J. M. WALDRON.

SIGNALING SYSTEM FOR RAILWAYS.

APPLICATION FILED SEPT. 30, 1908.

921,758.

Patented May 18, 1909.

2 SHEETS—SHEET 1.

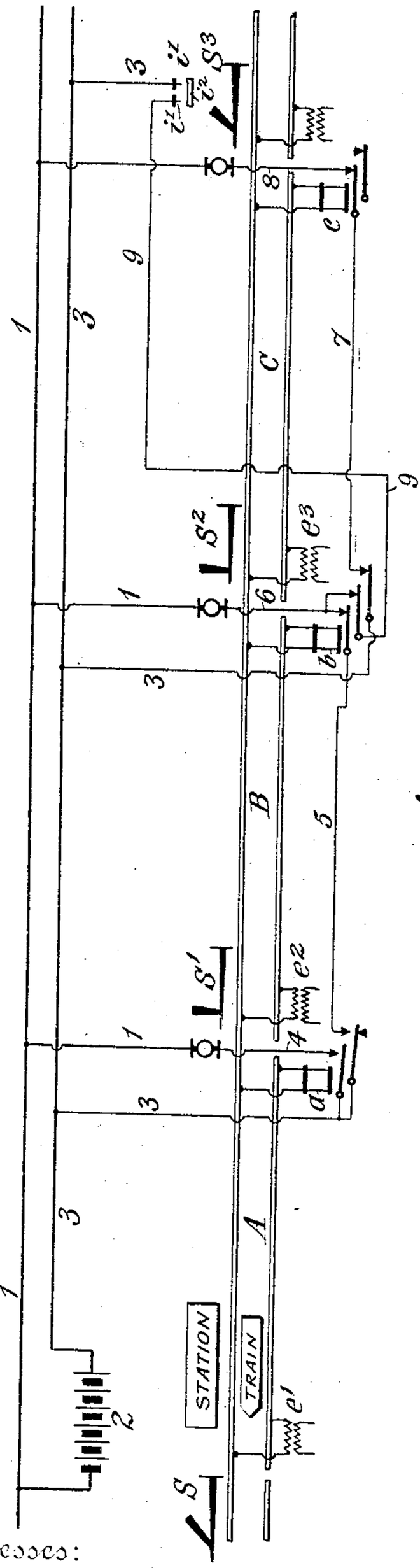

Fig. 1

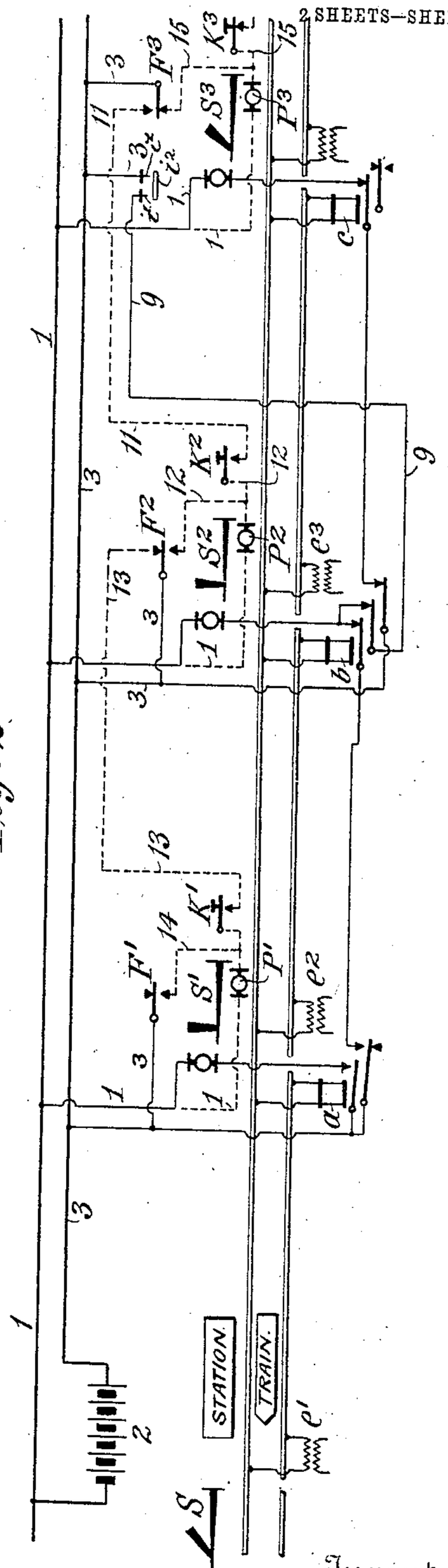

Fig. 2

Witnesses:

Raphaël Letter

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Fig. 3

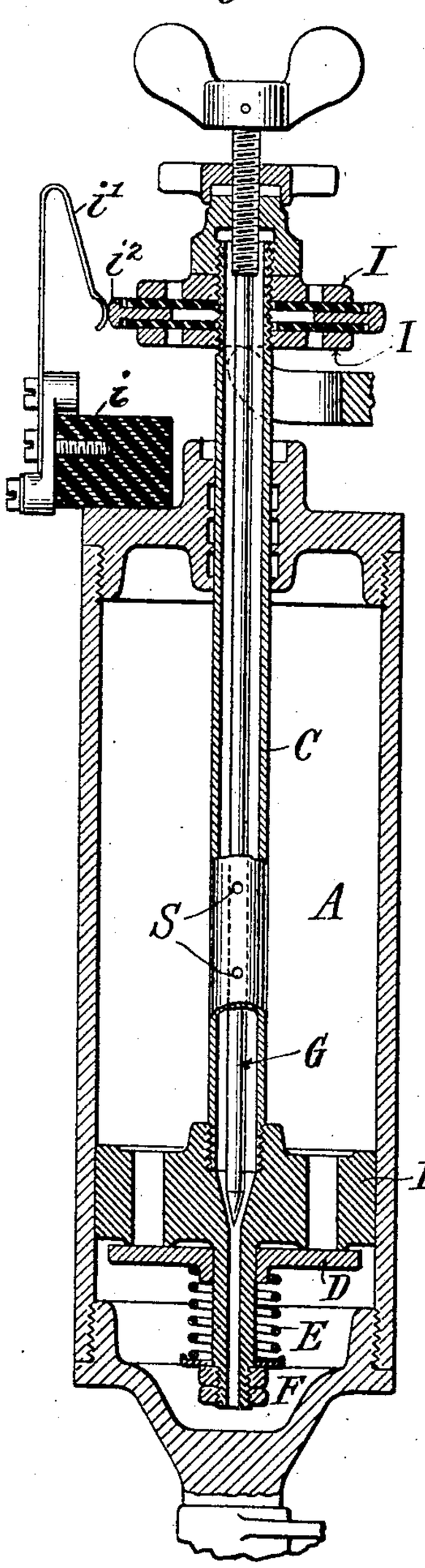
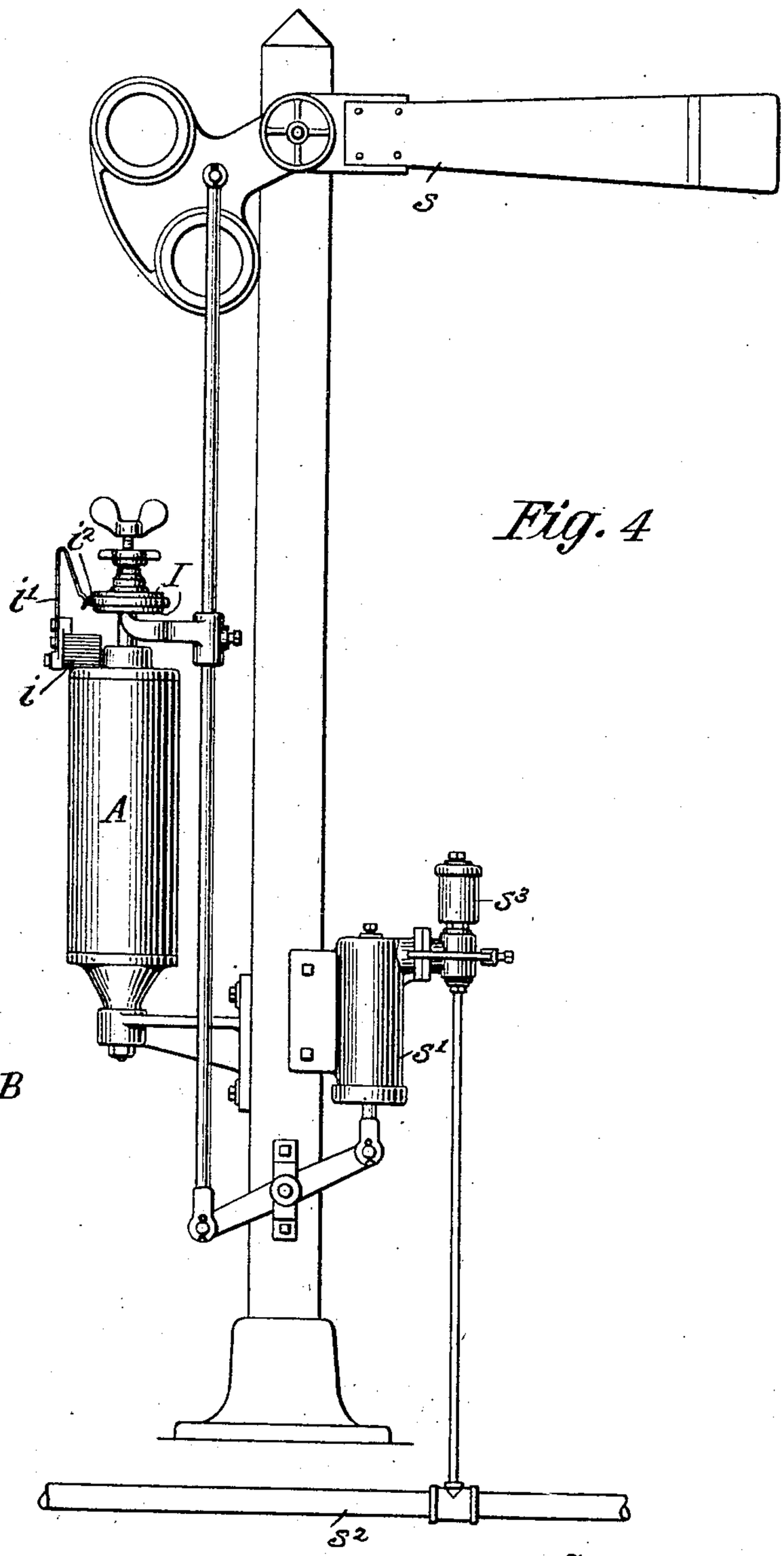


Fig. 4



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UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM FOR RAILWAYS.

No. 921,758. Specification of Letters Patent. Patented May 18, 1909.

Application filed September 30, 1908. Serial No. 455,523.

To all whom it may concern:

Be it known that I, JAMES M. WALDRON, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Signaling Systems for Railways, of which the following is a specification.

In the block signaling of railways, the greatest degree of protection is obtained by the use of such systems wherein the territory affecting the control of any block signal is extended beyond the location of the next succeeding block signal, a determined distance. Oftentimes, and especially where the distance between signals is the minimum in which a train can be stopped from full speed, the entire distance between the next two succeeding signals is used for the overlap. This method of control is old in the art, but it is advantageous when automatic train stops are used in connection with the block signals. The reason is, that full braking distance may thus be obtained beyond each signal wherein a train can be stopped by the automatic stop in the event of the train's overrunning a signal and its stop in the danger position. The use of train stops thus arranged in signaling systems of the class described is a well known feature in modern railway signaling where high speed and great frequency of trains prevail. The method, however, does not provide for trains approaching one another at slow speeds to thus obtain the greatest number of train movements in a minimum amount of time. At stations, in particular, where regular stops are made, a train is by the method of signaling hereinbefore described held quite a distance in the rear of one at the station, until the latter has cleared the block which includes the station stop, thus preventing the approach to the station of the rear train at a moderate speed, which might be safely done if not for the restriction imposed by the equipment.

It is an object of the present invention to enable one train to thus close in upon another provided it has first so reduced its speed as to make its approach a matter of reasonable safety. To accomplish this I have applied to one of the signals a time device which when the block signal is at safety holds a circuit open controlling another signal. When the train passes the signal at safety and the latter moves to danger, the time device acts to close the open circuit after the lapse of a predetermined interval, one sufficient to enable a train on passing the signal to move at a very much restricted speed up to the next signal, whereupon the next signal will move to safety by virtue of the circuit being closed through the time device, to permit the train (at this very much reduced speed) to enter the next block and irrespective of the normal means provided in the block system for preventing its movement to safety while a train occupies a part of the territory it governs. By means of this invention, therefore, material time is to be saved in reducing the headway of trains passing through stations or other points where stops or restricted speeds are regularly scheduled, or, if desired, my improvement may be applied continuously to each signal of the system and thus effect a saving in headway at any point along the line where regular stops or "slow-downs" are not scheduled, but where emergencies from time to time may cause them to occur. The automatic closing in of one train to within one block of another in the event of trouble to the first train is also thus rendered possible and assistance thus may be more quickly obtained than under the regular block equipment.

I do not lay claim herein to the use of automatic stops in connection with the systems shown nor to any novelty in their control or operation as these are old in the art as arranged, as are various other methods of their arrangement and control in conjunction with block systems. While I have shown them in the drawings and described them briefly I regard them as purely auxiliary devices to the signals themselves and used simply to enforce the proper observance of the signals by trainmen. I therefore do not limit myself to the use of automatic stops in carrying out my invention, but recognize that they may or may not be used as financial or other conditions justify and entirely at the discretion and within the skill of modern signal engineers. I also show in my drawings and specifications the ordinary forms and arrangements of block signals and apply my invention in such a manner thereto that the regular signal is employed under all conditions for advancing trains.

It is obvious to those skilled in the art that

a secondary or "calling-on" signal may be used for advancing the trains when the overlapping sections are eliminated by action of the time device, thus giving evidence to trainmen by use of a special signal of the fact.

In order that my invention may be fully understood I will proceed to describe the same with reference to the accompanying drawings, in which—

Figure 1 represents diagrammatically an application of my invention to a signal lying in the rear of a station in an overlapping signal system, a train being shown as standing at the station and holding at danger two signals S^1 and S^2 in its rear as is customary in such systems. Fig. 2 is the same as Fig. 1 except the addition therein of a well understood arrangement of automatic train stops controlled by and operating in conjunction with the signals in a manner also well understood. Fig. 3 shows in vertical cross section a form of time device which may be employed for retarding the closure of a circuit after a signal moves from safety until a predetermined time has elapsed. Fig. 4 shows the application of the device shown in Fig. 3 to a well known form of automatic railway signal.

Similar letters and numerals of reference designate corresponding parts in all of the figures.

Referring now to Fig. 1, the block signals are designated by the letters S, S^1, S^2 and S^3. I have shown three complete block sections, A, B and C, each of which is provided with a track circuit. Each track circuit as shown, comprises a transformer e, e^1 and e^2 or any other well known means of supplying alternating current or if desired a direct current generator such as a dynamo or primary or secondary batteries may be used, and a relay or translating device a, b and c, which is designed to operate from the generator of its particular track circuit.

As track circuits are so well understood in the art of signaling and as my invention does not embrace any novelty in their equipment or arrangement further description of them is deemed unnecessary. The manner of forming the block sections is also immaterial to my invention and any desired means may be employed for that purpose. As shown, the block sections are formed by inserting insulation or otherwise dividing one of the track rails. The type of railway signal is immaterial, though I prefer to use an automatic type of railway signal. I have shown in Fig. 3 what is commonly known as an electro-pneumatic railway signal, the signal device s being moved from its "danger" to its "safety" position by means of a suitable mechanism here shown as comprising a piston movable in a cylinder s' under the influence of compressed air which is supplied from a main pipe s^2 under the control of an electrically operated valve s^3. This is all well understood in the art.

The signal S^1 is held at safety normally (when no train is on section A) by a circuit through its operating mechanism; (which may be of any of the many well known types employing electricity for its operation or control), which may be traced as follows: From battery 2, wire 3, contact of relay a, wire 4, signal mechanism, wire 1 to battery 2. Thus, relay a is the primary medium of control of this signal.

Signal S^2 is controlled by a circuit which may be traced as follows: battery 2, wire 3, contact of relay a, wire 5, contact of relay b, wire 6, signal mechanism, and wire 1 to battery 2. Thus, relays a and b both normally control this signal.

Signal S^2 is controlled by a circuit which may be traced as follows: battery 2, wire 3, contact of relay b, wire 7, contact of relay c, wire 8, signal mechanism, and wire 1 to battery 2. Thus, relays b and c both control this signal.

It is assumed in Fig. 1 that all trains will be brought to a stop at the station hence the control of signal S^1 by an overlapping section beyond signal S is omitted as is customary in practice under such conditions. Should some trains not stop at the station it would be expedient to control the signal S by a track circuit beyond signal S also, but such a control would not alter the application of my invention to the situation from the diagrams of it shown in Figs. 1 and 2.

Assume a train to be standing at the station as shown. The relay a will then be deenergized and the circuits described as controlling the signals S^1 and S^2 will be interrupted at the relay contacts. The signal S^1 and S^2 will in consequence be retained at danger as shown. A following train upon entering section C will shunt current from the relay c which will then drop its armature and open the circuit on signal S^3 at that point, thus putting the signal to danger. Under ordinary methods and without my improvement the train could not proceed beyond the signal S^2 so long as that signal remained partly under the control of track section A while a train occupies wholly or in part the rails of that section as shown.

It is evident that if the following train could proceed past signal S^2 at a very much reduced speed, or if it were compelled, in other words, to run from signal S^3 to S^2 at such a slow speed as to compel its entrance to section B at a speed of say five miles an hour, and if the section B were made reasonably short the chance of the train's obtaining such speed on arriving at signal S^1 and overrunning that signal and into collision with the train at the station would be very remote, while the use of automatic stops at each signal effective when the latter are at

danger would be most effective in allowing such "closing in" of trains reasonably if not wholly safe. The time interval between trains that may by use of my improvement be obtained is of material advantage upon railroads employing frequent service and operating at times up to the full limit of their capacity. Additional capacity for trains is therefore obtainable with the use of my improvement without reducing to any material extent the safety to be obtained by the block system to which it is attached. To this end I apply my invention to signal S^3 which comprises a time device, a form of which is shown in Figs. 3 and 4, operating a circuit controller, and so embody it in the system that when signal S^3 is set to danger by a train passing it, the piston in the cylinder of the time device slowly descends and after the lapse of a predetermined time effects the closure of contacts comprised in a circuit for the signal S^2. The contacts are here shown as with wires 9 and 3, and located at signal S^3. When these contacts are closed a circuit is established from battery 2, wire 3, wire 9 through the contacts i^1, i^1 and i^2 of the time device to contact of relay *b*, wire 6, signal mechanism wire 1 to battery 2. The effect of this closed circuit is to operate to safety the signal S^2 to permit the advancing train to enter under its reduced speed into block B, providing that train has so reduced its speed as to consume the same time in passing through block C as the time device consumed in closing its contact after the signal S^3, which released it, moved to danger under the influence of the train on passing it.

In Fig. 2 I have shown my invention in connection with train stops, the train stopping devices being designated P^1, P^2, P^3. The train stop control shown involves a "normal stop" position of the stop mechanism and each device has two circuits, one to clear it and the other to hold it clear under the proper conditions. The circuit controllers in the circuits shown are operated by the signals and train stops only, the track relay contacts not directly affecting the train stop circuits, as might be done if desired, the method shown being one in common use.

Circuit controllers F^1, F^2 and F^3 of any desired construction are provided on signals S^1, S^2 and S^3 respectively, F^1 closing wire 3 to wire 14 when the signal S^1 is in the clear position; F^2 closing wire 3 to wire 12 when the signal S^2 is in the clear position; F^3 closing wire 3 to wire 15 when the signal S^3 is in the clear position.

Circuit controllers K^1, K^2 and K^3 of any desired construction are provided on the train stops P^1, P^2 and P^3 respectively and close the contacts shown only when the train stops are in the down or non-engaging position. The train stops P^1, P^2 and P^3 are of the well known form requiring the presence of an electric current to move to the down or non-engaging position, the absence of such current allowing gravity to raise the train stop arm to the train engaging position. The clearing circuit for train stop P^1 starts from battery 2, wire 3, signal circuit controller F^1, wire 14, mechanism P^1, wire 1 back to battery 2, and requires signal S^1 to be in the clear position before the train stop can be cleared.

A train in passing signal S^2, setting it to the stop position, operates circuit controller F^2 and closes the following circuit: battery 2, wire 3, contact F^2, wire 13, contact K^1 (closed when train stop was cleared by the "clearing" circuit), wire 14, mechanism P^1, wire 1, back to battery 2. This latter circuit is for the purpose of holding the train stop clear under the train when the signal S^1 in being passed was set to the stop position and circuit controller F^1 operated to open the "clearing" circuit. Similarly, the clearing circuit for train stop P^2 takes battery 2, wire 3, circuit controller F^2 on signal S^2, wire 12, train stop mechanism P^2, wire 1, back to battery 2.

When a train passes signal S^3 circuit controller F^3 on signal S^3 is closed and the following circuit is established, battery 2, wire 3, circuit controller F^3, wire 11, circuit controller K^2 on train stop P^2, wire 12, train stop mechanism P^2, wire 1, back to battery 2. The "clearing" circuit for train stop P^3 starts from battery 2, wire 3, circuit controller F^3, wire 15, mechanism P^3, wire 1 back to battery 2. The holding circuit will come from the signal in rear, not shown, via controller K^3, wire 15, to mechanism P^3, to wire 1, to battery 2. It will be understood that when the train passes the signal S^3 the time device will close a circuit on signal S^2 in the manner hereinbefore described to have it operate the circuit controller F^2.

In Fig. 3 is shown a time device which may be employed and which comprises a cylinder A that is fitted with a piston B and hollow rod C. On the under side of the piston is mounted a check valve D held seated against the piston by spring E which is secured in a compressed state by the nuts and washer F on the downward extension of the piston. Through the piston are a number of holes drilled vertically through the surface upon which the valve seats. If the piston be drawn up and the cylinder be partly filled with liquid the atmospheric pressure acting upon the liquid will force the latter to open the valve and fill the space under the piston that would otherwise constitute a vacuum and retard the upward movement of the piston. Upon descent of the piston again the check valve instantly seats and prevents passage of the liquid back through the ports

through which it descended under the piston. There is another passage, however, provided for this return of the liquid to the chamber above the piston through the hollow piston rod the hole in which extends down through the piston head and its lower extension into communication with the chamber under the piston. On descent of the piston the liquid is forced up through this passage past a pin valve formed on the lower end of stem G mounted in the hollow piston in the manner shown, so that the freedom with which the liquid passes this pin valve and through the perforations S S S into the chamber above the piston may be capable of regulation by adjustments of the pin valve from the top of the upper cylinder head. By this construction the piston may be raised rapidly in the cylinder with comparatively little resistance but its descent may be made to occupy as long a period of time as is desired by restricting the passageway of the liquid past the pin valve.

Attached to the piston rod external to and just above the cylinder I employ two disks I and I in a horizontal plane supporting between them a metal ring i^2 of slightly larger diameter mounted by suitable insulating material to stand electrically separated from all other parts of the piston and its attachments. Mounted on the cylinder head is an insulating block carrying two contact springs i^1 (only one of which is shown) which are secured to it but fully insulated from the balance of the structure. This metal ring i^2 and the contact springs constitute a circuit controller for controlling a circuit on an advance signal.

When the signal is at danger and the piston is in its lower position as shown this metal ring lies in contact with the two springs, electrically uniting them. As the signal moves to safety the ring is carried with the piston upward and contact with the spring is severed. When the signal moves to danger the piston does not return to its lower position at once but slowly descends after the signal has assumed danger under the restrictions imposed upon the flow of the liquid through the piston rod until the ring rests in contact with the two springs. In this way the closure of the special circuit upon the signal in advance of the one carrying the time device is closed at whatever interval is desired after the signal with the time device has assumed danger.

Fig. 4 shows the cylinder supported by some fixed part of the signal structure while a lug extends from the rod by which the signal is operated to a point under the disk I by means of which the piston is elevated with the signal rod. During the reverse movement of the signal rod the lug on the rod simply recedes from contact with the disks allowing them and the piston to descend at will.

Having thus described my invention, what I claim is:

1. In a signaling system for railways, a plurality of signals, track circuits lying between the signals, means actuated by the track circuits for controlling the movements of the signals, and means actuated by the signals for eliminating a portion of the track circuit control of the signals after the lapse of a predetermined time following the setting of the signals to danger by trains.

2. In an automatic block system for railways the combination of the signals and means adapted to extend the control of the signals by one or more track circuits in advance of that one forming the block section, and means actuated by trains for eliminating one or more of the said advance track circuits from the control of the signal to the end that trains moving at restricted speeds may follow one another at closer intervals under clear signals than would be possible otherwise.

3. In an automatic block system for railways wherever the control of each signal is in part affected by trains in the next succeeding block, means actuated by trains on passing one signal for clearing the next signal in advance independently of the means that may there be retaining the signal in advance at danger, after a given time has elapsed following immediately upon the setting of the first signal to danger by the train.

4. In a railway signaling system, the combination of a plurality of block sections, railway signals for each of said block sections, train controlled means comprising track circuits for holding at danger in the rear of a block section occupied by a train one or more of the railway signals in a position to indicate danger, a time device provided at a railway signal in the rear of the last railway signal held in the danger position by the train, and a circuit controlled by said time device for causing the next railway signal in advance which is in its danger position to move to its clear position.

5. In a railway signaling system, the combination of a plurality of block sections, railway signals for each of said block sections, train controlled means comprising track circuits for holding at danger in the rear of a block section occupied by a train one or more of the railway signals in a position to indicate danger, a time device operating a circuit controller and provided at a railway signal in the rear of the last railway signal held in its danger position by the train, said time device acting to clear the circuit controller when the railway signal operating it is in its danger position, and a circuit controlled by said time device for causing the next railway sig-

nal in advance which is in its danger position to move to its clear position.

6. In a railway signaling system, the combination of a plurality of block sections, railway signals for each of said block sections, train controlled means comprising track circuits for holding at danger in the rear of a block section occupied by a train one or more of the railway signals in a position to indicate danger, a train stopping mechanism at each railway signal and controlled by said railway signal to be in its engaging or non-engaging position according to whether the railway signal indicates danger or safety, a time device provided at a railway signal in the rear of the last railway signal held in the danger position by the train, and a circuit controlled by said time device for causing the next railway signal in advance which is in its danger position to move to its clear position.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES M. WALDRON.

Witnesses:
H. W. GRIFFIN,
H. O. HAMILTON.