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P. J. SIMMEN.
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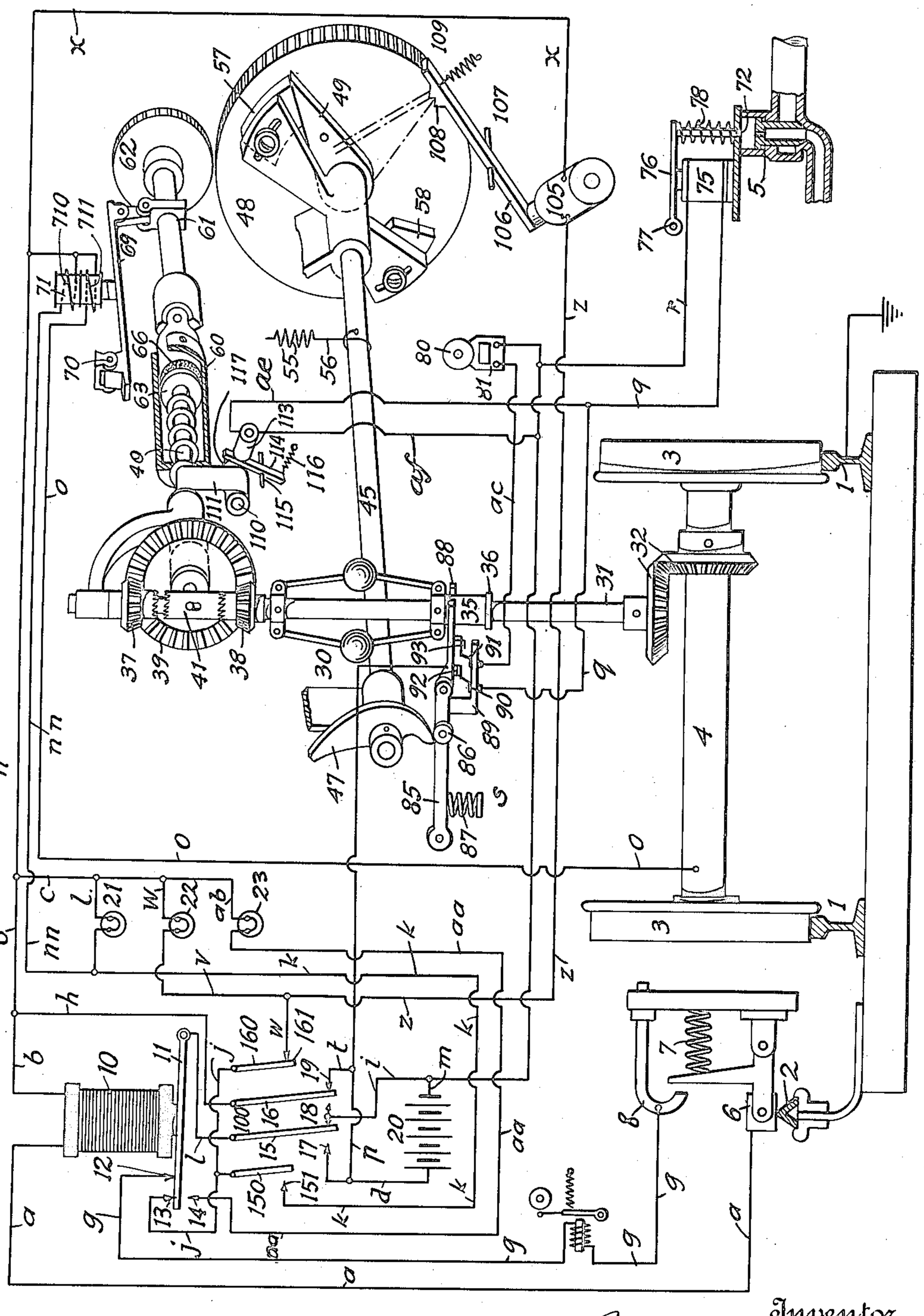

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AUTOMATIC TRAIN CONTROL.

Application filed March 17, 1920. Serial No. 366,500.

To all whom it may concern:

Be it known that I, PAUL J. SIMMEN, a citizen of the United States, and a resident of the city of Buffalo, county of Erie, and State of New York, have invented a new and useful Automatic Train Control of which the following is a specification.

This invention relates to an apparatus for automatically controlling the speed of a vehicle moving along a railway and more specifically to an apparatus for controlling such speed under conditions of safety, caution or danger indicated on the vehicle, and its novelty consists in the construction and adaptation of the parts as will be more clearly and specifically pointed out in the claims.

In my Letters Patent of the United States No. 1,150,308, granted August 17, 1915, and in another of my Patents No. 1,150,309, granted August 17, 1915, I have described an automatic apparatus for controlling the speed of a moving vehicle which in brief, comprises a device moving in accordance with the actual speed of the vehicle, another device moving in accordance with a permissible speed, together with means whereby when the actual speed exceeds the permissible speed at any time, retarding mechanism with which the vehicle is equipped is set into operation to reduce its speed or ultimately to stop the vehicle.

In my Letters Patent of the United States No. 1,257,412, granted February 26, 1918, I have described a train dispatching system for a railway, which comprises among other instrumentalities, means for energizing and deenergizing signal rails arranged in succession along the railway, whereby electrical impulses can be sent to such rails from a central office, as a train dispatcher's office, to create varying conditions upon an apparatus carried by the vehicle, which apparatus itself forms the subject-matter of my Letters Patent of the United States No. 1,239,049, granted September 4, 1917; and in a copending application for Letters Patent of the United States, Serial No. 14075 filed March 13th, 1915; I have described an apparatus for effecting the joint operation of some of the foregoing instrumentalities thereby, in brief, when a clear signal is sent through one of the signal rails to a moving vehicle, a green light or the like safety indication is displayed on the vehicle, and after the vehicle has left the signal rail, a holding circuit maintains such a safety indication until another rail is reached and the same indication repeated or a changed one set up. In addition, a permissible speed indicator is held normally inoperative under such conditions. In this same apparatus, when a caution signal is sent through the signal rail, it is similarly maintained in the vehicle after the signal rail has been passed, and upon its receipt a permissive speed indicator is moved to a submaximum or intermediate position. When a signal rail along which the vehicle passes is deenergized a danger signal is indicated on the vehicle and a permissive speed indicator is actuated from whatever position it happens to be in, and unless the actual speed of the vehicle is thereafter maintained at less than the permissive speed while danger conditions exist, a warning signal will be given to the operator and, if not heeded, the brakes will be automatically put on to retard or stop the vehicle.

The subject matter of the present application is specifically to provide means different from those described in the application last mentioned, whereby the permissive speed indicator is moved from a maximum to a submaximum position when and as soon as a caution signal is indicated on the vehicle. In addition, the apparatus is shown as provided with means for making a record of the times when the retarding mechanism is caused to be actuated by the apparatus.

In the drawings, there is illustrated a preferred form of apparatus embodying my invention, the parts being shown largely in diagram for the sake of promoting clearness in the description, and the positions of the parts being those assumed when a caution signal has been indicated on the vehicle, and the permissive speed indicating shaft and cam have been brought to a submaximum position.

In the drawings, 1, 1 indicates the track rails along which the vehicle is adapted to travel, 3, 3 are its wheels, 4 is its axle and the ordinary train pipe air valve controlling the brake system is indicated at 5; 6 is a shoe hingedly mounted at a convenient place on the car and adapted to contact with successive signal rails 2, during such contact pressing against a spring 7, and when out of such contact being pressed by this spring against an arm 8; 10 is a polarized relay on

the car, having a neutral armature 11, adapted to touch three contact points 12, 13 and 14; 100 is a polarized armature, adapted to actuate fingers 15 and 16 to touch contacts 17, 18 and 19, and fingers 150 and 160 to touch contacts 151 and 161; 20 is a local battery mounted on the car; 21 is a clear signal or green light; 22 is a caution signal or yellow light and 23 is a danger signal or red light.

Also mounted in the car is a centrifugal governor 30, moved from a shaft 31 by gears 32 on the wheel axle 4. On the ball frame is a sleeve 35, slidable on the shaft 31 and provided with an annular flange 36. At its upper end the shaft 31 is provided with gears 37 and 38, each adapted to mesh with a gear 39 mounted on a shaft 40. Between the gears 37 and 38 is a sleeve 41 slidable on the shaft 31 and indented at both ends to engage similarly indented annular flanges on the gears 37 and 38, but which indentations run in opposite directions, whereby the shaft 40 is always rotated in the same direction, no matter in which direction the shaft 31 is rotated.

A shaft 45 is mounted in suitable bearings 46, and near one end is provided with a speed-control cam 47, and at its opposite end with a gear 48 and a wing 49. A spring 55 and a cord 56 retract the shaft to its original position after rotation. Detents 57 and 58 are adjustably mounted in the circular path of the wing 49 to limit the extent of the movement of the shaft. The shaft 45 is moved from the shaft 40 by means of a power transmitting mechanism including a clutch indicated at 60, a shaft supported upon and carried by bearing 61, and a pinion 62 adapted to mesh with the gear 48. The clutch comprises two discs 63 and 66, pressed together by a spring 65 and so arranged that they slip when undue torsional strain is brought upon the shaft. The bearing 61 is suspended from an arm 69 swung upon a pivot 70, the arm being the armature of an electromagnet 71, which is provided with two coils indicated at 710 and 711.

Adjacent to the train air pipe valve indicated at 5 is a relay 75, having an armature 76 pivoted at 77 and adapted to compress a spring 78 normally adapted to hold open the valve 5, controlling the air pipe leading to the brake system. 80 is a bell adapted to be rung by an electromagnet 81 in the usual manner when such magnet is energized.

Hingedly mounted near the cam 47 is an arm 85, carrying a roller 86 adapted to contact therewith, a spring 87 serving to promote such contact. The arm is provided with a pivoted fork 88 adapted to straddle the collar 35, but to contact with the flange 36. The arm 85 also carries a supplemental arm 89 made of insulating material and carrying two contacts 90 and 91 adapted to touch two similar contact members 92 and 93, carried by the arm 85, the four contacts forming a make and break device.

An electromagnet indicated at 105 is conveniently located near the gear 48, its armature 106 being mounted to swing on a pivot 107 and being provided with a detent or catch 108, to cooperate with the wing 49. A spring 109 serves to hold the armature normally away from the gear.

A spool or paper roll holder 110 is secured near the shaft 40 and carries a paper ribbon 111, the other end of which is secured to a spool (not seen) on the shaft 40 in such a manner that it is wound on to such spool as the train moves. Adjacent the spools is an electromagnet 113, having an armature 114 mounted on a pivot 115 and under tension of a spring 116. This armature is provided with a needle 117, adapted to perforate the paper when the magnet 113 is energized, being propelled toward the paper by the tension of the spring 116.

The described parts are connected together by electrical conductors or wires which are designated by the lower case letters of the alphabet and will be so referred to as the operation of the apparatus is described.

The signal rail 2 may be positively or negatively energized or deenergized. First, let it be assumed that it is positively energized, that the shoe 6 has been moved into contact therewith and has been lifted to break the connection between the shoe and the contact 8. A circuit is then completed from the source of energization of the rail 2 through the shoe 6, the wire *a*, the relay 10, wire *b*, wire *n*, coil 711, wire *o*, axle 4, wheel 3 to rail 1. This causes the green light 21 to glow through the following circuit:—From the positive side of the battery 20 to the wire *d*, contact 17, finger 15, wire *e*, armature 11, contact 13, wire *j*, finger 150, contact 151, wire *k*, green light 21, wire *l*, wire *c*, wire *b*, wire *h*, finger 16, contact 18, wires *i* and *m* to the negative side of the battery. This also causes the coil 710 to be energized through the following circuits:—From the positive side of the battery 20 to the wire *d*, the contact 17, finger 15, wire *e*, armature 11, contact 13, wire *j*, finger 150, contact 151, wire *k*, wire *nn*, coil 710, wire *n*, wire *b*, wire *h*, finger 16, contact 18 and wires *i*, and *m*, to the negative side of the battery.

Upon leaving the signal rail, the relay 10 remains energized through the following holding circuit:—From the positive side of the battery 20 to the wire *d*, contact 17, finger 15, wire *e*, armature 11, contact 12 wire *g*, contact 8, shoe 6, wire *a*, relay 10, wire *b*, wire *h*, finger 16, contact 18 and wires *l* and *m* to the negative side of the battery. This causes the green light to continue to glow, and causes the coil 710 to remain energized. The coil 711, however, is

deenergized as soon as the bar leaves the rail as there is no longer a current flow to ground.

With the signal rail negatively energized and the shoe standing on the rail, the relay 10 is energized, but the polarized fingers take the right hand position as shown in the drawing. The circuit causing the energization of the relay 10 is as follows:—From the rail 2 to the shoe 6, wire *a*, relay 10, wire *b*, wire *n*, coil 711, wire *o*, axle 4, wheel 3 and rail 1 to the ground. This causes the yellow light 22 to glow through the following circuit:—From the positive side of the battery 20 to the wire *d*, wire *p*, wire *t*, contact 19, finger 16, wire *h*, wire *b*, wire *c*, wire *u*, yellow light 22, wire *v*, wire *w*, contact 161, finger 160, wire *j*, contact 13, armature 11, wire *e*, finger 15, contact 18, wires *i* and *m* to the negative side of the battery. This also causes the energization of the magnet 105 through the following circuit:—From the positive side of the battery 20 to the wire *d*, wire *p*, wire *t*, contact 19, finger 16, wire *h*, wire *b*, wire *n*, wire *x*, magnet 105, wire *z*, wire *w*, contact 161, finger 160, wire *j*, contact 13, armature 11, wire *e*, finger 15, contact 18, wires *i* and *m* to the negative side of the battery. It will be noted that the coil 710 is deenergized.

Upon the vehicle leaving the signal rail 2, the relay 10 will remain energized through a holding circuit the same as before, when it was positively energized, but with the flow of current in the opposite direction. This will result in the continued glowing of the yellow light, and in the continued energization of the magnet 105. It will be again noted that after leaving the signal rail the coil 711 is deenergized as there is no further current flow to ground.

If the signal rail is deenergized the holding circuit will be broken at contact 8; and relay 10, coils 710, 711 and 105 will all be deenergized. The red light 23, however, will glow through the following circuit:—From the positive side of the battery 20 to the wire *d*, contact 17, finger 15, wire *e*, armature 11, contact 14, wire *aa*, red light 23, wire *ab*, wire *c*, wire *b*, wire *h*, finger 16, contact 18, wires *i* and *m* to the negative side of the battery.

When the points 90 and 92 are in contact, the following circuits are established:—From the positive side of the battery 20 to the wire *d*, wire *p*, contact 92, contact 90, wire *q*, wire *ad*, coil 75, wire *r*, wire *s*, wire *m* to the negative side of the battery; also from the positive side of the battery 20 to the wire *d*, wire *p*, contact 92, contact 90, wire *q*, wire *ae*, coil 113, wire *af*, wire *s*, wire *m* to the negative side of the battery. Thus when contacts 92 and 90 are forced apart, the coil 75 will be deenergized and the air brake will be applied and coil 113 will also be deenergized and the needle 117 will punch a hole through the recording paper 111 giving a record of each automatic application of the brakes.

When the contacts 91 and 93 are closed, the warning bell 80 is rung through the following circuit:—From the positive side of the battery 20 to the wire *d*, wire *p*, contact 93, contact 91, wire *ac*, coil 81, wire *s*, wire *m* to the negative side of the battery.

The operation of this device is as follows:—With a green light glowing the magnet 71 is always energized when the vehicle is on a signal rail by coils 711 and 710, and after leaving the signal rail by coil 711 only, therefore the pinion 62 is out of mesh with the gear 48 whenever a green light is displayed.

When a yellow light is displayed, and the shoe is standing on the signal rail, the magnet 71 is energized through the current flow in the coil 711 and the pinion 62 is thus held out of mesh with the gear 48. At the same time, the coil 105 is energized, and the catch 108 is placed in a position so that it will engage the wing 49, if the latter attempts to pass by; thus if the light in the cab was red before passing upon the signal rail, the receipt of a yellow light would mean that the wing 49 would be returned by the spring 55 from its minimum position to its submaximum position and held there by the catch. If, however, the light in the cab were green before the vehicle passed upon the signal rail, the wing 49 would remain in its maximum position. Upon leaving the rail with a yellow light, the coil 105 remains energized, but the coil 711, and therefore, the magnet 71, becomes deenergized and, therefore, the pinion 62 drops into mesh with gear 48. If the wing 49 were at that time in its maximum position, the subsequent movement of the vehicle would drive it to its submaximum position, and it would be held in this submaximum position by the catch 108.

I claim:

1. In a railway signal system, signal rails arranged along the tracks and adapted to be energized positively or negatively or deenergized, a vehicle on the track carrying an electromagnet, three signals on the vehicle, connections between them and the electromagnet whereby one signal is displayed when the electromagnet is positively energized, a second signal is displayed when it is negatively energized, and a third signal is displayed when it is deenergized, a device on the vehicle moving in accordance with its actual speed, means whereby the vehicle may be retarded, a device on the vehicle to indicate a permissible speed for it and adapted when actuated to move from a higher speed indicating position to a lower speed indicat-

ing position, means for actuating said last named device from the device moving in accordance with the actual speed including power transmitting mechanism, electrical connections brought into play to actuate the retarding means whenever the actual speed equals the permissible speed, and means for interrupting the function of the power transmitting mechanism whenever the electromagnet on the vehicle is energized and either one of two of the signals is in circuit therewith.

2. In an apparatus of the character described, a brake, an actual speed indicator, a permissible speed indicator, means automatically adapted when the actual speed exceeds the permissible speed to actuate the brake and means adapted to move the permissible speed indicator to a maximum position when clear conditions exist along the trackway and to arrest it at a sub-maximum position when caution conditions obtain along the trackway.

3. In a railway signal system, signal rails arranged along the tracks and adapted to be energized positively or negatively or deenergized, a vehicle on the track carrying an electromagnet, three signals on the vehicle, connections between them and the electromagnet whereby one signal is displayed when the electromagnet is positively energized, and a second signal is displayed when it is negatively energized, and a third signal is displayed when it is deenergized, a device on the vehicle moving in accordance with its actual speed, means whereby the vehicle may be retarded, a device on the vehicle to indicate a permissible speed for it and adapted when actuated to move from a higher speed indicating position to a lower speed indicating position, means for actuating said last named device from the device moving in accordance with the actual speed including power transmitting mechanism, electrical connections brought into play to actuate the retarding means whenever the actual speed equals the permissible speed, and means for detaining the permissible speed indicating device at a sub-maximum position when the electromagnet is energized in one direction and interrupting the function of such detainer when the electromagnet is energized in the opposite direction or deenergized.

4. In a railway signal system, signal rails arranged along the tracks and adapted to be energized positively or negatively or deenergized, a vehicle on the track carrying an electromagnet, three signals on the vehicle, connections between them and the electromagnet whereby one signal is displayed when the electromagnet is positively energized, a second signal is displayed when it is negatively energized, and a third signal is displayed when it is deenergized, a device on the vehicle moving in accordance with its actual speed, means whereby the vehicle may be retarded, a device on the vehicle to indicate a permissible speed for it, and adapted when actuated to move from a higher speed indicating position to a lower speed indicating position, means for actuating said last named device from the device moving in accordance with the actual speed including power transmitting mechanism, electrical connections brought into play to actuate the retarding means whenever the actual speed equals the permissible speed, in combination with means for automatically making a record of each application of the retarding device.

5. In a railway signal system, signal rails arranged along the tracks and adapted to be energized positively or negatively or deenergized, a vehicle on the track carrying an electromagnet, three signals on the vehicle, connections between them and the electromagnet whereby one signal is displayed when the electromagnet is positively energized, a second signal is displayed when it is negatively energized, and a third signal is displayed when it is deenergized, a device on the vehicle moving in accordance with its actual speed, means whereby the vehicle may be retarded, a device on the vehicle to indicate a permissible speed for it and adapted when actuated to move from a higher speed indicating position to a lower speed indicating position, means for actuating said last named device from the device moving in accordance with the actual speed including power transmitting mechanism, electrical connections brought into play to actuate the retarding means whenever the actual speed equals the permissible speed, in combination with means for automatically making a record of each application of the retarding device, including a needle armature in circuit with the retarding device actuating mechanism, and a paper roll moved from the power transmitting mechanism.

6. In an apparatus of the character described, a device on a vehicle moving in accordance with its actual speed, power transmitting mechanism, a device on the vehicle moved by such mechanism but in accordance with a permissible speed, and which device includes a shaft, a member rotating therewith, detents adjustably arranged to limit the extent of its rotation and a movable detent adapted to hold the shaft at an intermediate position.

7. In an apparatus of the character described, a device on a vehicle moving in accordance with its actual speed, power transmitting mechanism, a device on the vehicle moved by such mechanism but in accordance with a permissible speed, and which device includes a shaft, a member rotating therewith, detents adjustably ar-

ranged to limit the extent of its rotation, and a movable detent adapted to hold the shaft at an intermediate position, in combination with automatic means for holding it normally inactive, and other automatic means to move it to position whenever certain predetermined conditions exist along the trackway.

8. In an apparatus of the character described, a permissive speed indicator adapted by its movement to generate a speed-reducing curve, means for moving it from a maximum to a minimum position controlled by an electromagnet and means for arresting its motion at a sub-maximum position, comprising an armature lever normally held inactive by a spring and brought into active position by the energization of a second electromagnet to move the armature lever against the tension of the spring.

9. In a railway signal system, three signals adapted to indicate danger caution and safety conditions, a permissible speed indicator, means for moving it from a maximum to a minimum position, independent means for moving it from a minimum to a maximum position, a detent adapted to arrest it at an intermediate position and means for moving such detent to position whenever the caution signal is displayed.

10. In a railway signal system, three signals adapted to indicate danger, caution and safety conditions, a permissible speed indicator, means for moving it from a maximum to a minimum position, independent means for moving it from a minimum to a maximum position, a detent adapted to arrest it at an intermediate position and means for moving such detent to position whenever the caution signal is displayed, including an armature lever and an electromagnet adapted to control the same in circuit with the means for operating the caution signal.

11. In a railway signal system, three signals adapted to indicate danger, caution and safety conditions, a permissible speed indicator, means for moving it from a maximum to a minimum position, independent means for moving it from a minimum to a maximum position, a detent adapted to arrest it at an intermediate position and means for moving such detent to position whenever the caution signal is displayed, including an armaturs lever and an electromagnet adapted to control the same in circuit with the means for operating the caution signal, the means for moving the permissible speed indicator including two gear wheels, means for normally holding them out of mesh when either clear or caution signals are displayed and means for permitting them to mesh whenever a danger signal is displayed.

12. In a railway signal system, three signals adapted to indicate danger caution and safety conditions, a permissible speed indicator, means for moving it from a maximum to a minimum position, independent means for moving it from a minimum to a maximum position, a detent adapted to arrest it at an intermediate position and means for moving such detent to position whenever the caution signal is displayed, including an armature lever and an electromagnet adapted to control the same in circuit with the means for operating the caution signal, the means for moving the permissible speed indicator including two gear wheels, means for normally holding them out of mesh when either clear or caution signals are displayed and means for permitting them to mesh whenever a danger signal is displayed, the means for holding them out of mesh comprising an armature, and an electromagnet provided with two coils one of which is in circuit with the safety signal operating means, and the other of which is in circuit with the caution signal operating means.

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