H. B. TAYLOR.

CONTACT SHOE FOR AUTOMATIC TRAIN CONTROL SYSTEMS.

APPLICATION FILED AUG 9, 1917.

1,308,534.

Patented July 1, 1919.

4 SHEETS-SHEET 1.

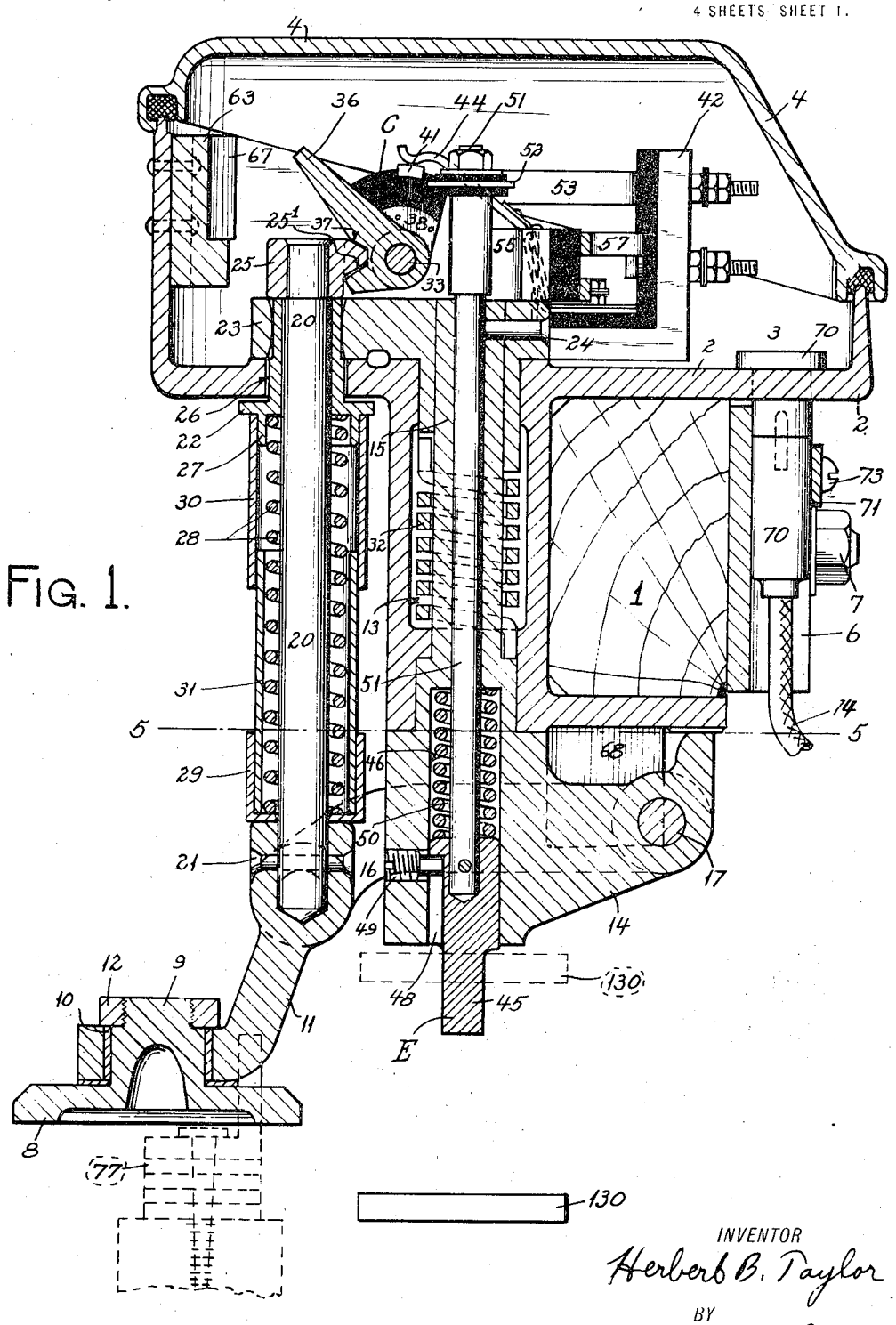


Fig. 1.

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4 SHEETS—SHEET 2.

FIG. 2.

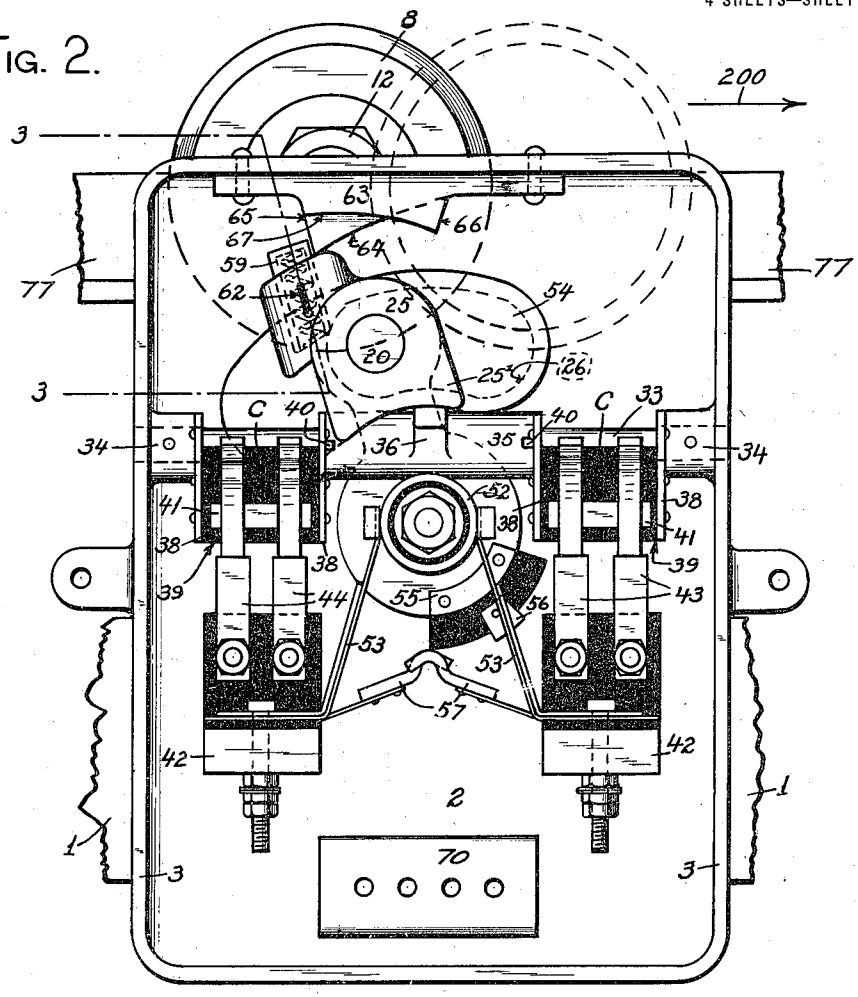
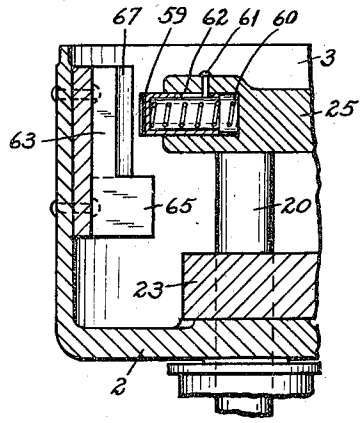


FIG. 3.



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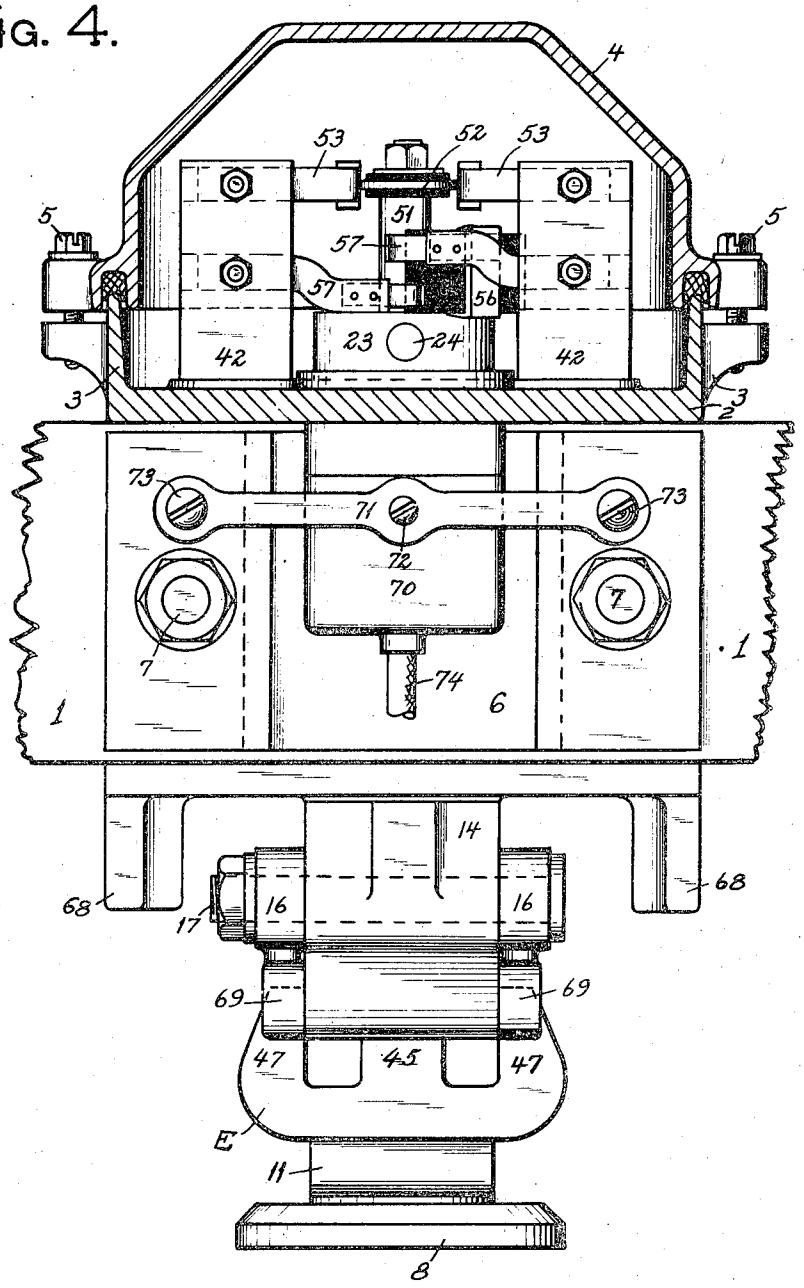
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4 SHEETS—SHEET 3.

FIG. 4.



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4 SHEETS—SHEET 4.

FIG. 5.

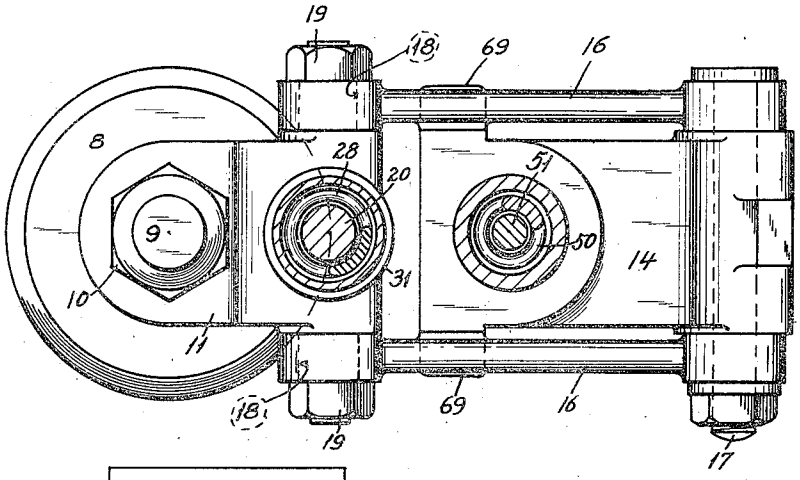
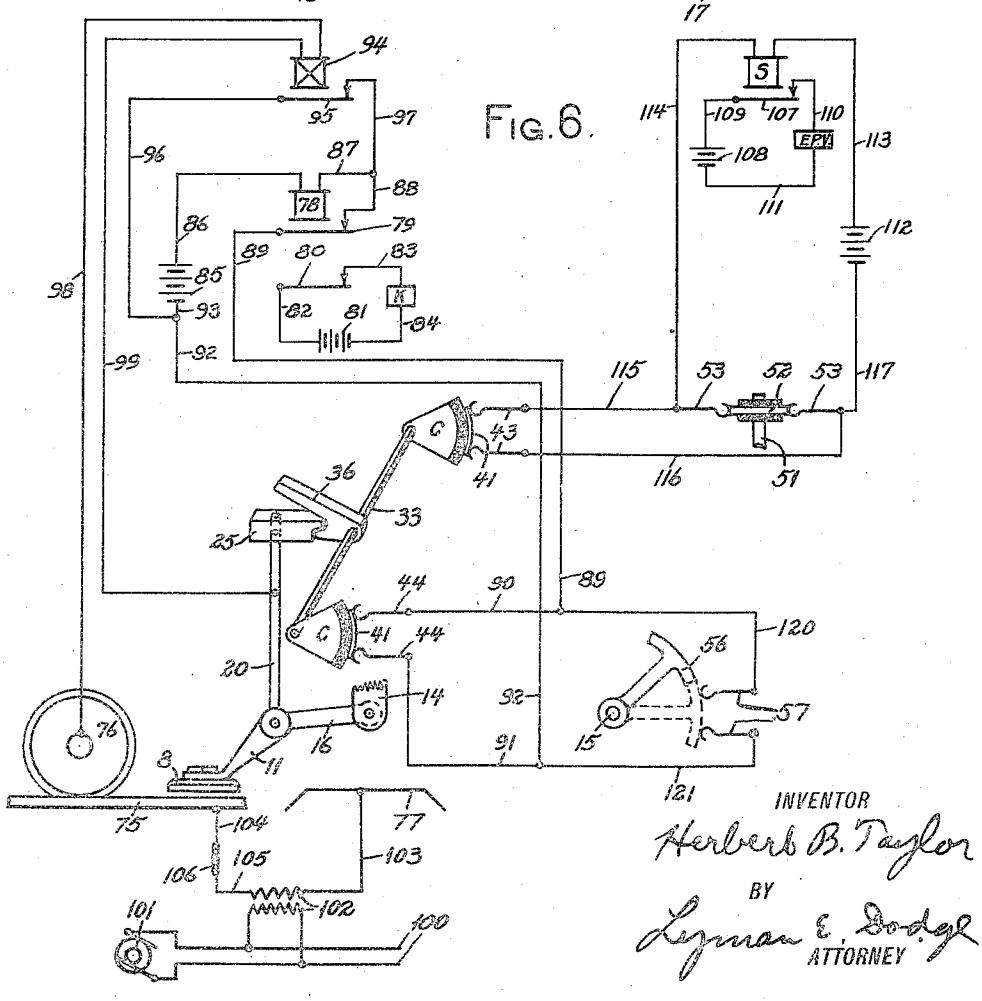


FIG. 6.



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HERBERT B. TAYLOR, OF ROCHESTER, NEW YORK, ASSIGNOR TO GENERAL RAILWAY SIGNAL COMPANY, OF GATES, NEW YORK, A CORPORATION OF NEW YORK.

CONTACT-SHOE FOR AUTOMATIC TRAIN-CONTROL SYSTEMS.

1,308,534. Specification of Letters Patent. Patented July 1, 1919.

Application filed August 9, 1915. Serial No. 44,497.

To all whom it may concern:

Be it known that I, HERBERT B. TAYLOR, a citizen of the United States, and a resident of the city of Rochester, in the county of Monroe and State of New York, have invented a new and useful Contact-Shoe for Automatic Train-Control Systems, of which the following is a specification.

This invention relates to contact shoes for automatic train control systems.

One of the principal objects of the invention is to devise a simple and inexpensive contact shoe for automatic train control systems which will be strong and durable and which will act as a means for obtaining electrical contact with suitable ramps and also, upon engagement with a ramp, as a circuit controlling device.

A further object of the invention is to devise a simple and compact contact shoe for automatic train control systems which is so arranged and constructed that appropriate automatic control of the speed of the train may be obtained, and also so that, when required, an absolute stop of the train may be obtained.

A still further object of the invention is to devise a simple contact shoe which is so arranged and constructed that provision is made for the movement of the vehicle upon which the shoe is mounted both with and against the normal direction of traffic, and also for the surging or recoil of the vehicle on its springs at the time it comes to a stop.

Other objects and advantages will appear as the description of the invention progresses, and the novel features of the invention will be particularly pointed out in the appended claims.

The invention consists in the parts, and in the arrangements and combinations of parts, more fully set forth hereinafter.

In describing the invention in detail, reference is had to the accompanying drawing, wherein I have illustrated a preferred physical embodiment of my invention, and wherein like characters of reference designate corresponding parts throughout the several views, and in which:

Figure 1 is a vertical section through a contact shoe and a mounting therefor embodying the invention; Fig. 2 is a top plan view of the contact shoe, the cover of the casing being removed; Fig. 3 is a fragmentary vertical taken substantially on the line 3—3 in Fig. 2; Fig. 4 is a rear elevation of the contact shoe, the upper casing being shown in section; Fig. 5 is a horizontal section taken on the line 5—5 in Fig. 1; and Fig. 6 is a diagrammatic view showing the electrical wiring and connections between the parts of the contact shoe and a certain assumed arrangement of devices carried on the vehicle, the parts in said Fig. 6 being shown in their normal position.

Referring to the accompanying drawings, the contact shoe is arranged to be supported in any suitable way (not shown) preferably adjustably, on some part of the vehicle, as a journal box, axle, truck side frame, or the like; and for this purpose the shoe is mounted upon a bar 1 of wood or other insulating material, so that the shoe as a whole is electrically isolated from the vehicle which carries it. The shoe comprises a main casting or body portion 2 which is provided at its upper end with walls forming a box-like casing 3, which is used to house the circuit controlling devices operated by the movements of the shoe, said casing 3 being provided with a cover 4 which makes a weather tight joint with the lower portion of the casing and which is held in place by screws 5 (see Fig. 4). The body portion 2 of the shoe is formed with a transverse groove (see Fig. 1) in which the bar 1 fits, and said body portion 2 is clamped to said bar 1 by means of a washer-like member 6 and two clamping bolts 7.

The foot 8 of the shoe, that is, the portion thereof which engages the contact rail or ramp fixed along the trackway, is disk-like in form and is hollowed out in its under face for the purpose of making it light and so as to leave a narrow rim. The foot 8 of the shoe has a central upstanding bearing stud 9, which is revolubly mounted in anti-friction bearing sleeves or bushings 10 in a shoe supporting arm 11, being held in place by a clamping nut 12. In the body portion 2 of the shoe is a cylindrical bore 13 in which is mounted a hollow spindle 15 integral with a swivel block 14, said spindle 15 extending upwardly through the bottom of the casing 3. The supporting arm 11 is connected to the swivel block 14 by two parallel links 16, each of which is pivoted at one end on a pin 17 secured in said swivel

block, and at its other end on an outwardly extending stud 18 integral with the supporting arm 11 of the shoe, said other end being held in place on said stud by a nut 19 (see Fig. 5).

The mechanism for operating the circuit controller of the shoe comprises a plunger 20, which is secured to the supporting arm 11 by a pin 21 and extends upwardly through a sleeve 22 and through an arm 23, said arm 23 being fastened to the turning spindle 15 by a pin 24; and to the upper end of the plunger 20 is fastened a head 25, one side of which is formed with a concaved and beveled ridge 25^1. The sleeve 22 passes loosely through an arcuate slot 26 (see Fig. 2) in the bottom of the upper casing 3 and also loosely through a hole in the arm 23, so that said sleeve and the plunger 20 therein may have a limited amount of sidewise play relatively to the body portion 2 and the casing 3. The sleeve 22 is provided with a downwardly projecting flange 27; and a compression coil spring 28 bears at its upper end against the underside of said sleeve 22 inside of said flange 27 and at its lower end against the upper face of a cap 29 which rests on the upper end of the supporting arm 11. Two tubes 30 and 31 are secured to the sleeve 22 and cap 29 respectively and are arranged telescopically together so as to form a protecting casing for the spring 28 and prevent snow and the like from packing between its coils. A spring 32 is mounted in the body portion of the shoe surrounding the hollow spindle 15; and one end of said spring 32 is secured to the arm 23 and its other end is secured to the body portion of the casing, said spring 32 serving to return the spindle 15 and the swivel block 14 to the extreme lefthand position as viewed in Fig. 2 after it has been displaced to the right as viewed in the same figure.

In the casing 3 is a shaft 33 which is secured in bosses 34 integral with the end walls of said casing (see Fig. 2), and journaled on this shaft 33 is a sleeve 35 carrying an arm 36, which has a V-shaped notch 37 therein adapted to receive the beveled ridge 25^1 of the head 25 of the plunger 20. Also journaled on the shaft 33 are two contact holders (see Fig. 2), designated as a whole as C, and each comprising two sector-shaped plates 38 to which is secured a block 39 of insulating material; and one of the sector-shaped plates 38 of each contact holder C is provided with a projection 40 which fits in a corresponding notch in the sleeve 35, so that said contact holders C move simultaneously with the sleeve 35. Contact strips 41 are suitably secured to the blocks 39, preferably by being molded therein; and arranged to coöperate with said contact strips 41 are two pairs of contact fingers 43 and 44 which are bolted to blocks 42 fastened to the bottom of the casing 3, said pairs of contact fingers being insulated from said blocks 42 and from each other. The pairs of contact fingers 43 and 44 are normally in contact with their corresponding contact strips 41 when the shoe is in its lower or normal position, as shown in Fig. 1.

There is also provided an auxiliary shoe E, which in the particular construction shown and described, is arranged to control the devices on the vehicle which cause said vehicle to come to an absolute stop; said auxiliary shoe E being supported in the swivel block 14 so as to be vertically movable. In the particular construction shown the auxiliary shoe E, hereinafter termed the emergency shoe, has a squared shank 45 which fits into a corresponding recess 46 in the swivel block 14; and to facilitate the engagement of the emergency shoe with a ramp or other fixed stop device, said emergency shoe is provided with two horns or prongs 47 at each end, which are shown to the best advantage in Fig. 4. A groove 48 is formed in one side of the shank 45 for part of the length thereof (see Fig. 1), and a pin 49 is screwed in place in the swivel block 14 to coöperate with said groove 48 and to limit the downward movement of said shank. In the recess 46 is a compression spring 50, one end of which bears against the upper face of the shank 45 of the emergency shoe E and the other end of which bears against the bottom of the recess 46. An emergency plunger 51 is pinned to the shank 45 and extends downwardly through the hollow in the spindle 15; and at the upper end of this plunger 51 is fixed a contact disk 52 which is insulated from said plunger in any suitable way. Two contact springs 53 are secured to the supporting blocks 42 and are insulated therefrom; and the contact springs 53 are arranged to press against the circumferential edge of the contact disk 52.

Referring to Fig. 2, the arm 23 has an arcuate flat plate integral therewith, and designated generally by the reference character 54, which plate slides over the upper surface of the bottom of the casing 3 and constitutes a cover for the slot 26 in said bottom of the casing 3. A contact supporting member 55 is secured to the arm 23 on the opposite side of the plunger 20, and suitably secured to this contact supporting member 55, as by being molded therein, is a contact block 56. The contact block 56 is arranged to make contact with a pair of contact fingers 57, which are secured to the blocks 42.

The head 25, which is secured to the plunger 20, has a cylindrical recess therein in which is mounted a hollow detent or latch 59 (see Figs. 2 and 3), which latch is pressed

outwardly by a spring 60, the outward movement of said latch being limited by the engagement of a pin 61 secured in the head 25 with an end of a slot 62 in said latch. Riveted to the end wall of the casing 3 is a stop block 63 having two arcuate faces 64 and 67 arranged one above the other in two intersecting planes and terminating in shoulders 66 and 65 respectively, which shoulders extend substantially radially toward the axis of the plunger 20. The latch 59 is arranged to coöperate with the shoulders 65 and 66 respectively in certain moved positions of the foot of the shoe and the spindle 20, which positions will be more fully discussed hereinafter. Integral with the body portion 2 of the shoe are two downwardly projecting lugs 68 arranged on opposite sides of the swivel block 14 in position to be engaged by the links 16 when the foot 8 of the shoe and the swivel block 14 are swung in either direction so as to limit their movement. Integral with the swivel block 14 are two outwardly extending lugs 69 (see Figs. 4 and 5) which limit the downward movement of the links 16 and serve to support these links 16 and the foot 8 of the shoe in its lower or normal position, shown in Fig. 1.

The wires and electrical connections in the casing between the different contact springs and parts are not shown in order to avoid confusion, but these wires and electrical connections are shown diagrammatically in Fig. 6. These conductors are preferably connected to the base portion of a plug coupling 70, which is held in place by a bar 71 fastened thereto by a screw 72 and to the clamping member 6 by screws 73 (see Fig. 4). The terminals of this plug coupling are connected to a flexible cable 74, which leads to the car upon which the shoe is mounted.

In order to make clear the operation of the shoe shown and described, the shoe is illustrated diagrammatically in Fig. 6 for controlling a certain arrangement of controlling circuits, constituting part of an automatic train control system with which the shoe is adapted to be used; but it is to be understood that this application of the shoe is merely illustrative and that the shoe may be used with other controlling circuits and other controlling devices. Referring to Fig. 6, the track rail upon which the vehicle or train runs, is designated by the numeral 75, and one wheel of the train is designated by the numeral 76. The shoe is supported in any suitable way upon the vehicle in position so that its foot 8 will make contact with suitable contact rails or ramps 77 located at different points along the trackway and insulated from the track rails. The movement of the vehicle or train may be controlled in any way; but in the particular arrangement illustrated, the speed of the train is controlled by an apparatus designated generally as K, which is arranged to govern automatically the speed of the vehicle under conditions where the vehicle should proceed cautiously. Various devices capable of performing the necessary functions of the apparatus K are well known in the art, and it is deemed unnecessary to show and describe the detail construction of the apparatus K. At certain points in the travel of the vehicle, as for instance, at places where there are diverging tracks, it is desirable to provide means whereby the vehicle may be brought to an absolute stop; and for this purpose a suitable device, as an electropneumatic valve, designated in Fig. 6 by E. P. V., is arranged to control the venting of the train line of the well known pneumatic system of brakes so as to cause an emergency application of said brakes.

The operation of the speed control apparatus K is controlled by a control relay 78 having two armatures 79 and 80; and when the armature 80 of said control relay 78 is in its upper position, corresponding to the position assumed when said relay is energized, the speed control apparatus K is energized from a local source of electric current on the train, as a battery 81, by a circuit which may be traced as follows:

Circuit number one.

From the battery 81, conductor 82, armature 80 of the control relay 78 in its upper position, conductor 83, speed control apparatus K, and conductor 84 back to the battery 81.

The other armature 79 of the control relay 78 is included in a normally closed circuit for energizing said control relay from a local source of current on the vehicle, as a battery 85, when the shoe is in its lower or normal position, said circuit being as follows:

Circuit number two.

From the battery 85, conductor 86, control relay 78, conductors 87 and 88, armature 79 in its upper position, conductors 89 and 90, contact finger 44, contact block 41, contact finger 44, and conductors 91, 92 and 93 back to the battery 85.

The control relay 78 may also be energized from the battery 85 when an alternating current relay 94 is energized and its armature 95 is in its upper position, according to a circuit which may be traced as follows:

Circuit number three.

From the battery 85, conductor 86, control relay 78, conductors 87 and 97, armature 95 in its upper position, and conductors 96 and 93 back to the battery 85.

One terminal of the alternating current relay 94 is connected by a conductor 98 to

the wheel 76 of the vehicle and the other terminal of said relay is connected by a conductor 99 to the body of the shoe, so that when a difference of potential exists between the track rails and a ramp with which the foot 8 of the shoe is in contact, current will pass through the alternating current relay 94. This difference of potential between a ramp and the track rails may be controlled in any suitable way in accordance with the traffic conditions, as by track circuits and track relays; but in the diagrammatic illustration shown in Fig. 6, there is shown a simple arrangement which consists of two wires 100 connected to a generator 101 or other suitable source of alternating current, a transformer 102 whose primary is connected to the wires 100, and whose secondary is connected by a conductor 103 to the ramp 77 and by conductors 104 and 105 and a suitable controlling switch 106 to the track rail 75.

The electropneumatic valve E. P. V. for controlling the automatic absolute stop of the vehicle is shown as arranged to be idle or ineffective when supplied with current, and to be set into operation when deënergized. The valve E. P. V. is controlled by a stop relay S, and when the stop relay S is energized and its armature 107 is in its upper position, the valve E. P. V. is supplied with current from a local source, as a battery 108, according to a circuit which may be traced as follows:

Circuit number four.

From the battery 108, conductor 109, armature 107 of the stop relay S in its upper position, conductor 110, valve E. P. V., and conductor 111 back to the battery 108.

The stop relay S is normally energized from a local source, as a battery 112, according to a circuit which may be traced as follows:

Circuit number five.

From the battery 112, conductor 113, stop relay S, conductor 114, contact spring 53, contact disk 52 mounted on the emergency plunger 51, contact spring 53, and conductor 117 back to the battery 112.

Another circuit for the stop relay S which is in multiple with the above traced circuit number five, is as follows:

Circuit number six.

From the battery 112, conductor 113, stop relay S, conductors 114 and 115, contact finger 43, contact block 41, and conductors 116 and 117 back to the battery 112.

Having described the construction of the contact shoe embodying the invention and the arrangement of parts of an automatic train control system with which this contact shoe may be used, the operation of the contact shoe and its functions may now be made clear.

Operation: As the vehicle which carries the contact shoe moves along the trackway the foot 8 of the shoe engages a contact rail or ramp 77, and since the end portions of this ramp incline gradually upward the foot 8 of the shoe is gradually raised. When the foot 8 of the shoe and the supporting arm 11 are raised they rock the links 16 up about the pin 17 as an axis, the loose fitting of the sleeve 22 in the slot 26 of the casing 3 and in the arm 23 permitting the slight outward movement of the plunger 20 necessary to permit this rocking of the links 16. During this upward movement of the supporting arm 11, the spring 28 is compressed and the head 25 secured to the plunger 20 is raised; and by a coöperation of the beveled ridge 25^1 with the notch 37 in the arm 36 of the sleeve 35, the sleeve 35 is rocked and swings the contact holders C so as to bring the contact blocks 41 out of contact with the pairs of contact springs 43 and 44. The separation of the pairs of contact springs 44 and their corresponding block 41 interrupts the normally closed circuit for energizing the control relay 78, hereinbefore set forth and designated circuit number two.

Assuming that the traffic conditions are such that the vehicle may pass by the ramp 77 and proceed for some distance at an unlimited speed, there will be a difference of potential between the ramp 77 and the track rail 75, that is, in the particular arrangement shown, the switch 106 will be closed. Then, when the foot 8 of the shoe engages the ramp 77 and makes electrical contact therewith, current will be supplied to the alternating current control relay 94 from the secondary of the track transformer 102 according to a circuit which may be traced as follows:

Circuit number seven.

From one terminal of the transformer 102, conductor 105, closed switch 106, conductor 104, track rail 75, wheel 76, conductor 98, relay 94, conductor 99, body of the shoe along supporting arm 11 to the foot 8 and thence to the ramp 77 and by conductor 103 back to the other terminal of the secondary of the transformer 102.

The alternating current relay 94 being energized, its armature 95 is raised to complete the pickup circuit for the control relay 78, hereinbefore set forth and designated circuit number three. Consequently, although the normally closed circuit number two for energizing the control relay 78 is broken by the raising of the foot 8 of the shoe, the pickup circuit number three for said control relay is simultaneously established and the effect is that the control relay will remain energized and its armatures will

remain in their upper position, thus retaining the speed control apparatus K in its normal or idle condition.

In case, however, traffic conditions are such that the vehicle should be placed under the restraint of the speed control apparatus K, no difference of potential exists between the ramp 77 and the track rail 75; or, in other words, the switch 106 is open. Consequently, the alternating current relay 94 is not energized, and the pickup circuit number three for the control relay 78 is not established; and since the normally closed circuit number two for the control relay 78 is broken, said control relay 78 will be deënergized. When the control relay 78 is deënergized, its armature 79 drops and makes a break in the normally closed circuit number two, so that after the foot 8 of the shoe has left engagement with the ramp 77 and has returned to its normal or lower position, although the contact block 41 again makes contact with the contact fingers 44, the circuit number two is interrupted at the armature 79 and will not be reëstablished. In other words, whenever the control relay 78 is deënergized, it will remain deënergized irrespective of the position of the contact shoe, until the armature 95 of the alternating current relay 94 is raised. Also, when the control relay 78 is deënergized, its armature 80 drops and interrupts the normally closed circuit for the speed control apparatus K, hereinbefore set forth and designated circuit number one; and consequently the speed control apparatus K is set into operation.

From the foregoing it can be seen that by properly controlling the difference of potential between the ramps along the trackway and the track rails, the speed control apparatus may be set into operation as required.

At some points in the travel of the vehicle it may be desirable to bring the vehicle to an absolute stop, as for instance, at a point where there are diverging tracks and the movement of trains is controlled by an interlocking plant; since in this case, if a train continued to move, even at a very low speed, along a certain track, it might come into the path of a fast moving train and result in serious damage. In the shoe embodying the invention provision is made for such cases by the auxiliary emergency shoe E, the movement of which is controlled by a suitable movable member or ramp 130 which is shown in full lines in Fig. 1 in its lower position, in which the emergency shoe is not operated, and in dash lines in its upper position. When the emergency ramp 130 is in its upper position, the emergency shoe E engages said ramp and is raised against the opposition of the coil spring 50, and the upward movement of the emergency shoe is transmitted to the plunger 51, which moves the contact disk 52 out of contact with the contact springs 53 and breaks the normally closed circuit number five for energizing the stop relay S. If the foot 8 of the shoe is raised at the same time, the contact block 41 will be out of contact with the pair of contact fingers 43 and the circuit number six for energizing the stop relay will also be broken. Consequently, when the foot 8 of the shoe and the emergency shoe E are both raised, the stop relay S is deënergized; and its armature 107 drops and interrupts the normally closed circuit number four for energizing the electropneumatic valve E. P. V. When the valve E. P. V. is deënergized it causes an immediate application of the brakes in any suitable manner, and preferably prevents the release of the brakes until the vehicle or train has been brought to an absolute stop.

In order to cause the operation of the electropneumatic valve E. P. V. it is necessary to raise not only the emergency shoe E, but also the contact shoe, so that the accidental elevation of the emergency shoe E, as by obstructions along the trackway, will not cause an application of the brakes. Obviously, after the emergency ramp 130 has been lowered to its normal position, the spring 50 will restore the emergency shoe E and the plunger 51 to their lower or normal position, and reëstablish one of the multiple circuits for energizing the stop relay S, that is, circuit number five. In this way, the stop relay S and the valve E. P. V. may be reënergized to permit the train to proceed.

It may happen that the locomotive or motor car which carries the contact shoe will move along the trackway in a direction opposite to the normal direction of traffic, and in such cases the locomotive or motor car would encounter ramps between which and the track rails no difference of potential would exist, since the track circuits or other controlling devices used for governing the difference of potential between the ramps and the track rails will be affected by the locomotive or motor car as it approaches each ramp in the same way as they should be affected in order to protect properly the trains moving in the normal direction of traffic. For this reason, it is desirable to provide means whereby the movement of the locomotive or motor car against the normal direction of traffic will not cause it to be stopped. For this purpose, the contact rails or ramps 77 are all located on the same side of the track with reference to the normal direction of traffic, as for example, on the right-hand side of the track; and, when a vehicle is approaching in the normal direction of traffic, as in the direction indicated by the arrow 200 in Fig. 2, and the foot 8 of the shoe strikes a ramp 77, the friction between the foot 8 and the ramp 77 causes the foot

8, the supporting arm 11, the links 16 and the swivel block 14 to swing about a vertical axis backward to the position indicated in full lines in Fig. 2, one of the stops 68 limiting this movement. In this swinging movement of the contact shoe the sleeve 22 carrying the plunger 20 moves in the slot 26 in the casing 3 of the shoe, and carries with it the arm 23. In this particular swinging movement of the contact shoe corresponding to the movement of the vehicle in the normal direction of traffic the movement of the arm 23 does not change the controlling circuits; and because of the curved or concaved shape of the ridge 25^1 of the head 25, this ridge 25^1 maintains its engagement with the arm 36 of the sleeve 35 during this swinging movement. When the foot 8 of the shoe reaches the end of the ramp and gradually drops, the foot 8 of the shoe is still held by the friction between it and the ramp in its swung position so that the latch 59 engages behind the shoulder 65 of the lower guide 64. In this way, the shoe is ordinarily held in its backward swung position so that on the engagement with the next ramp going in the normal direction of traffic, the backward swinging movement of the shoe does not have to take place.

Assuming that the vehicle is moving against the normal direction of traffic, that is, in a direction opposite to the direction indicated by the arrow 200 in Fig. 2, then, when the foot 8 of the shoe engages a ramp, the foot 8 is lifted to raise the head 25 and carry the latch 59 out of engagement with the shoulder 65, and the friction between the foot 8 of the shoe and the ramp swings said foot 8, the supporting arm 11 and the swivel block 14 about the axis upon which said swivel block is pivoted, in the direction opposite to the direction in which the vehicle is traveling, to the position indicated by the dash lines in Fig. 2, one of the stops 68 limiting this swinging movement of the shoe. When the contact shoe is swung to this position, the contact block 56 is brought into contact with the contact springs 57, so as to establish a shunt for the contact fingers 44. Consequently, although the contact shoe is raised, and although no difference of potential may exist between the ramp 77 and the track rail 75, the control relay 78 remains energized by reason of the existence of a circuit which may be traced as follows:

Circuit number eight.

From the battery 85, conductor 86, control relay 78, conductors 87 and 88, armature 79 in its upper position, conductors 89 and 120, contact spring 57, contact block 56, contact spring 57, conductors 121, 92 and 93 back to the battery 85.

When the vehicle is traveling against the normal direction of traffic and the foot 8 of the shoe is swung to the position indicated in dash lines in Fig. 2, as hereinbefore described, the latch 59 is pressed inwardly by the guide 67, and when the foot 8 of the shoe is fully swung, snaps behind the shoulder 66, so that, so long as the foot 8 of the shoe remains in its upper position, said foot will be held against swinging movement in either direction, the stop 68 limiting its movement in one direction and the coöperation of the latch 59 and the shoulder 66 limiting its movement in the other direction. In this way, although the vehicle in proceeding against the normal direction of traffic may come to a stop while its contact shoe is in engagement with a ramp, the backward surging or recoil of the vehicle upon its springs just at the instant it comes to a stop is unable to shift the foot 8 of the shoe and separate the contact block 56 from the contact springs 57. If the contact block 56 should separate from the contact springs 57, the circuit number eight, which at that time would be the only circuit for energizing the control relay 78, would be broken and the apparatus K would be set into operation. As soon as the foot 8 of the shoe returns to its lower position, the engagement between the latch 59 and the shoulder 66 ceases and the coil spring 32 (see Fig. 1) returns the shoe to its other extreme position shown in full lines in Fig. 2.

The foot 8 of the shoe is revolubly mounted in the supporting arm 11 so that the foot 8 in engaging a ramp at one side of its axis will be rotated with a scraping action which insures a better electrical contact between the foot 8 and the ramp.

Although the contact shoe shown and hereinbefore described comprises two separate shoes, in some cases the use of the emergency shoe E may be found to be unnecessary; and it is obvious that this emergency shoe E may be omitted without destroying the effectiveness of the other shoe. Also, although a particular arrangement of trackway circuits along the trackway and for an automatic train control system, has been illustrated in Fig. 6, it is to be understood that this Fig. 6 merely shows an illustrative application of the contact shoe, and that the contact shoe is not limited in its application to this particular arrangement.

Although I have particularly described the construction of one physical embodiment of my invention, and explained the operation and principle thereof; nevertheless, I desire to have it understood that the form selected is merely illustrative, but does not exhaust the possible physical embodiments of the idea of means underlying my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A contact shoe for automatic train control systems comprising a supporting arm mounted to swing horizontally and to rock vertically; circuit controllers operatively connected to said arm and actuated by its swinging and rocking movements respectively; means for locking said arm against swinging movement in one direction when said arm is raised; and means for locking said arm against swinging movement in the other direction when said arm is lowered.

2. A contact shoe for automatic train control systems comprising a supporting arm mounted to move vertically and horizontally; a circuit controlling device operated by a horizontal movement of said arm in one direction; means for latching said arm when raised against horizontal movement in a direction opposite to said direction; means for locking said arm when lowered against horizontal movement in a direction the same as said first-mentioned direction; and a circuit controlling device operated by the vertical movement of said arm.

3. A contact shoe for automatic train control systems comprising a vertically movable plunger; a circuit controlling device operated by said plunger; a spring for resiliently pressing said plunger downwardly; means for limiting the downward movement of said plunger; and a protecting casing for said spring comprising tubes arranged telescopically.

4. A contact shoe for automatic train control systems comprising a support; a body secured to said support and insulated therefrom; an electrically conducting arm movably mounted on said body; a circuit controller operated by said arm; a vertically movable plunger mounted on said body; a second circuit controller operated by said plunger; and two multiple circuits controlled by said circuit controllers.

5. A contact shoe for automatic train control systems comprising a support; a body portion secured to said support and insulated therefrom; a swivel block mounted in said body portion to turn on a vertical axis; a foot having a contacting surface; a pair of links hinged at one end to said swivel block and at their other ends to said foot; a vertically movable plunger secured to said foot; means for limiting the downward movement of said arms; a spring for pressing said plunger downwardly; and a circuit controlling device operated by the upward movement of said plunger.

6. In a contact shoe for automatic train control systems, in combination; a railway vehicle; a support carried by said vehicle; a contact shoe carried by said support and comprising a body portion secured to said support and insulated therefrom; an electrically conducting arm movably mounted on said body; a circuit controller operated by said arm; a vertically movable plunger mounted on said body; a second circuit controller operated by said plunger; two multiple circuits controlled by said circuit controllers; means for controlling the movement of said vehicle; and a circuit for controlling said means including said two multiple circuits.

7. A contact shoe for automatic train control systems comprising a body portion provided with an inclosed casing, a movable element supported by the body portion and adapted to be lifted vertically and to swing horizontally in either direction, and circuit controlling devices in the casing adapted to be operated independently in accordance with the movements of said movable element.

8. A contact shoe for automatic train control systems comprising a body portion provided with an inclosed casing, an oscillatory contact carrying member supported within said casing, a plunger, an arm secured to said member and extending over the end of the plunger, whereby movement of the plunger causes oscillation of the member and also holds it in its oscillated position, and means for operating the plunger.

9. A contact shoe for automatic train control systems comprising a support, a movable arm carried by the support and arranged to swing horizontally in either direction, and resilient means tending to move said arm to its extreme position in one direction.

10. A contact shoe for automatic train control systems comprising a support, a movable arm carried by the support and adapted to swing both horizontally and vertically, and resilient means tending to move the arm horizontally in one direction.

11. A contact shoe for automatic train control systems comprising a support, a block swiveled in the support to turn on a vertical axis, an arm supported by links from the block and arranged to swing vertically, means tending to move the arm downward to a predetermined lower position, a circuit controlling device operated by the movement of said arm, and another circuit controlling device operated by a partial rotation of said block.

12. A contact shoe for automatic train control systems comprising a support, a block carried by the support and adapted to turn horizontally about a vertical axis, a movable arm supported by said block and capable of having a vertical movement, means tending to move said arm downward to a predetermined lower position, and means tending to move the block and arm horizontally in one direction.

13. A contact shoe for automatic train control systems comprising a support, a

movable arm carried by the support and adapted to swing both horizontally and vertically, means tending to move the arm downward to a predetermined lower position, and means for preventing swinging movement of said arm in one direction horizontally when the arm is in its lower position, said means being automatically released when the arm is raised.

14. A contact shoe for automatic train control systems comprising a support, a movable arm carried by the support and adapted to swing horizontally and vertically, means tending to move the arm downward to a predetermined lower position, means for locking the arm against horizontal movement in one direction when the arm is in its lower position, and means for preventing the horizontal movement of the arm in the opposite direction when the arm is raised.

15. A contact shoe for automatic train control systems comprising two separately movable elements, separate circuit controllers operated selectively by the movement of said elements, and a circuit having two branches in multiple each including one of the circuit controllers.

16. In an automatic train control system, the combination with two separate train control devices, of a contact shoe having separately movable elements and adapted to selectively control said train control devices.

17. In an automatic train control system, the combination with two separate train control devices, of a contact shoe having separately movable elements, means operated by one element for governing one of the train control devices, and means governed jointly by both elements for controlling the other train control device.

18. Impulse transmitting means for automatic train control systems comprising a circuit controller having a movable part secured to a rocker shaft on a vehicle, an arm on the shaft having a notch therein, a plunger on the vehicle arranged to move lengthwise, a toothed member carried by said plunger and coöperating with the notch in said arm, whereby movement of the plunger causes said shaft to be rocked to a predetermined extent regardless of the extent of movement of the plunger, and means along the track for causing movement of the plunger.

19. In an automatic train control system for railways, the combination with a combined impulse receiving device comprising two movable elements, of a train control device, two circuits in multiple for controlling said train control device, and circuit controlling devices one included in each of said circuits and controlled separately by said movable elements.

20. In an automatic train control system for railways, the combination with an impulse receiving device on a vehicle including two influence elements, of two separate train control devices on the vehicle, means operated by one of said elements for governing one of the train control devices, means governed jointly by both elements for controlling the other train control device, and impulse transmitting devices along the track for coöperating with said impulse receiving device.

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