Oct. 28, 1924. 1,513,562

A. G. SHAVER ET AL

TRAIN CONTROL SYSTEM

Filed Nov. 6, 1923 2 Sheets-Sheet 1

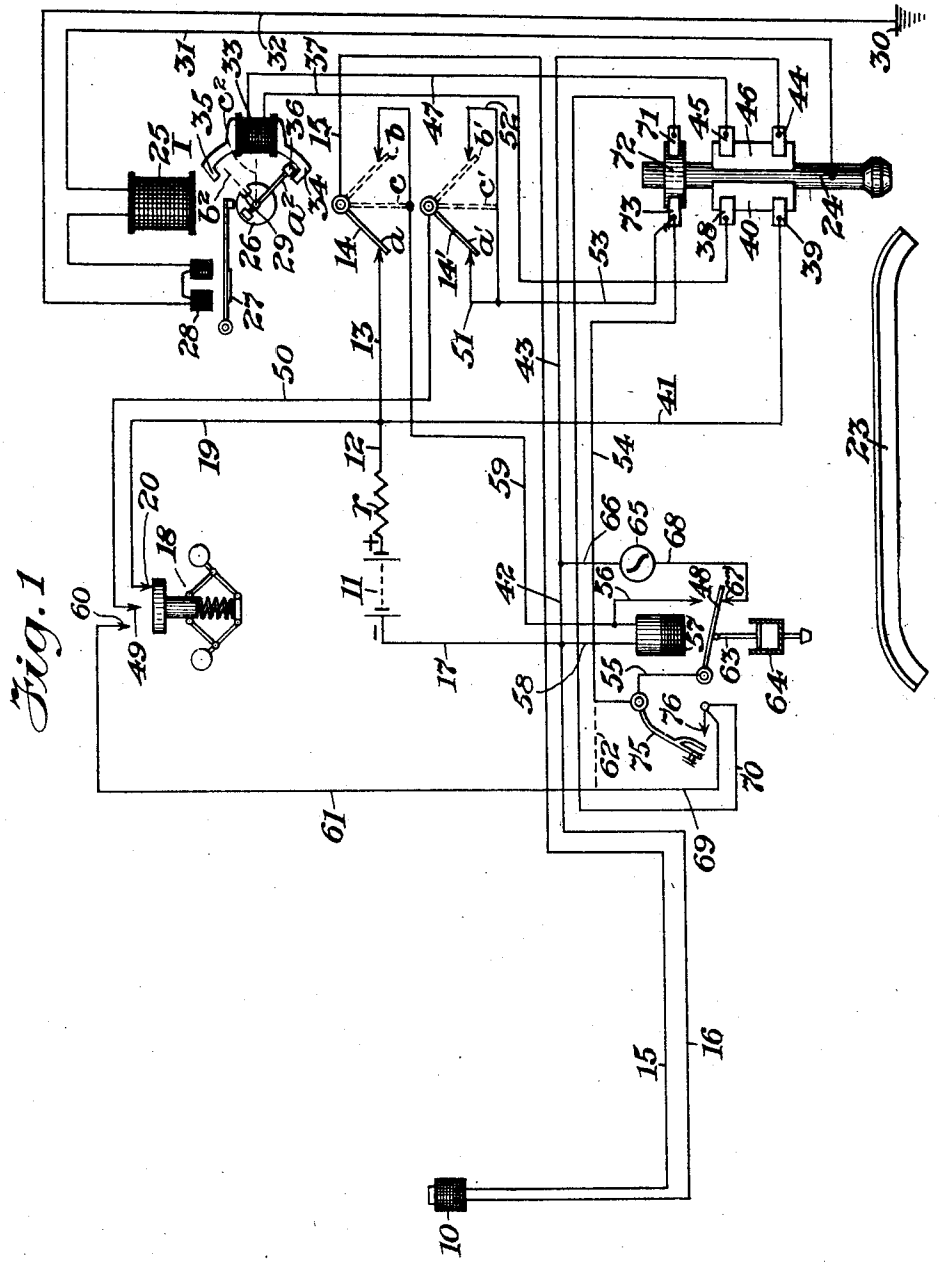


Fig. 1

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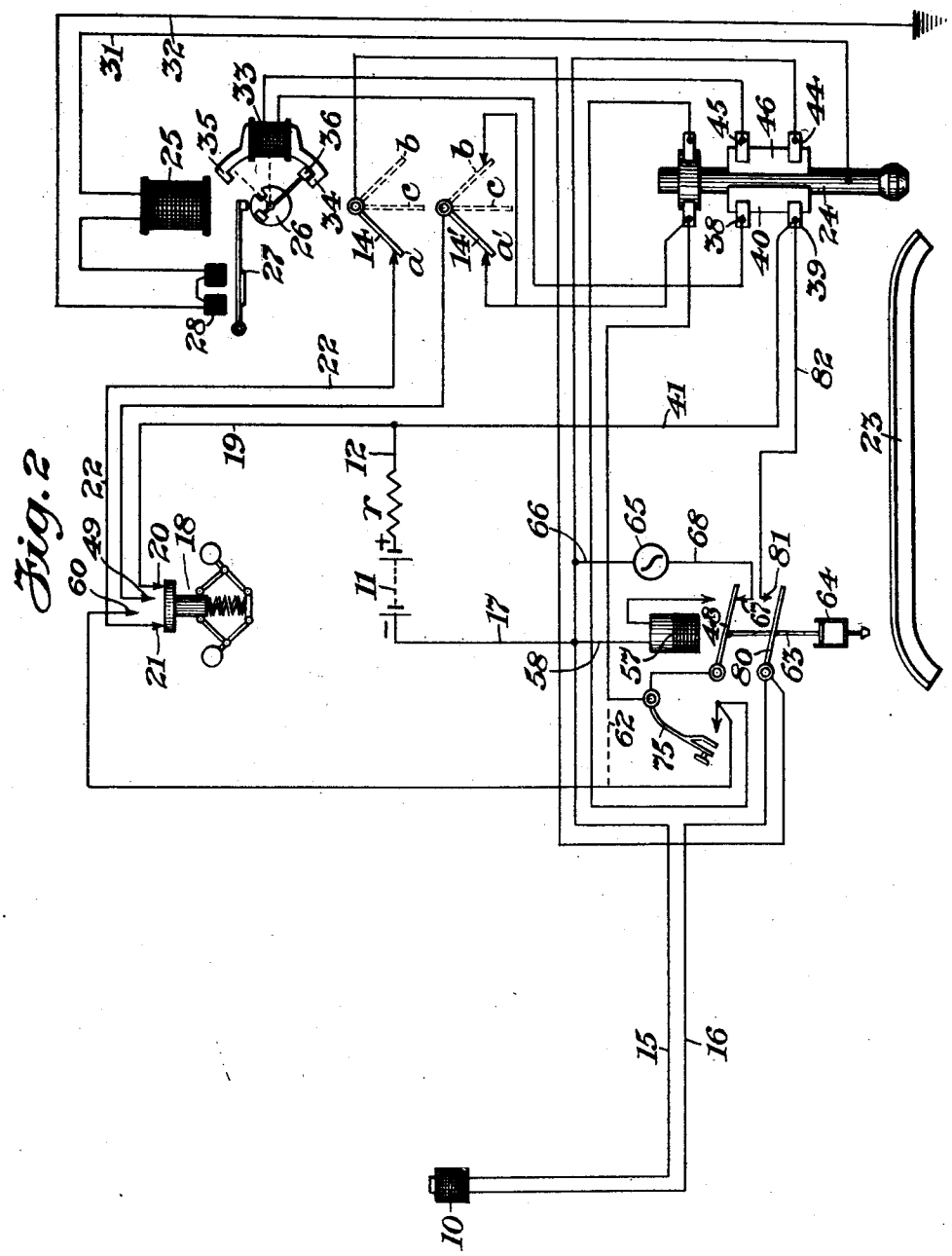


Fig. 2.

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Patented Oct. 28, 1924. 1,513,562

UNITED STATES PATENT OFFICE.

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TRAIN-CONTROL SYSTEM.

Application filed November 6, 1923. Serial No. 673,087.

To all whom it may concern:

Be it known that we, ARCHIBALD G. SHAVER and BENJAMIN W. MEISEL, citizens of the United States, and residents of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Train-Control Systems (Case A), of which the following is a specification.

This invention relates to a train control system and more particularly to a system for controlling the movement of trains automatically by roadside mechanism and manually by the engineman on the train, and has special reference to the provision of a system in which automatic control is so combined with manual control as to assure absolute safety while permitting proper dispatch in the movement of trains.

One of the principal objects of our present invention comprehends the provision of a train control system in which train carried mechanism for governing the operation of the train is automatically controlled by roadside mechanism operable in accordance with roadside conditions in such a manner that the running operation of the train under unsafe traffic conditions is made dependent upon such traffic conditions only so as to provide absolute safety in train operation, and in which the cooperative control by the engineman is necessitated to supplement the automatic control for producing efficient and expeditious train movement.

In the production of an efficient train control system one of the factors of paramount importance is that of providing for the element of absolute safety of train movement under unsafe traffic conditions. To accomplish this it is requisite that the roadside mechanism reflecting the conditions on the roadside should assume unchallenged predominance in controlling the behaviour of the train under hazardous conditions, and that any condition of control impressed or imposed on an unsafely moving vehicle by the roadside mechanism should be beyond human interference. Another desideratum of infinite importance, however, is that of providing a system in which the engineman is restrained from shifting or casting the full burden of control upon the automatic train control mechanism, substitution of the automatic mechanism alone for the engineman being highly undesirable in practice. The ideal mode of controlling the movement of trains is that in which the engineman is compelled to be alert, or is deterred or restrained from being remiss in his duties so that proper handling of the train is enforced and in which the engineman is supplanted by the automatic control mechanism only upon his failure to properly discharge his duties, and in which when so supplanted the automatic control is the dominant factor until safe running conditions of the train is resumed and the engineman again assumes control. When the engineman and the automatic train control mechanism are made to cooperate in this manner, the one acting as a check upon the other, absolute safety and proper dispatch in the running of trains is assured.

By our present invention to accomplish this object we provide a train control system in which full control of the train is left in the hands of the engineman so long as he is properly performing his duties in obedience to and in conformity with the indications of the roadside signalling apparatus, in which the control of the train is automatically taken from the engineman who is incapacitated or remiss in the performance of his duties and the train is automatically operated in accordance with roadside conditions, and in which the engineman is compelled to be alert and operate his train in accordance with an "unsafe" roadside signal indication and to acknowledge such indication to prevent an undesirable automatic operation, and if remiss in preventing the automatic operation the engineman is thereafter compelled to be alert and to again take charge of the operation of the train in order to avoid an undesirable condition of train control, the system thus combining the factor of absolute safety by making train operation dependent upon the automatic dictation of the roadside mechanism under hazardous conditions with the factor of proper train dispatching by making the efficient movement of the train dependent upon the activity and alertness of the engineman.

Another principal object of the present invention relates to the provision of a train control system in which the movement of

the vehicle is controlled within the limits of two or three permissive speeds including a maximum speed beyond which the vehicle cannot run, a medium speed at or below which the vehicle must approach points of danger and run in localities where a greater speed would be unsafe, and a low speed above which the vehicle cannot run in "danger" localities, as in blocks occupied by other trains. In accomplishing this object of the invention, the design and construction of the system is such that if a speed greater than the permissive maximum speed is attempted, the train is automatically controlled to cause a retardation of the speed of the vehicle to or below the permissive maximum; the system operating further so that if a speed greater than the medium permissive speed is attempted when roadside conditions require the movement of the vehicle at or below the medium speed, the train is automatically controlled to bring the same to a halt, the alertness of the engineman permitting, however, the placing of the train under the control of the medium permissive speed; and if a speed greater than the low permissive speed is attempted when the roadside conditions require a low speed restriction on the train, the train is automatically controlled to bring the same to a halt unless the engineman again modifies the automatic operation to place the train under the control of the low permissive speed.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, our invention consists in the elements and their relation one to the other, as hereinafter particularly described and sought to be defined in the claims, reference being had to the accompanying drawing showing the preferred embodiment of our invention, and in which:—

Fig. 1 is a diagrammatic view showing the vehicle carried apparatus and circuits and part of the roadside apparatus cooperating therewith, and

Fig. 2 is a diagrammatic view of a modification thereof.

In the train control system of our present invention, for directly controlling the movement of the train there is provided an electrically operated device for controlling the operation of the air brake system, the said device being under the control of cooperating train and roadside mechanism, and being operated thereby in accordance with roadside conditions. The electrically operated device comprises in the preferred construction an electromagnet 10 which controls the operation of a combined reservoir and brake valve of the type disclosed in the patent to A. G. Shaver No. 1,411,526 of April 4, 1922 and in the copending application of Allen B. Kendall Serial No. 443,046 of Feb. 7, 1921, the said reservoir and brake valve functioning upon the deenergization of the electromagnet 10 for cutting off the supply of air from the main reservoir of the air brake system to the engineman's brake valve and for opening the train pipe to exhaust, the electromagnet 10 being normally energized to hold open the communication between the main reservoir and the engineman's brake valve and to close the train pipe to exhaust.

For normally controlling the operation of the electromagnet 10, there is provided a train carried circuit which is normally energized as under "clear" roadside conditions by a train carried source of energy such as the battery 11, the said circuit including the resistance r connected to the positive terminal of the battery, conductors 12 and 13, the movable make and break indicating means 14 which is operable in response to roadside conditions as will be detailed hereinafter to assume any one of the three positions a, b and c, the full-line inclined position a corresponding to the "normal" or "clear" position, the inclined dotted position b corresponding to one of the "non-clear" positions such as the "caution" position, and the vertical dotted line position c corresponding to another "non-clear" such as the "danger" position, the said circuit further including the conductor 15, the electromagnet 10, conductor 16 and conductor 17 connected to the negative terminal of the battery 11. Under "normal" or "clear" conditions with the indicating means 14 in the position a, the brake controlling magnet is energized to permit the vehicle to proceed.

To place the train under the control of a maximum permissive speed, the electromagnet 10 instead of being controlled under "clear" conditions by the circuit traced above, may be controlled by an alternative circuit which is placed under the control of a speed circuit controller 18 which is operated in accordance with the speed of movement of the train. This alternative circuit is shown in Fig. 2 of the drawings and is the same as that above described, with the exception that the conductor 13 is replaced by the conductor 19, the common contact 20, the contact 21 and the conductor 22, so that the electromagnet 10 in addition to being under the control of the make and break indicating means 14 is also under the control of the speed controlled contact mechanism 18 at the contact 21. It will be apparent that with this construction when the speed of the train exceeds a predetermined maximum limit the maximum speed control circuit will be opened at the contact 21 and the electromagnet 10 deenergized, and that when the speed of the train is thereafter reduced to the maximum permissive speed, the magnet 10 is automati-

cally reenergized to permit the train to proceed.

The brake controlling magnet 10 in the operation of our system is operated in response to and in accordance with roadside or traffic conditions, and to this end there is provided cooperating train and roadside mechanism which functions to cause the make and break indicating means 14 and a make and break indicating means 14′ to be operated selectively to the positions *a*, *a′*; *b*, *b′*; and *c*, *c′*; position *a*, *a′* being as already indicated the "clear" indicating position; position *b*, *b′* the "caution" indicating position; and position *c*, *c′* the "danger" indicating position.

The train and roadside mechanism for controlling the action of the indicating means includes the provision of a roadside energy transmitting means which in the present form of our invention comprises a plurality of ramp rails spaced along the roadside, a rail such as indicated at 23 being provided for each section or block of the track, the said ramp rail comprising means for transmitting energy to a train carried shoe mechanism 24 under "safe" roadside conditions, such energy being transmitted to a translating device such as the indication selector I, the action of which directly controls the operation of the make and break indicating means 14, 14′.

The indication selector I preferably comprises a unit such as is disclosed in the copending application of Theodore Bodde, Ser. No. 634,059, filed April 23, 1923, the indication selector comprising a stator 25 and a rotor 26 movable into any one of three positions, the "normal" position a^2, the "caution" position b^2 and the "danger" position c^2 corresponding to the positions *a*, *b* and *c* simultaneously assumed by the make and break means 14, the position a^2 being produced by energizing the stator magnet 25 with a current of a given polarity, the position b^2 being assumed by energizing the magnet 25 with a current of a reverse polarity, and the position c^2 being assumed when the magnet 25 is unenergized. The indication selector further includes a locking device 27 controlled by an electromagnet 28 and operative for engaging a notch 29 in the rotor 26 to lock the same in the "neutral" or "danger" position.

The electromagnets 25 and 28 are arranged in series and are connected in a partial circuit to the shoe 24 and to the frame of the vehicle represented by the ground connection 30 by means of the conductors 31 and 32, the construction being such that when the shoe 24 rides the ramp 23 the said partial circuit will cooperate with a roadside partial circuit (not shown) connected to the ramp 23 and to the rails as is disclosed for example in the application of A. G. Shaver, Ser. No. 292,548. filed May 25, 1919, the cooperation being such that under "normal" or "clear" roadside conditions the ramp 23 will be energized by current of a given polarity to correspondingly energize the magnet 25 and under a "non-clear" such as a "caution" roadside condition, the ramp 23 will be energized by current of an opposite polarity to correspondingly energize the magnet 25 and under a "danger" roadside condition the ramp 23 will be deenergized so that the magnet 25 is unenergized when the shoe rides the ramp.

For holding or mantaining the rotor 26 of the indication selector and the make and break means 14 and 14′ in the positions to which these parts are actuated when the shoe moves over the ramp, the indication selector includes a holding circuit which is broken when the shoe moves over the ramp to permit freedom of action of the moving parts in response to energization of the magnet 25 and which is closed when the shoe disengages the ramp, the said holding circuit comprising an electromagnet 33 having pole pieces 34 and 35 selectively operable for cooperating with the armature 36 of the rotor 26 to hold the same in either the positions a^2 or b^2, the holding circuit further including conductor 37, the contact elements 38 and 39 normally bridged by the conducting piece 40 movable with the shoe 24, conductor 41, conductor 12, resistance *r*, battery 11, conductors 17, 42 and 43, contact elements 44 and 45 normally bridged by the conducting piece 46 also fixed to and movable with the shoe 24 and conductor 47. This circuit is normally closed as traced and when the shoe engages the ramp is broken at the contacts 39 and 44 to effect the deenergization of the holding magnet 33 and permit the freedom of motion and operation of the rotor by the action of the magnet 25. When the shoe leaves the ramp this circuit is again closed at the contacts for reenergizing the holding magnet 33 to hold the armature 36 in the position to which it has been operated by the selective energization of the magnet 25.

As heretofore mentioned, in accordance with our present invention it is desired to operate trains by a combined automatic and manual control, the train being automatically controlled by roadside mechanism in accordance with roadside or traffic conditions, the automatic control being supplemented by a manual control to prevent or modify the automatic operation if the engineman is alert and is acting in obedience to the indications of the roadside signalling system. To compel alertness it is contemplated by the present invention to produce an automatic operation to bring the vehicle to a halt or stop whenever an unsafe such as a "caution" or "danger" indication is received

by the vehicle mechanism, this automatic stop being produced irrespective of the speed of the vehicle when passing an indication ramp, the stop condition, however, being preventable or modifiable by the engineman either before or after an indication ramp is passed if the speed of the vehicle has been reduced to or is running at a permissive speed.

For producing this operation when a "caution" block is being approached or has been entered, and more specifically when the indicating means 14, 14′ is moved from the "clear" position *a* to the "caution" position *b*, we provide a medium permissive speed control circuit for controlling the operation of the brake controlling magnet 10, this circuit being under the control of the speed controller 18, the make and break indicating means 14, 14′ and a contact mechanism 48, the circuit comprising battery 11, resistance *r*, conductors 12 and 19, contact 20, controller 18, medium speed control contact 49, conductor 50, make and break means 14′ in either the "clear" position *a*′ or the "caution" position *b*′, conductor 51 if the means 14′ is in "clear" position, or conductor 52 if the said means is in the "caution" position, conductors 53, 54 and 55, normally open contact mechanism 48, conductor 56, magnet 57, conductors 58 and 17. This circuit is normally open at the contact 48 and it will be apparent that if the speed of the vehicle is at or below the medium speed for closing the contact 49 irrespective of whether the train mechanism is running under "clear" conditions or has changed to a "caution" condition, the closing of the contact 48 will close this normally open circuit and the circuit will be maintained closed by the continued energization of the magnet 57, the said magnet in association with the contact 48 comprising a stick relay.

This medium speed control circuit controls the electromagnet 10 so that if the circuit is closed and the indication selector has received a "caution" indication, the normal operation of the magnet 10 will persist, thus preventing or modifying an automatic control thereof, and in the construction shown in Fig. 1 this is accomplished by placing the electromagnet 10 and the indicating means 14 in "caution" position in parallel with the stick relay magnet 57 by means of the parallel circuit comprising the conductor 59, make and break means 14 in position *b*, conductor 15, electromagnet 10, and conductor 16. With this circuit arrangement it will be seen that:

a. If the speed of the vehicle is at or below the medium permissive speed and the contact 48 has been operated by the engineman to circuit closing position, when the shoe 24 rides the ramp 23 operating the make and break means 14 and 14′ to the "caution" position, the magnet 10 will remain energized and the automatic operation will be inhibited, and

b. If the shoe 24 irrespective of the speed of the vehicle moves over a "caution" ramp 23 and the indicating means 14, 14′ is moved to "caution" position *b*, *b*′, the electromagnet 10 will be deenergized to bring the vehicle to a halt and after such deenergization the magnet 10 may be reenergized by manually operating the contact 48 to circuit closing position provided that the speed of the train is at or has been reduced to the medium permissive speed for closing the contact 49.

For producing the desired automatic manual operation when a vehicle running "clear" is approaching or enters a "danger" block and more specifically when the indicating means 14, 14′ is moved from the "clear" to the "danger" position, we provide a low permissive speed circuit for controlling the electromagnet 10, this circuit comprising the battery 11, resistance *r*, conductors 12 and 19, common contact 20, controller 18, low speed contact 60, conductor 61, conductor 62, conductor 55, normally open contact 48, conductor 56, stick relay 57 and conductors 58 and 17. With this low permissive speed control circuit it will be seen that when the speed of the train is at or below the low permissive speed either before or after the shoe 24 rides the ramp, the closing of the contact 48 will close the circuit and maintain the same closed.

The low speed control circuit controls the operation of the electromagnet 10 by means of a branch circuit arranged in parallel with the stick relay 57 and including the make and break means 14 in the "danger" position *c*, the said parallel circuit comprising conductor 59, make and break indicating means 14 in position *c*, conductor 15, electromagnet 10, and conductor 16. With this circuit arrangement, it will be manifest that in operation:

a. If the speed of the vehicle is at or below the low permissive speed and the contact 48 has been operated by the engineman to circuit closing position, when the shoe 24 rides the ramp 23 operating the make and break means 14 to the "danger" position, the magnet 10 will remain energized by the low speed control and branch circuits and the automatic operation will be inhibited.

b. If the shoe 24 irrespective of the speed of the vehicle moves over a "danger" ramp 23 and the indicating means 14, 14′ is moved to "danger" position *c*, *c*′, all the circuits to the electromagnet 10 will be opened and the electromagnet will be deenergized to bring the vehicle to a halt, but after such deenergization the magnet 10 may be reenergized by manually operating the con-

tact 48 to close the low speed control circuit provided that the speed of the train is at or has been reduced to the low permissive speed for closing the contact 60.

With this circuit arrangement it will be also seen that when a vehicle is running under a "caution" restriction, the contact mechanism 48 having previously been closed to make the medium speed control circuit effective, and a "danger" indication is thereafter received moving the make means 14, 14' from positions *b*, *b'* to *c*, *c'*, it will be unnecessary for the engineman to again operate the contact mechanism 48, the medium speed control circuit being replaced by the low speed control circuit as the indicating means 14 moves from position *b* to *c*, the stick relay 57 being made slow releasing for this purpose.

For manually operating the contact mechanism 48, we preferably provide a circuit controlling means of the type disclosed in the application of Archibald G. Shaver Ser. No. 634,053 of April 23, 1923, the said circuit controlling means generally comprising a stem part 63 coacting with the contact mechanism 48 and a push button part 64 manually manipulable by the engineman and connected to the stem part by means of a mechanism which comprises a fluid transmission means formed by providing a piston at the lower end of the stem part 63 loosely fitting the interior wall of a cylindrical vessel forming the upper part of the push button 64, the said vessel containing a suitable fluid. With this construction when the push button is operated to an ascended position the fluid will act against the piston to transmit the operation of the stem to an ascended position and to actuate the contact mechanism 48 to circuit closing position, and that after such an operation has taken place the stem under the influence of gravity or the like will return to descended position independently of the return of the push button device, the fluid gradually seeping through the clearance between the piston and the cylindrical vessel, the operation being such that the contact mechanism is actuated by a mechanical impulse to assume its upper position only momentarily and being free to move to descended position in the event that the medium or low speed control circuit is not in a condition to be energized. The condition automatically imposed by the train and roadside mechanism is therefore maintained and cannot be cancelled by a premature operation of the manual push button 64. Moreover with this construction of the manual circuit controlling means the push button cannot be held by the engineman in its ascended position so as to thwart or negative the operation of the automatic control mechanism, the integrity of the control of the electromagnet by means of the indication selector and the speed controller being thereby maintained.

For the purpose of informing the engineman when an operation of the push button will be fruitful in modifying or preventing an automatic operation, and more specifically when the train has been brought to or below the predetermined speed (either medium or low speed), we provide a signalling means 65 which may comprise a lamp 65 connected to the conductor 42 by means of a conductor 66 and to a back contact 67 by means of a conductor 68. With this circuit construction it will be seen that:

a. When the train has received a "caution" indication the lamp will be illuminated only when the speed of the train has been reduced to the medium permissive speed by means of the circuit comprising battery 11, resistance *r*, conductors 12 and 19, contact 20, contact 49, conductor 50, contact 14' in position *b'*, conductors 52, 53, 54 and 55, contact mechanism 48, back contact 67, conductor 68, lamp 65 and conductors 66, 42 and 17, and that:

b. When the train has received a "danger" indication the lamp 65 will be illuminated only when the low permissive speed of the train has been reached by means of the following circuit: battery 11, resistance *r*, conductors 12 and 19, contact 20, contact 60, conductors 61, 62, and 55, contact 48, back contact 67, conductor 68, lamp 65, and conductors 66, 42 and 17.

Since the low speed control circuit of the system above described is not under the automatic control of the roadside mechanism, it may at times be desirable to enforce an acknowledgement by the engineman upon passing into a "danger" zone even though the speed of the train has been reduced to or below the low permissive speed, and to this end the system may include means for making the low speed control circuit manual and automatic instead of manual. To accomplish the desired result the low speed control circuit is taken through a contact means which is opened and closed by ascending and descending movement of the shoe, the said circuit including a means substituted for the conductor 62 shown in dotted lines, the said means comprising the conductor 69, conductor 70, stationary contact 71, conducting piece 72 connected to and movable with the shoe 24, contact 73, and conductor 54. With this substituted branch connection for the low speed control circuit, it will be seen that when the shoe rides the ramp the circuit will be opened at the contacts 71 and 73 so that the stick relay will be deenergized if the engineman does not intervene and will cause a deenergization of the magnet 10 even though the train is moving below the low permissive speed whether passing from a "caution" to a "danger"

block or from one "danger" block to another. If, however, the "danger" indication is acknowledged by the engineman by the operation of a low speed release key 75 normally open and closed into engagement with contact 76, the prior state of operation of the magnet 10 may be maintained since the low speed release key and contact are arranged in parallel with the shoe contacts 71 and 73. If, however, the key is not closed when the shoe rides the ramp, the low speed control circuit will be automatically opened to bring the vehicle to a halt, this automatic operation being, however, modifiable by the operation of the push key 64 when the speed of the train is at or assumes the low permissive speed limit.

Referring now to Fig. 2 of the drawings, we show a modification of our system in which the control of the brake controlling magnet 10 by means of the medium and low speed control circuits is modified, the remainder of the system being however similar with the exception of the provision of the maximum speed control heretofore referred to, the similar parts being designated by similar reference characters.

In the system shown in Fig. 2 instead of controlling the electromagnet 10 by arranging the same in parallel with the stick relay 57 in the medium and low speed control circuits, we provide a second contact 80 connected to the push key stem 63 which is normally open at the contact 81 but which is closed upon actuation of the key 64 and held closed when the medium or low speed control circuit is maintained closed under proper speed conditions, the magnet 10 being then energized from the battery 11 through the circuit comprising resistance r, conductors 12 and 41, contact 39, the conductor 82, contact 81 closed, contact 80, conductor 16, magnet 10, and conductors 15 and 17.

While we have shown our invention in the preferred forms, it will be apparent that numerous changes and modifications may be made in the structure disclosed without departing from the spirit of the invention, defined in the following claims.

We claim:

1. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising a device for controlling the movement of the vehicle, an indicating means operable in response to roadside conditions for producing a "clear" or "non-clear" indication, means under the control of said indicating means in "clear" indicating position for producing a normal operation of the said device, additional means under the control of the speed of the vehicle and of said indicating means in "clear" or "non-clear" indicating position for controlling the operation of the said device so that when the indicating means is operated from its "clear" to its "non-clear" position or is in the "clear" or "non-clear" position and the speed of the vehicle is at or below a permissive speed, the said device may be operated by intervention of the engineman to maintain its normal operation upon a change of the indicating means to the "non-clear" position but without such intervention and with the change of the indicating means to the "non-clear" position the device will be automatically operated to reduce the speed of the vehicle, such automatic operation persisting regardless of the subsequent decrease of speed of the vehicle below the permissive speed, and manual means under the control of the engineman for operating the said additional means to restore the normal operation of the device when the speed of the vehicle has been reduced to or below the said permissive speed so as to permit vehicle movement at or below such speed.

2. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising a device for controlling the movement of the vehicle, an indicating means operable in response to roadside conditions for producing a "clear" or "non-clear" indication, means under the control of said indicating means in "clear" indicating position for producing a normal operation of the said device, additional means under the control of the speed of the train and of said indicating means in "non-clear" indicating position for controlling the operation of the said device so that when the indicating means is changed from its "clear" to its "non-clear" position and the speed of the vehicle is at or below a permissive speed, the said device may be operated by intervention of the engineman to maintain its normal operation but without such intervention and with the change of the indicating means to the "non-clear" position the device will be automatically operated to reduce the speed of the vehicle, such automatic operation persisting regardless of the subsequent decrease of speed of the vehicle below the permissive speed, and manual means under the control of the engineman for operating the said additional means to restore the normal operation of the device when the speed of the vehicle has been reduced to or below the said permissive speed so as to permit vehicle movement at or below such speed.

3. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising an electrically operated device, a make and break indicating means operable into a "clear" or "non-clear" position, a speed controlled contact mechanism, a normally operative circuit for the device controlled by the indicating means in "clear" position, a second and normally inoperative circuit for the device controlled by

the contact mechanism and the make and break indicating means in the "non-clear" position, the said second circuit being operable so that when the indicating means is operated from its "clear" to its "non-clear" position and the speed of the vehicle is reduced from a speed above to a speed at or below a permissive speed, the circuit is in a condition to be operated by intervention of the engineman to maintain the normal operation of said device but without such intervention will remain inoperaitve so that the change of the indicating means to the non-clear position will automatically operate the device to reduce the speed of the vehicle, such operation persisting regardless of the subsequent decrease of speed of the vehicle below the said permissive speed and manual means for operating the said second circuit when the speed of the vehicle has been reduced to or below the said permissive speed so as to permit vehicle movement at or below such speed.

4. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising an electrically operated device, a make and break indicating means operable into a "clear" or "non-clear" position, a speed controlled contact mechanism, a normally operative circuit for the device controlled by the indicating means in "clear" position, a second and normally inoperative circuit for the device controlled by the contact mechanism and the make and break indicating means in "clear" or in "non-clear" position, the said sceond circuit being operable so that when the indicating means is operated from its "clear" to its "non-clear" position or is in the "clear" or "non-clear" position and the speed of the vehicle is reduced from a speed above to a speed at or below a permissive speed, the circuit is in a condition to be operated by interventioa of the engineman to maintain the normal operation of the said device upon a change of the indicating means to the "non-clear" position but without such intervention will remain inoperative so that the change of the indicating means to the "non-clear" position will automatically operate the device to reduce the speed of the vehicle, such automatic operation persisting regardless of the subsequent decrease of speed of the vehicle below the said permissive speed and manual means under control of the engineman for operating the said second circuit when the speed of the vehicle has been reduced to or below the said permissive speed so as to permit vehicle movement at or below such speed.

5. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising an electrically operated device, a make and break indicating means operable into a "clear" or "non-clear" position, a speed controlled contact mechanism, a normally closed circuit for energizing the device controlled by the indicating means in "clear" position, a second and normally open circuit for the device controlled by the contact mechanism and the make and break indicating means in the "non-clear" position the said second circuit being operable so that when the indicating means is operated from its "clear" to its "non-clear" position and the speed of the vehicle is reduced from a speed above to a speed at or below a permissive speed, the circuit is in a condition to be closed by intervention of the engineman to maintain the normal energization of said device but without such intervention will remain open so that the change of the indicating means to the "non-clear" position will automatically deenergize the device, such deenergization persisting regardless of the subsequent decrease of speed of the vehicle below the said permissive speed and manual means for closing the said second circuit effective when the speed of the vehicle has been reduced to or below the said permissive speed so as to again energize the device to permit vehicle movement at or below such speed.

6. A manual-automatic speed control system for vehicles, comprising vehicle carried mechanism including an electrically operated device, a make and break indicating means operable into a "clear" or "non-clear" position, a speed controlled contact mechanism, a normally operative circuit for the device controlled by the indicating means in "clear" position, a second and normally inoperative circuit for the device controlled by the contact mechanism and the make and break indicating means in the "non-clear" position, the said second circuit being operable so that when the indicating means is operated from its "clear" to its "non-clear" position and the speed of the vehicle is reduced from a speed above to a speed at or below a permissive speed, the circuit is in a condition to be operated by intervention of the engineman to maintain the normal operation of said device but without such intervention will remain inoperative so that the change of the indicating means to the "non-clear" position will automatically operate the device to reduce the speed of the vehicle, such operation persisting regardless of the subsequent decrease of speed of the vehicle below the said permissive speed, manual means for operating the said second circuit when the speed of the vehicle has been reduced to or below the said permissive speed so as to permit vehicle movement at or below such speed, and intermittently effective roadside mechanism for operating the indicating means to its "clear" or "non-clear" positions.

7. A manual-automatic speed control system for vehicles, comprising vehicle carried

mechanism including an electrically operated device, a make and break indicating means operable into a "clear" or "non-clear" position, a speed controlled contact mechanism, a normally operative circuit for the device controlled by the indicating means in "clear" position, a second and normally inoperative circuit for the device controlled by the contact mechanism and the make and break indicating means in "clear" or in "non-clear" position, the said second circuit being operable so that when the indicating means is operated from its "clear" to its "non-clear" position or is in the "clear" or "non-clear" position and the speed of the vehicle is reduced from a speed above to a speed at or below a permissive speed, the circuit is in a condition to be operated by intervention of the engineman to maintain the normal operation of said device upon a change of the indicating means to "non-clear" position but without such intervention will remain inoperative so that the change of the indicating means to the "non-clear" position will automatically operate the device to reduce the speed of the vehicle, such automatic operation persisting regardless of the subsequent decrease of speed of the vehicle below the said permissive speed, manual means under control of the enginemen for operating the said second circuit when the speed of the vehicle has been reduced to or below the said permissive speed so as to permit vehicle movement at or below such speed, and roadside mechanism intermittently effective for operating the indicating means to its "clear" or "non-clear" positions.

8. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising an electrically operated device, a make and break indicating means operable into a "clear" or "non-clear" position, a contact mechanism, a speed controlled contact mechanism, a normally operative circuit connecting the device and the make and break indicating means in "clear" position, a second and normally inoperative circuit for controlling the device and connecting the contact mechanism, the speed controlled contact mechanism and the make and break indicating means operable so that when the indicating means is operated to its "non-clear" position and the speed of the vehicle is reduced from a speed above to a speed at or below a permissive speed the said device may be operated by intervention of the engineman to maintain its normal operation but without such intervention and with a change of the indicating means to the non-clear position, the device will be automatically operated to an abnormal condition and such automatic operation will persist regardless of the subsequent decrease of the speed of the vehicle below the permissive speed, and manual means under the control of the engineman for operating the said contact mechanism when the speed of the vehicle has been reduced to or below the permissive speed to render the said second circuit operative for restoring the normal operation of the device.

9. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising an electrically operated device, a make and break indicating means operable into a "clear" or "non-clear" position, a contact mechanism, a speed controlled contact mechanism, a normally operative circuit connecting the device and the make and break indicating means in "clear" position, a second and normally inoperative circuit for controlling the device and connecting the contact mechanism, the speed controlled contact mechanism and the make and break indicating means in either "clear" or "non-clear" position operable so that when the indicating means is operated to its non-clear position or is in the "clear" position and the speed of the vehicle is reduced from a speed above to a speed at or below a permissive speed the said second circuit may be operated by intervention of the engineman to maintain the normal operation of the device when the indicating means is changed to the "non-clear" position but without such intervention and with the change of the indicating means to the non-clear position, the device will be automatically operated to an abnormal condition and such automatic operation will persist regardless of the subsequent decrease of the speed of the vehicle below the permissive speed, and manual means under the control of the engineman for operating the said contact mechanism when the speed of the vehicle has been reduced to or below the permissive speed to render the said second circuit operative for restoring the normal operation of the device.

10. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising a device for controlling the movement of the vehicle, an indicating means operable in response to roadside conditions for producing a "clear" or "non-clear" indication, means under the control of said indicating means in "clear" position for producing a normal operation of the said device, means under the control of the speed of the train and of said indicating means in "clear" and "non-clear" position for controlling the operation of the said device so that when the indicating means is operated from its "clear" to its "non-clear" position or is in the "clear" or "non-clear" position and the speed of the vehicle is at or below a permissive speed, the said

device may be operated by intervention of the engineman to maintain its normal operation upon a change of the indicating means to the "non-clear" position but without such intervention and with a change of the indicating means to the "non-clear" position, will be automatically operated to reduce the speed of the vehicle.

11. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising an electrically operated device, a make and break indicating means operable into a "clear" or "non-clear" position, a stick relay contact mechanism, a speed controlled contact mechanism, a circuit for controlling the device and connecting the stick relay contact mechanism, the speed controlled contact mechanism and the make and break indicating means in "clear" or "non-clear" position, the circuit being normally open at the stick contact mechanism and being operable so that when the vehicle is moving at or below a permissive speed the said stick contact mechanism may be operated by intervention of the engineman to close the circuit and maintain the same closed for maintaining a normal operation of said device but without such intervention and with a change of the indicating means to the non-clear position the circuit will remain open to produce an abnormal operation of the device.

12. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising an electrically operated device, a make and break indicating means operable into a "clear" or "non-clear" position, a stick relay contact mechanism, a speed controlled contact mechanism, a circuit for controlling the device and connecting the stick relay contact mechanism, the speed controlled contact mechanism and the make and break indicating means in "clear" or "non-clear" position, the circuit being normally open at the stick contact mechanism and being operable so that when the vehicle is moving at or below a permissive speed the said stick contact mechanism may be operated by intervention of the engineman to close the circuit and maintain the same closed for maintaining a normal operation of said device but without such intervention and with a change of the indicating means to the non-clear position the circuit will remain open to produce an abnormal operation of the device, and a signalling means for indicating when the said stick contact mechanism is open and the speed controlled contact mechanism is closed.

13. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising a device for controlling the movement of the vehicle, an indicating means operable in accordance with roadside conditions for indicating "clear", "caution" and "danger" conditions, means for operating the device to permit movement of the vehicle above a medium permissive speed when the indicating means indicates "clear" and for automatically operating said device to bring the vehicle to a halt when the indicating means changes from "clear" to "caution" or from "clear" to "danger", and means operable by the engineman either before or after the change of indication of the indicating means for preventing or modifying the automatic operation of said device provided that the speed of the vehicle is at or below the medium permissive speed if the indicating means is changed from "clear" to "caution" and is at or below a low permissive speed if the indicating means changes from "clear" to "danger".

14. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising a device for controlling the movement of the vehicle, an indicating means operable in accordance with roadside conditions for indicating "clear", "caution" and "danger" conditions, means for operating the device to permit movement of the vehicle above a medium permissive speed when the indicating means indicates "clear" and for automatically operating said device to bring the vehicle to a halt when the indicating means changes from "clear" to "caution" or from "clear" to "danger", and means operable by the engineman either before or after the change of indication of the indicating means for preventing or modifying the automatic operation of said device and for placing the said device under the control of the speed of the vehicle provided that the speed of the vehicle it at or below the medium permissive speed if the indicating means is changed from "clear" to "caution" and is at or below a low permissive speed if the indicating means changes from "clear" to "danger".

15. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising a device for controlling the movement of the vehicle, an indicating means operable in accordance with the roadside conditions for indicating "clear," "caution" and "danger" conditions, means for operating the device to permit movement of the vehicle above a medium permissive speed when the indicating means indicates "clear" and for automatically operating said device to bring the vehicle to a halt when the indicating means changes from "clear" to "caution" or from "clear" to "danger," means operable by the engineman either before or after the change of indication of the indicating means from "clear" to "caution" for preventing or modifying the automatic operation of said device for placing the vehicle under the control of the medium permissive speed provided that the

speed of the vehicle is at or below the said medium permissive speed and means operable by the engineman either before or after the change of indication of the indicating means from "clear" to "danger" for preventing or modifying the automatic operation of the device and for placing the same under the control of a low permissive speed provided that the vehicle speed is at or below the low permissive speed.

16. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising a device for controlling the movement of the vehicle, an indicating means operable in accordance with roadside conditions for indicating "clear," "caution" and "danger" conditions, means for operating the device to permit movement of the vehicle above a medium permissive speed when the indicating means indicates "clear" and for automatically operating said device to bring the vehicle to a halt when the indicating means changes from "clear" to "caution" or from "clear" to "danger" irrespective of the speed of the vehicle, and means operable by the engineman for modifying the automatic operation of said device provided that the speed of the vehicle is at or below the medium permissive speed if the indicating means is changed from "clear" to "caution" and is at or below a low permissive speed if the indicating means changes from "clear" to "danger".

17. In a manual-automatic speed control system for vehicles, vehicle carried mechanism comprising a device for controlling the movement of the vehicle, an indicating means operable in accordance with roadside conditions for indicating "clear," "caution" and "danger" conditions, means for operating the device to permit movement of the vehicle above a medium permissive speed when the indicating means indicates "clear" and for automatically operating said device to bring the vehicle to a halt when the indicating means changes from "clear" to "caution" or from "clear" to "danger" irrespective of the speed of the vehicle, and means operable by the engineman for modifying the automatic operation of said device and for placing the same under the control of the speed of the vehicle provided that the speed of the vehicle is at or below the medium permissive speed if the indicating means is changed from "clear" to "caution" and is at or below a low permissive speed if the indicating means changes from "clear" to "danger".

Signed at city of Chicago, in the county of Cook, and State of Illinois, this 15th day of October A. D. 1923, by BENJAMIN W. MEISEL.

BENJAMIN W. MEISEL.

Signed at Chicago in the county of Cook and State of Illinois, this 15th day of October, 1923, by ARCHIBALD G. SHAVER.

ARCHIBALD G. SHAVER.