No. 809,794.

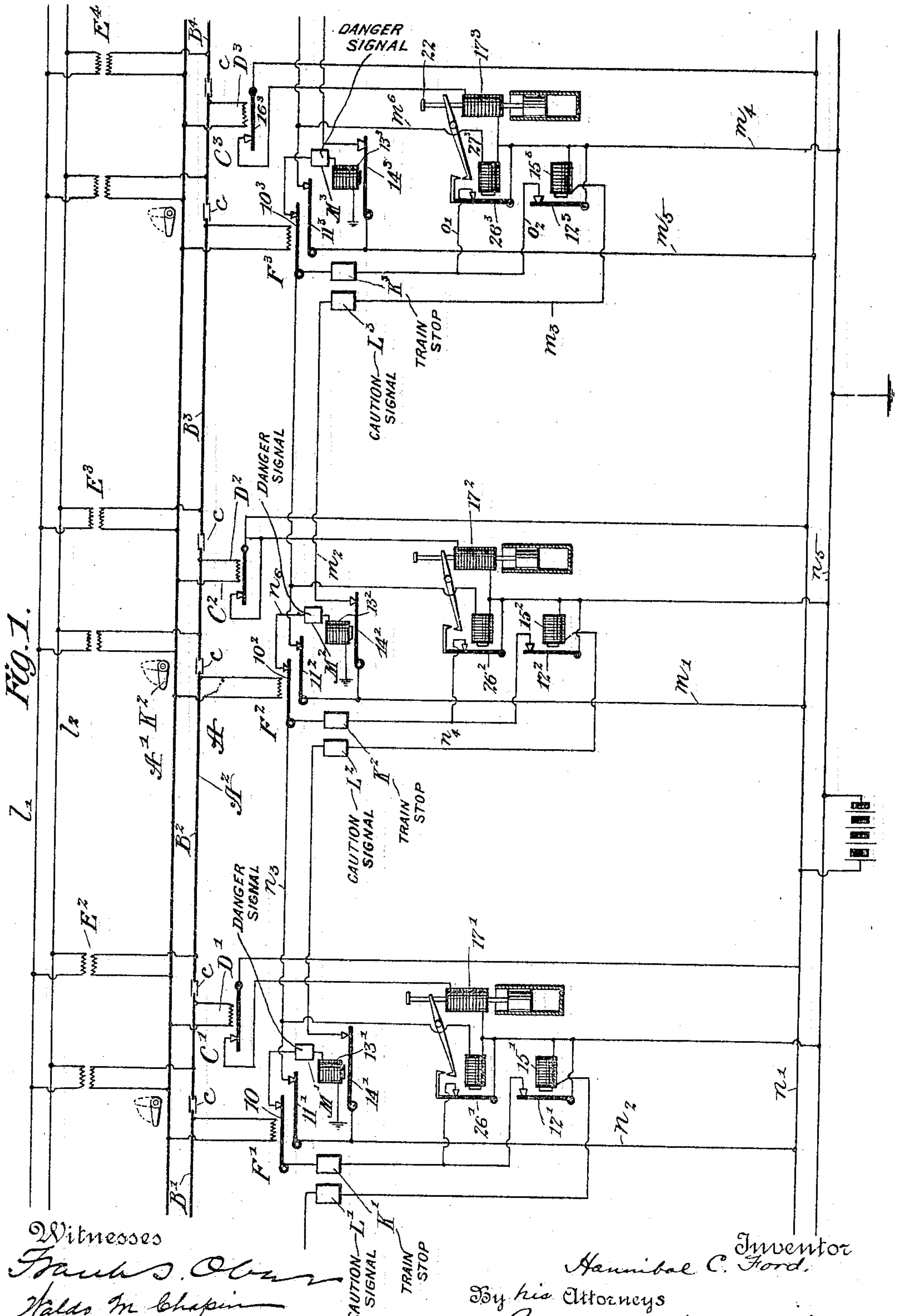
PATENTED JAN. 9, 1906.

H. C. FORD.

RAILROAD SYSTEM.

APPLICATION FILED SEPT. 12, 1905.

2 SHEETS—SHEET 1.



Witnesses
Frank S. Ober
Waldo M. Chapin

Inventor
Hannibal C. Ford.
By his Attorneys
Rosenbaum & Stockbridge

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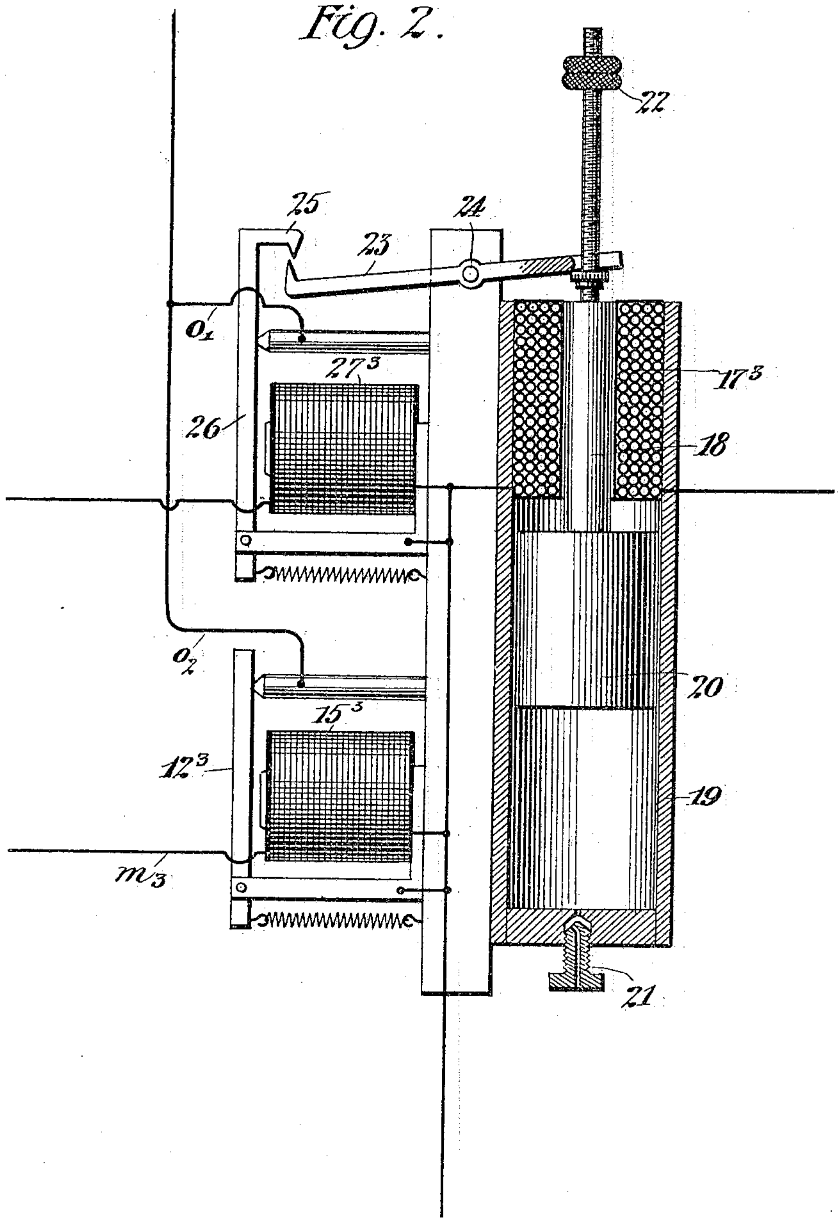
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

HANNIBAL C. FORD, OF JAMAICA, NEW YORK.

RAILROAD SYSTEM.

No. 809,794. Specification of Letters Patent. Patented Jan. 9, 1906.

Application filed September 12, 1905. Serial No. 278,184.

To all whom it may concern:

Be it known that I, Hannibal C. Ford, a citizen of the United States, residing at Jamaica, in the county of Queens and State of New York, have invented certain new and useful Improvements in Railroad Systems, of which the following is a full, clear, and exact description.

In my companion application, Serial No. 278,183, filed herewith, I have set forth in its broad aspects a railroad system in which each train produces in its rear a traveling zone of variable influence which serves to automatically govern the speed of the following train entering said zone.

The present application relates to a special case of the above system in which the traveling zone of variable influence created by the preceding train has only two grades or characters of influence which govern the following train to half-speed or full stop, respectively. The present case is, however, not limited to only two grades or characters in the zone of influence, since three or four grades or characteristics could be used in practice.

The object of the present invention is to provide a system which shall be very simple and applicable to the railroad installations now in use, such as the interborough transit system of New York city.

The invention further aims to secure a sufficiently perfect automatic control of trains for all practical purposes, securing a zone of influence having two grades or characteristics, as above stated, and which shall employ only the usual train-stops and other devices commonly available.

With these and other objects in view my invention consists in the construction, combination, location, and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally particularly pointed out in the appended claims.

Referring to the drawings, Figure 1 is a diagrammatic view showing a system embodying the principles of my invention; and Fig. 2 is a detail sectional view of a time-relay which may be used in connection with the above.

A form of block system which is now extensively used, and particularly in the subway system of New York city, involves the subdivision of the track into sections or blocks the rails of which are separately charged by transformers. As the trains progress along this track the sections are successively short-circuited and relay-magnets deënergized to display "home" or "danger" and "distant" or "caution" signals behind the train. The rules of the road provide that a following train may run by a caution-signal at reduced speed, but must come to a full stop whenever a home or danger signal is exhibited. This insures adequate protection if the rules of the road are always observed; but an onerous duty is imposed upon the trainmen, who are liable to human negligence or error. In my present system the human element is eliminated.

Referring to the drawings, A denotes a portion of a railroad-track having rails A′ and A². Rail A′ may be continuous and constitute a ground-return circuit. The rail A² is divided into blocks B′, B², and B³, &c., which are insulated from one another by insulating-joints *c*. Between the different blocks are small insulated sections C′, C², and C³ for purposes which will be later described.

Each of the rail-sections B′, B², B³, C′, C², C³, &c., is charged to a slight difference of potential over the continuous rail A′ by step-down transformers E² E³, &c., supplied from the alternating-current mains *l*′ and *l*². Connected across each of such rail-sections are alternating-current magnets F′, F², and F³, which under normal conditions are energized to attract armatures 10′, 10², and 10³ and 11′, 11², and 11³. In Fig. 1 all of the above-named armatures are shown attracted, which constitutes the normal safety condition of the road when no trains are passing.

By means of the above armatures certain electrical circuits are normally completed, as follows: Starting from a source of electric potential represented by the line-wire *n*′ circuit is made, through wire *n*², armature 11′, wire *n*³, into armature 10, where it divides, part going through a train-stop K², (the mechanical features of which are diagrammatically indicated adjacent the rails at the entrance to the section,) wire *n*⁴, armatures 12² and 26², back to the negative main *n*⁵. In this way the train-stop K² is depressed into its non-operative relation. The other branch of the circuit of wire *n*³ traverses the armature 10², wire *n*⁶, home signal M², magnet 13² to ground. By this means an armature 14² is attracted, which completes a circuit as follows: Through the wire m', armature 14^2, wire m^2, distant or caution signal L^3, displaying "clear" therein, wire m^3, magnet 15^3 to ground at m^4.

By the completion of the above circuits it will be observed that the magnet 13^2 has been energized, and in a similar way the magnets $13'$ and 13^3 are all continuously energized, which has the effect of displaying "safety" in each of the home or danger signals M', M^2, and M^3. At the same time the attraction of the armatures $14'$, 14^2, and 14^3 closes all of the circuits through all of the distant or caution signals L', L^2, and L^3, so that the latter are displayed to "safety." It will also be noted that the magnet 15^3 was energized, and in like manner the magnets $15'$ and 15^2 are all energized to set the train-stops K', K^2, and K^3 to "safety." In other words, everything is in condition for the free passage of a train.

I will now imagine a train to pass onto the track from right to left, successively traversing blocks B^3 B^2 and occupying B'. When the train is in this position, magnet F' will be deënergized; but the magnets F^2 and F^3 will have again attracted their armatures. The result is to deënergize magnets $13'$ and 13^2, displaying a danger-signal at M' and M^2, and by the release of armatures $14'$ and 14^2 to display caution or distant signals L^2 L^3. In other words, danger-signals are exhibited in the blocks occupied by and next to the rear of the train and a caution-signal at the entrance to the next block still farther in the rear thereof. These features constitute, generally, the block-signal system now in use, and up to this point I have not particularly referred to the special features of my invention.

I provide means for enforcing a reduction of speed when a caution-signal is passed, and for this purpose I have connected the train-stops K', K^2, and K^3 into circuit in a special way. The presence of a train on section B^2, but which has not yet arrived on section B', releases the armatures 10^2 and 11^2; but the circuit through the train-stop K^2 is still completed by the armature $11'$, which is still attracted. Thus the train-stop K^2 is not thrown to stop the train passing over it and does not become actuated until such train has entered section B' and released armature $11'$. Train-stop K^2 then becomes effective. So long as the train is on section B^2 the train-stop K^3 is also effective to stop any train entering section B^3; but when the train leaves section B^2 circuit is again completed, and K^3 returns to normal position unless its circuit is broken by certain other means. In accordance with my invention the train-stop K^3 becomes ineffective or not to stop a following train according to the speed of the latter. The circuit through the train-stop K^3 is completed through two separate branches o' o^2. If a caution-signal is displayed at L^3, which occurs as long as a train is on section B^2 by reason of the opening of the circuit of magnet 13^2 at 10^2 and also as long as the train is on section B' by reason of the opening of the circuit at $11'$, the connection at o^2 will be broken. Accordingly the only way the train-stop K^3 can be set to allow a train to pass while the caution-signal L^3 is displayed is through the branch o'. As long as a train is on section B^2 the train-stop cannot be set to let a following train pass, since its circuit is broken at 11^2; but when the train has left section B^2 armature 11^2 rises, and the train-stop K^3 can receive current provided the circuit is completed through branch o'. The circuit is or is not completed in this branch o', according to the speed of the following train. As the following train passes onto the subsection C^3 (it being understood that the preceding train has wholly entered block B') an alternating-current magnet D^3 is deënergized and an armature 16^3 released, which opens a circuit through a solenoid-magnet 17^3, which is particularly illustrated in Fig. 2. The armature 18 of the solenoid-magnet 17 is permitted to drop with a slow movement of a predetermined speed, and for this purpose I have arranged a fluid-cylinder 19, containing a weighted piston 20, attached to the armature 18. 21 indicates an adjustable valve by which the fluid is permitted to escape from the cylinder 19, so that the weighted piston 20 drops with a graduated speed in accordance with the adjustment of the valve 21. Under these circumstances the armature 18 falls slowly, and after a certain predetermined time, which can be regulated by the adjustment of the nuts 22, the latter strikes a tilting lever 23, pivoted at 24 upon the frame of the device, causing such lever to pass beneath a hook 25 on a pivoted armature 26 of a magnet 27^3. Referring again to Fig. 1, the circuit of the magnet 27^3 is completed as follows: Immediately when the train has passed over the small section C^3, so as to enter the section B^3, the armature 11^3 is released and the circuit of the magnet 27^3, which receives its current from the wires m^5 and m^6, is broken. Accordingly the armature 26 will be released, and branch circuit o', above referred to, will be broken, provided the train has been moving so rapidly as to arrive at section B^3 before the nuts 22 have tilted the lever 23. Should the latter occur, the hook 25 will be engaged and mechanically prevent the branch circuit o' from being broken. The result has been that as long as a train is on section B^2 train-stop K^3 would be effective under any circumstances and stop the train from entering section B^3. When the preceding train has left section B^2, the caution-signal L^3 is still displayed; but train-stop K^3 is ineffective to stop ensuing trains, unless the branch circuit o' is broken. The following train passes the rail-section C^3 in a certain interval, and if this interval is too small, corresponding to too high speed, the branch circuit o' is broken and train-stop K^3 made effective to stop the train. If the preceding train has left section B′, the branch o^2, above referred to, is completed, so that the train-stop is released, whether or not the following train traverses at such high speed as to open the branch circuit o'. As soon as the following train has left the short section C^3 the magnet 17^3 is energized to raise its armature 20 and restore all the apparatus to normal relation. Thus it will be seen that behind each train I leave a traveling zone of variable influence, causing the absolute stoppage of a following train in case it is within a certain distance, but the qualified stoppage of a following train, if it is a one block greater distance, depending on whether or not the engineer has sufficiently reduced his speed. In practice the aparatus would be so adjusted that the following train would be obliged to run at half-speed in order to pass a caution-signal.

The system is effective to absolutely preclude the possibility of collisions, since it is wholly automatic, and it further has the effect of discouraging an attempt to pass a caution-signal at too high speed, since the penalty of total stoppage is automatically and certainly inflicted if the speed in passing the caution-signal is the least bit too high.

It is to be understood that my invention is not limited to the use of speed-controlling devices along the track subdivisions or units. The invention is equally applicable to use with any form of governor-controlled tappet upon the train which serves to mechanically open the switches 26′, 26^2, and 26^3 as the train passes the successive sections in case its speed is too high. The particular form of means by which the train is made effective to open the switches 26′, 26^2, and 26^3 in case its speed is too high is not important, it being merely essential to devise some means by which this is accomplished in connection with an electrical system for rendering the train-stop effective in case the caution-signal is simultaneously displayed.

What I claim is—

1. In a railroad system, a track divided into sections, and electrical connections for setting a train-stop absolutely to enforce a home or danger signal, but releasably to enforce a caution-signal depending on the speed of a following train.

2. In a railroad system, a track divided into sections, a train-stop corresponding to each caution-signal, and means whereby said train-stop is rendered ineffective when the speed of a following train falls below a certain amount.

3. In a railroad system, a track divided into sections, means whereby caution-signal circuits are successively opened by the passage of a train, each caution-signal circuit constituting a branch of a circuit operating a train-stop.

4. In a railroad system, a track divided into sections, means whereby a train absolutely stops a following train a certain distance behind, and stops the following train an increased distance behind in case its speed exceeds a certain amount.

5. In a railroad system, a track divided into sections, and connections for stopping a following train in case its speed exceeds a certain amount.

6. In a railroad system, a track divided into sections, and means operated from a passing train for setting a train-stop in the rear thereof, and means for rendering said train-stop ineffective in case the speed of the following train is below a certain value.

7. In a railroad system, a track divided into sections, and means operated from a passing train for setting a train-stop in the rear thereof, and means for rendering said train-stop operable only in case the speed of the following train exceeds a certain value.

8. In a railroad system, electrical connections for displaying a home signal in the rear of a train, means whereby such home signal displays a distant signal farther in the rear, a train-stop, and means whereby said train-stop is absolutely effective as long as the home signal is displayed and is effective for high-speed trains only as long as the distant signal is displayed.

9. In a railroad system, a track divided into sections, means whereby said sections are short-circuited by the passage of a train, a magnet which releases a slowly-movable part actutated by the short-circuiting of one section, and a second magnet actuated by the following section for releasing its armature unless held up by said part.

10. In a railroad system, a track divided into sections, means whereby a train-stop is made effective at the entrance to a section, after, but not while, a train is located thereon, and means whereby said train-stop can be rendered ineffective by trains below a certain speed after the preceding train has traversed a certain distance.

11. In a railroad system, a track divided into sections, and means whereby a preceding train causes behind it a traveling zone of variable influence, and means whereby a following train is absolutely stopped or stopped in case its speed is too great, according to its penetration into such zone.

In witness whereof I subscribe my signature in the presence of two witnesses.

HANNIBAL C. FORD.

Witnesses:

ALFRED W. PROCTOR,

WALDO M. CHAPIN.