circuit path is completed extending from element 15 through contact segment 23 of device ES, terminal wire 58, wire 42 and unit L3 of signal CS to terminal C.

If lever SL is in its *b* position and the train traverses section F—G at a speed below 32 miles per hour, a circuit path is completed extending from element 15 of device ES through contact segment 20 of device ES and terminal wire 55 to wire 63, or through contact segment 21 of device ES, terminal wire 56, contact element 74 of lever SL and terminal wire 55 to wire 63, through wire 63 to unit L2 of signal CS and to terminal C. If, however, the train operates at a speed in excess of 32 miles per hour, then a circuit path is completed for unit L3 of signal CS, this path including terminal wire 58, wire 42, unit L3 and terminal C, and since terminal wire 58 is connected directly to contact segment 23 of device ES and also is connected to contact segment 22 of device ES through contact element 75 of lever ES and terminal wire 57, it can be seen that this circuit path is completed whenever either contact segment 22 or 23 is engaged by element 15.

In the event that lever SL is in its *c* position while the train traverses section F—G at a speed below 22 miles per hour, a circuit path is completed extending from element 15 through contact segment 20 of device ES, terminal wire 55, wire 63 and unit L2 to terminal C. However, if the train operates at a speed in excess of 22 miles per hour, a circuit path is completed for unit L3 of signal CS, this path including terminal wire 58, wire 42, unit L3 and terminal C. As is readily apparent from an inspection of Fig. 2, terminal wire 58 is connected directly to contact segment 23 of device ES and is connected also to contact segments 21 and 22 of device ES through the medium of contact element 82 of lever SL and terminal wires 56 and 57, respectively, and it follows that the mentioned circuit path of unit L3 of signal CS is completed whenever a class *c* train operates in section F—G at a speed in excess of 22 miles per hour so that element 15 engages contact segment 21, 22 or 23.

From the foregoing detailed tracing of the plurality of circuits one or another of which is established when a train traverses section F—G, it can be seen that the particular aspect that is displayed by signal CS to a train is determined both by the speed at which the train is operating and also by the position of the selector lever SL. It should be noted that the least restrictive aspect displayed the trains in section F—G is the "brake next" aspect since all trains irrespective of class should be prepared for a brake application in the section next in advance in order to bring such trains to a stop in such block short of the occupied block.

In section E—F, all trains irrespective of class are provided with a "restricting" aspect by virtue of an energizing circuit which may be traced from terminal B through front contact 36 of relay DR7, back contact 38 of relay DR1, back contact 85 of relay DR2, back contact 87 of relay DR3, back contact 89 of relay DR4, back contact 91 of relay DR5, front contact 92 of relay DR6 and the filament of signal unit L4 of signal CS to terminal C. This aspect is common to all classes of trains since each train should be prepared to stop short of the entrance of the next block.

If a train follows another train in a block,

then the trackway energy is shunted away from the following train and all decoding relays carried thereby are released so that irrespective of class all following trains in an occupied block are provided with a "stop" aspect by virtue of an energizing circuit which extends from terminal B through back contact 93 of relay DR1 and the filament of signal unit L5 of signal CS to terminal C. This aspect is common since all following trains are required to proceed with care and should be prepared to stop short of the preceding train in the block.

From the foregoing, it is readily apparent that apparatus embodying my invention provides means whereby the signal aspects provided for each of several different classes of trains operating on a trackway may be adjusted to the particular braking characteristics of each of the several classes and to the speed at which trains of such classes operate. It follows, therefore, that the spacing of trains on a stretch of track may be adjusted to the braking characteristics of each individual train and need not be adjusted to the braking requirements of the class of trains most difficult to stop, so that as a result the capacity of the track may be materially increased.

While I have assumed specific values for different speeds and braking distances and have assumed a classification of trains based upon certain illustrated braking-distance curves, it is to be understood that such values, classes and curves have been selected merely for the purpose of illustration and that in practicing my invention the braking-distance curves and classes of trains may be selected to conform within limits, of course, to the particular conditions desired.

In addition, it should be understood that while my invention has been described in connection with a signaling system wherein five indications are utilized to control traffic over sections six blocks in the rear of an occupied section, the scope of my invention is in no way limited to such system but embraces systems employed to control any number of indications (preferably three or more) controlling traffic in four or more blocks in the rear of an occupied section.

Although I have herein shown and described only one form of railway traffic controlling apparatus embodying my invention, it is to be understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. Railway traffic controlling apparatus of the type adapted to be employed in conjunction with a stretch of trackway to the rails of which is supplied one or another of a plurality of different forms of trackway energy in accordance with traffic conditions in advance, comprising the combination with train-carried means for receiving energy from the track rails and control means operated by energy supplied from said receiving means and selectively responsive to each of said different forms of trackway energy, of a train-carried multiple indication signal having a clear indication and a plurality of restrictive indications, circuit means controlled by said control means for selectively controlling said signal, and a multiple position manually operable selector lever having contacts interposed in said circuit means and effective to condition said signal to display a restrictive indication at one or another of a plurality of distances in the rear of a danger

condition on the trackway according as said selector lever is in one or another of its positions.

2. Railway traffic controlling apparatus of the type adapted to be employed in conjunction with a stretch of trackway to the rails of which is supplied one or another of a plurality of different forms of trackway energy in accordance with traffic conditions in advance, comprising the combination with train-carried means for receiving energy from the rails of the trackway and control means operated by energy received by said receiving means and selectively responsive to each of said different forms of trackway energy, of a train-carried governing device having a plurality of distinctive control conditions including a clear and a restrictive condition, circuit means controlled by said control means for controlling said governing device to one or another of its said plurality of control conditions in accordance with the form of trackway energy received from the track rails, and train-carried selecting means having a plurality of conditions one for each of a plurality of classes of trains arranged according to braking characteristics and manually adjustable to selectively determine which of said plurality of control conditions of said governing device shall be controlled by said control means in response to each form of trackway energy for controlling in accordance with the condition of said selecting means the distance in the rear of another train on the stretch that said signal displays its restrictive indication in order that the spacing of trains on said stretch may be adjusted to the particular braking characteristics of the class of train to which the signal is assigned to control.

3. Railway traffic controlling apparatus of the type adapted to be employed in conjunction with a stretch of trackway to the rails of which is supplied one or another of a plurality of different forms of trackway energy in accordance with traffic conditions on said stretch, comprising the combination with train-carried means for receiving energy from the track rails and a train-carried governing device having a plurality of different control conditions including a clear and a restricting condition, of control means operated by energy supplied from said receiving means and selectively responsive to each of said different forms of trackway energy, circuit controlling means responsive to the speed of the train, circuit means controlled jointly by said trackway energy responsive control means and by said speed responsive control means for controlling said governing device to its clear or its restricting condition in accordance with the form of trackway energy received from the track rails and the speed of the train, and selecting means manually operable to one or another of a plurality of conditions one for each of a plurality of classes of trains arranged according to certain characteristics, said selecting means having means controlled in accordance with the position of said selecting means for modifying the control exerted over said governing device by said circuit means to cause the distance in the rear of danger condition on the trackway that a restrictive indication of said governing device is displayed to be varied in accordance with certain characteristic features of the different classes of trains.

4. Railway traffic controlling apparatus of the class wherein train-carried trackway energy responsive means is selectively controlled in response to trackway energy of one or another of a plurality of different forms of energy received

from the trackway and said energy responsive means selectively controls in accordance with the form of the received trackway energy one or another of a plurality of circuits one for each of a plurality of control units of a train-carried visual signaling device, said signaling device having a clear and a restrictive indication, characterized by the fact that there is combined with said trackway energy responsive means a manually adjustable selector lever having a plurality of selecting positions and having means controlled in accordance with the position of said selector lever for modifying the control established by said energy responsive means over the circuits of said signaling device to condition said signaling device to display its restrictive indication for one or another of a plurality of distances on the stretch according as said selector lever is in one or another of its plurality of selecting positions.

5. Railway traffic controlling apparatus of the class wherein train-carried trackway energy responsive means is selectively controlled in response to trackway energy of one or another of a plurality of different forms of energy received from the trackway and said energy responsive means selectively establishes in accordance with the form of the received trackway energy one or another of a plurality of circuits one for each of a plurality of control units of a train-carried visual signaling device, said signaling device having a clear and a restrictive indication, characterized by the fact that said circuits of said signaling device are carried through contacts operated by an adjustable selector having a plurality of selecting positions and further that the contacts of said selector are selectively interposed into or cut out of one or another of said circuits according as said selector is in one or another of its plurality of selecting positions whereby to condition said signaling device to display its restrictive indication for one or another of a plurality of distances in the rear of another train on the stretch according as said selector is in one or another of its plurality of selecting positions.

6. Railway traffic controlling apparatus of the class wherein train-carried trackway energy responsive means is selectively controlled in response to trackway energy of one or another of a plurality of different forms of energy received from the trackway and said energy responsive means selectively establishes in accordance with the form of the received trackway energy one or another of a plurality of circuits one for each of a plurality of indications of a train-carried visual signaling device, said signaling device having a clear and a restrictive indication, characterized by the fact that said circuits of said signaling device are carried through contacts operated by an adjustable selector having a plurality of selecting positions one for each of a plurality of different classes of trains arranged according to certain characteristics and further that the contacts of said selector are selectively interposed into one or another of said circuits according as said selector is in one or another of its plurality of selecting positions to condition said signaling device to display its restrictive indication for one or another of a plurality of distances in the rear of a danger condition in the stretch and thus signal each of said classes of trains in a different manner.

7. Railway traffic controlling apparatus of the class wherein train-carried trackway energy responsive means is selectively controlled in response to trackway energy of one or another of a plurality of different forms of energy received

from the trackway and said energy responsive means selectively establishes in accordance with the form of the received trackway energy one or another of a plurality of circuits one for each of a plurality of indications of a train-carried visual signaling device, said signaling device comprising a clear and a restrictive indication characterized by the fact that there is combined with said trackway energy responsive means a manually adjustable selector lever having a plurality of positions one for each of a plurality of different classes of trains arranged according to certain characteristics and said selector lever having contacts through which said circuits are carried and which contacts are selectively interposed into said circuits in accordance with the position of said lever for controlling the distance in the rear of another train on the stretch that said signaling device displays its clear indication.

8. Railway traffic controlling apparatus of the class wherein train-carried trackway energy responsive means is selectively controlled in response to trackway energy of one or another of a plurality of different forms of energy received from the trackway and said energy responsive means selectively establishes in accordance with the form of the received trackway energy one or another of a plurality of circuits one for each of a plurality of indications of a train-carried visual signaling device, said signaling device comprising a clear and a restrictive indication, characterized by the fact that there is combined with said trackway energy responsive means an adjustable selector lever having a plurality of positions one for each of a plurality of different classes of trains and having contacts through which said circuits are carried and which contacts are selectively interposed into or cut out of said circuits in accordance with the position of said lever for varying the distances in the rear of another train on the stretch that said signaling device displays its restrictive indication, whereby to enable each of said different classes of trains to be signaled in a manner which differs from the other classes and is dependent upon the position of said selector lever.

9. Railway traffic controlling apparatus of the type adapted to be employed in conjunction with a stretch of trackway to the rails of which is supplied one or another of a plurality of different forms of trackway energy in accordance with traffic conditions in advance, comprising the combination with train-carried means for receiving energy from the rails of the trackway and control means operated by energy received by said receiving means and selectively responsive to each of said different forms of trackway energy, of a train-carried governing device having a plurality of distinctive control conditions including a clear and a restrictive indication, circuit means controlled by said control means for controlling said governing device to one or another of its said plurality of control conditions in accordance with the form of trackway energy received from the track rails, and train-carried selecting means adjustable for selectively controlling the distances in the rear of another train in the stretch that said governing device displays its restrictive indication in response to each form of trackway energy, whereby to enable each of said plurality of forms of trackway energy to control said governing device in a different manner determined by the condition of said selecting means for adjusting the condition to

which said governing device is controlled by each of said forms of trackway to the particular characteristics of different classes or types of trains.

10. Train-carried apparatus of the type adapted to be controlled by control influences continuously transmitted from the rails of a trackway, comprising a train-carried governing device having a plurality of distinctive conditions including a clear and a restrictive condition, means receiving energy from the rails of said trackway and selectively responsive to each different form of trackway energy received from the track rails, means responsive to the actual speed of the train, other means responsive to the combined action of both said energy responsive and speed responsive means for controlling said device to one or another of its said distinctive conditions, and means on said train for selectively controlling the distances in the rear of another train on the stretch that said device is controlled to its restrictive condition by combined action of said energy responsive means and said speed responsive means, whereby the condition to which said device is controlled may be varied to conform to the different characteristic features of different trains.

11. Train-carried apparatus of the type adapted to be controlled by trackway energy continuously transmitted from the rails of a trackway, comprising a train-carried governing device having a plurality of distinctive control conditions including a clear and a restrictive condition, means operable by energy received from said trackway and selectively responsive to each different form of energy received from the trackway, circuit controlling means selectively responsive to different ranges of speed of the train, circuit means controlled jointly by both of said means for controlling said device to one or another of its said plurality of distinctive conditions, and other circuit controlling means operable to one or another of a plurality of conditions for selectively controlling the distances in the rear of another train on the stretch that said device is controlled to its restrictive condition by the combined action of said energy responsive and speed responsive means, whereby the condition to which said device is controlled in response to each different form of trackway energy and to each range of train speed may be varied to conform to the varying braking conditions of different classes of trains.

12. The apparatus of claim 4 further characterized by the fact that there is interposed in certain of the control circuits of the signaling device contacts of a speed controlled member responsive to the speed of the train whereby the control established by the trackway energy responsive means is modified jointly by the posi-

tion of the selector lever and by the speed of the train.

13. The apparatus of claim 10 further characterized by the fact that there is combined with said trackway energy responsive means and said selector lever a speed responsive device having a plurality of contacts selectively closed in accordance with the speed of the train and which contacts are selectively interposed into or cut out of the circuits of said signaling device in accordance with the speed of the train whereby to enable each of said classes of trains to be signaled in a manner that differs from the other classes and is dependent jointly upon the position of the selector lever and upon the speed at which the train is operating.

14. The apparatus of claim 10 further characterized by the fact that there is combined with said trackway energy responsive means and said selector lever a speed responsive device having a plurality of contacts selectively closed in accordance with the speed of the train and which contacts are selectively interposed into or cut out of one or another of the plurality of circuits of said signaling device in accordance with the speed of the train for modifying the control exerted by said trackway energy responsive means over said signaling device in response to each of said plurality of forms of trackway energy whereby to control said signaling device jointly in accordance with the form of trackway energy received from the trackway and the position of said selector lever and the speed of the train.

15. Train carried apparatus for use with a stretch of railway trackway divided into successive adjoining track sections supplied with track circuit current having one or another of a plurality of characteristics depending upon traffic and/or track conditions in advance, comprising the combination with means carried on a train for receiving track circuit current and control means energized thereby and selectively responsive to the characteristics of such received current, of a traffic controlling signal having a clear and a plurality of restricting indications, a selector device having a plurality of conditions one for each of a plurality of classes of trains arranged according to braking characteristics, and a plurality of circuits for said signal selectively controlled by said control means in accordance with the characteristic of the received track circuit current to cause said signal to display restrictive indications for a different number of track sections in the rear of an occupied section dependent upon the braking characteristics of the class of train signaled as determined by the condition of said selector device.

JOHN W. LOGAN, JR.

CERTIFICATE OF CORRECTION.

Patent No. 2,249,015.

July 15, 1941.

JOHN W. LOGAN, JR.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 11, first column, line 21, claim 10, after the word "by" insert --the--; line 24, same claim, for "conform to the" read --conform to--; and second column, lines 3 and 17, claims 13 and 14 respectively, for the claim reference numeral "10" read --8--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of September, A. D. 1941.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)