

No. 860,561.

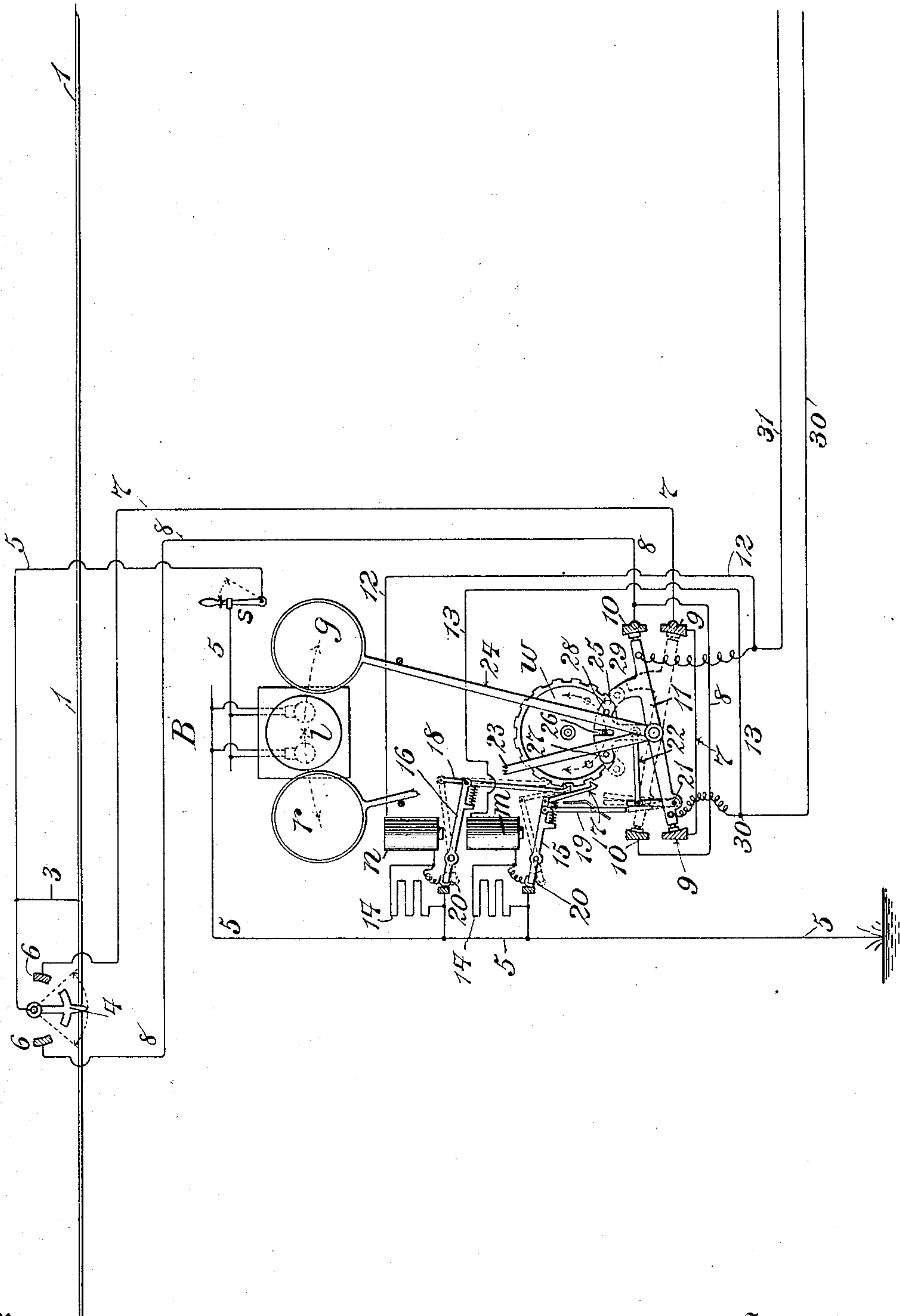
PATENTED JULY 16, 1907.

W. T. OVIATT, E. F. LATIMER & W. GRUNOW, JR.
ART OF RAILWAY SIGNALING.

APPLICATION FILED AUG. 2, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

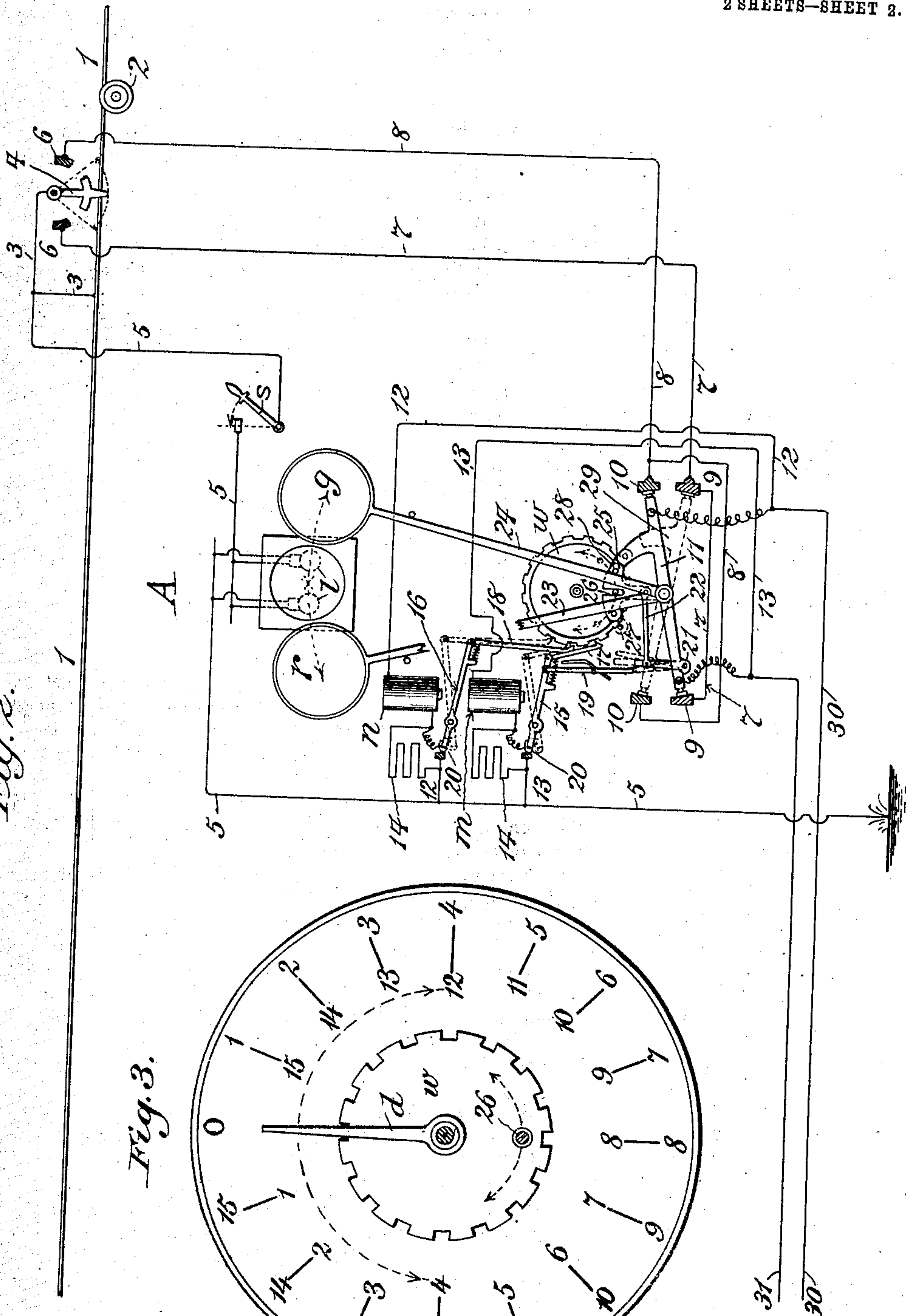
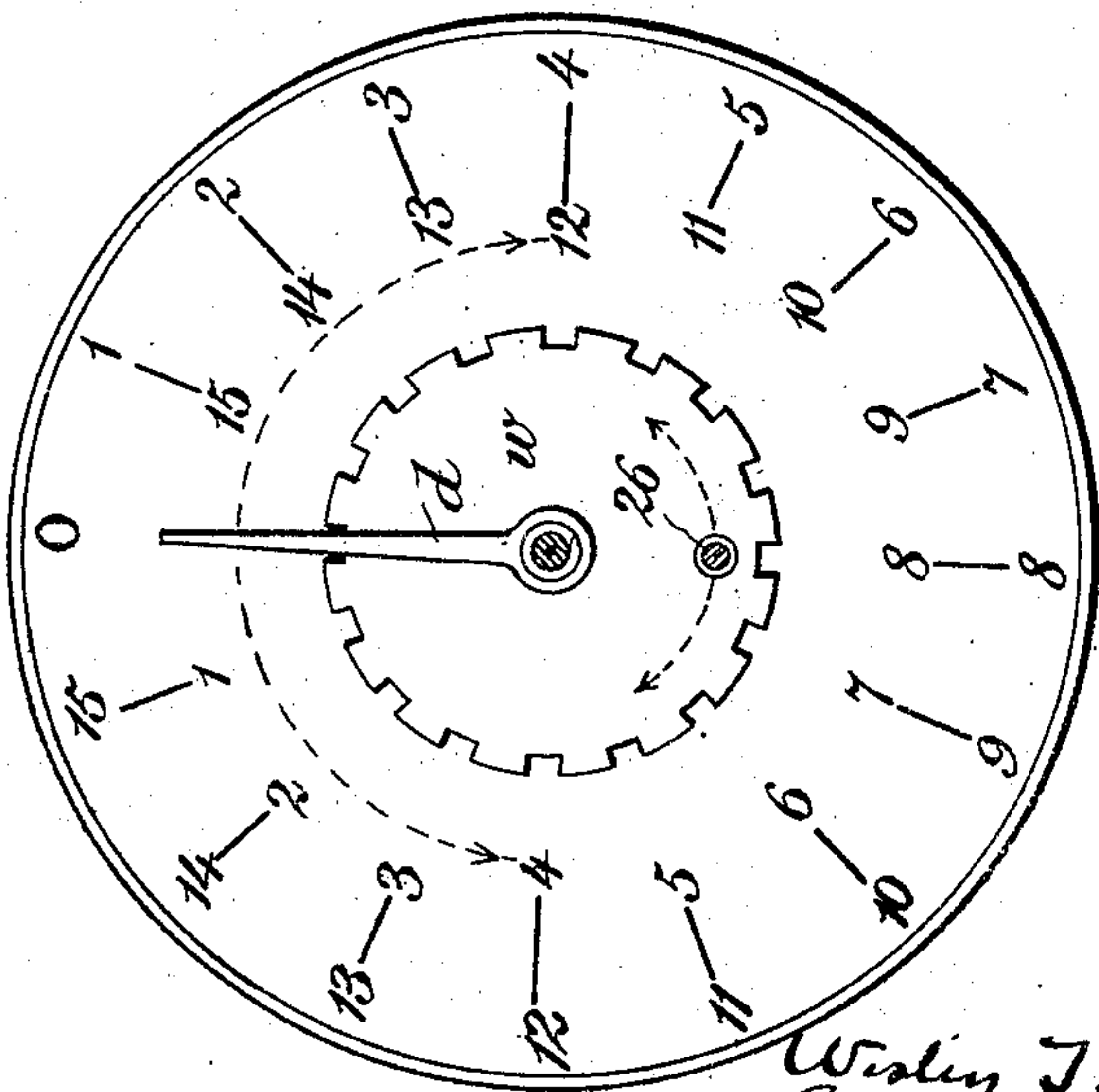


Fig. 3.



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UNITED STATES PATENT OFFICE.

WESLEY T. OVIATT, OF STRATFORD, AND EDWARD F. LATIMER AND WILLIAM GRUNOW, JR.,
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ART OF RAILWAY SIGNALING.

No. 860,561.

Specification of Letters Patent.

Patented July 16, 1907.

Application filed August 2, 1906. Serial No. 328,972.

To all whom it may concern:

Be it known that we, WESLEY T. OVIATT, EDWARD F. LATIMER, and WILLIAM GRUNOW, Jr., citizens of the United States, and residents of Stratford, Fairfield county, State of Connecticut; Bridgeport, Fairfield county, State of Connecticut, and Bridgeport, Fairfield county, State of Connecticut, respectively, have made a new and useful Invention in the Art of Railway Signaling, of which the following is a specification.

Our invention is directed particularly to a novel system for effecting the movement of railway cars or trains over a railway, either in the same or opposite directions, in such manner as to avoid damaging collisions or accidents, and it has for its objects—First, to provide a novel system or apparatus whereby cars or trains may enter a definite section of the roadway, from either end thereof, and in any desired number, the first car to enter such section effecting the operation of signals at both ends of the section giving definite indications, other cars entering the section giving indication at both ends thereof of the number of such cars in the section; the arrangement being such that when each car enters the section it does not disturb the signals and when any car leaves the section no matter from which end, the signals still remain in the same condition until the last car remaining therein has passed out, no matter in which direction. Second, to provide a novel system of signals and circuit changing switches at each end of a section to be protected and all so arranged that no matter at which end a car may enter it will set or display definite signals at the opposite ends and place the switches in such relation to the circuits and controlling apparatus of the signals that no matter whether the car passes out at the distant end or backs out at the home end the signals will be restored to normal condition and no matter what the number of cars, within limits, be admitted to the section the signals will perform their evolutions for the perfect protection of the road and be restored to safety only after all of the cars have passed out of the section, no matter in which direction they may enter or move out of the same. Third, to provide means whereby should two cars enter an open or unoccupied block from opposite ends thereof at identically the same moment, such signal displays will be given at both ends of the section as will indicate to the motorists of both cars the fact that they are approaching each other on the same section and that one of said cars should back out, the arrangement being such that no matter which cars first backs out it will establish a danger signal against itself and will give a safety indication to the other car at the distant end of the section, allowing it to proceed, and if both back out all

signals will return to normal or safety. Fourth, to provide means for permitting of the simultaneous entrance or exit of cars in and out of a block, whereby indications of such entrances or exits are simultaneously added or deducted at both distant signal boxes without changing the condition of the signals as originally set by the first car which entered. Fifth, to provide a safety system of signals with indicating apparatus adapted to indicate definitely the number of cars which enter any section and remain therein for any length of time and also adapted to deduct or subtract from the indicated number on the indicator at each end of the section successively as the cars leave the same, no matter in which direction, the successive additive indications in increasing order always being in the same direction until the maximum number of cars has entered, and the successive deductive or subtractive indications being always in a reverse direction thereto, so that both indicators always give a positive indication at each end of the section of the number of cars located thereon.

Our invention is particularly adapted for single track railways of the well known trolley type, although it may be used in connection with electric railways of the third rail type, or with steam railways and any controlling source of electrical energy; or with an electric railway and an independent controlling source of electrical energy, the circuit relations of the signals, the indicators, the operating switches, the circuit changing switches and controlling magnets being such that they may be adapted for such use generally in railways.

Prior to our invention attempts have been made to give an absolute indication of the number of cars at each end of a protected section of a railway that shall enter the same and shall withdraw therefrom, and to also display a definite signal at each end of the section indicating the fact that said section is occupied, such a system being made operative by a single electromagnetically controlled indicator at each end operated by two electromagnets, electrically connected with four circuit wires running over the entire section, trolley controlled switches being provided at the opposite ends for effecting the circuit relations for the several circuits on entering or leaving the section, a single signal at each end being combined with such an indicator. A further system has also been proposed in which two electrical circuits are utilized over the entire section, one indicator at each end, each controlled by two electromagnets, a single signal being provided at each end, the arrangement being such that the indicator hand is operated to give two definite types of indications; namely, one from left to right in the direction of the hands of a clock, and the other in reverse

direction over separate dial numbers. Both of these systems, however, are so arranged that should two cars enter from opposite directions or leave in opposite directions at identically the same instant of time, both sets of controlling magnets for each indicator would operate and no indication would therefore be effected. Our invention differs from these, in that we utilize two normally open main line controlling circuit wires and electromagnetically controlled switches at each end operatively brought into action by switches controlled by the trolley, and in such manner that the additive indication of cars entering from either end or successively from one end always gives an indication of the absolute number of cars upon a section, so that should the maximum number of cars enter, whether in opposite directions or the same direction, this fact will be indicated upon both indicators. Our invention also differs from the before-mentioned systems, in that by no possibility can there be a non-operation of the indicators and the electromagnetically controlled switches connected thereto, by reason of the simultaneous entrance or departure of cars past the switches at opposite ends, a feature of material importance in that such an action would positively disarrange the apparatus and make it inoperative for future use. With our system a positive indication is given of the simultaneous entrance or departure of two cars in the same or opposite directions. A further system has been devised in which a normally open two wire controlling circuit extends over the section and one individual signal at each end thereof is controlled for disclosing the presence of cars at both ends of the section should a car enter at either end thereof, but this system, like those before mentioned, is not so devised as to prevent the possible operation or display of the signals in the event of two cars entering a section simultaneously. With our invention, therefore, it is not possible, by reason of the movement of the cars themselves, to place the apparatus in inoperative position or to give a false indication.

For a full and clear understanding of our invention, such as will enable others skilled in the art to construct and use the same, reference is had to the accompanying drawings, in which,

Figures 1 and 2 represent diagrammatically a complete system applicable to a single section of railway, said figures of the drawings being placed the one upon the left of the other, so as to indicate the operative relation of the parts when cars enter or withdraw therefrom in either direction. Fig. 3 is an enlarged elevational view of one of the signal indicating wheels with the dial-hand attached thereto, and dial-face for indicating the number of cars on any section at any one time.

Referring now to the drawings in detail, 1 represents a trolley wire connected to a source of electrical energy, not shown.

2 represents a trolley wheel, such as is ordinarily used in connection with railways of this type, and 3 is a normally open branch feeder connected to the trolley wire, one at each end of the section, as shown.

Inasmuch as all of the parts of the apparatus applicable to each end of the section to be protected are identically alike, a description of such parts at one end, say station A, will apply equally well with those at the other end, say station B: the signals being shown in normal or

safety position and the circuit connections between the switches and the trolley wire normally disconnected, so that no current is flowing through any part of the system other than the trolley wire.

4 represents a pivoted switch having sufficient weight to normally maintain it in a vertical position.

5 represents a branch circuit running to earth and having connected in multiple circuit therewith two electric lamps, 1, 1, *s* being a hand-switch for closing this branch circuit to the lamps; said lamps giving under normal conditions a white light in the field of the signal box.

The contacts of the switch 4 are normally out of contact with stationary contacts 6, 6, the lower end of said switch being bifurcated and located in the path of the trolley wheel 2 and the arrangement thereof such that when said trolley wheel is moved in opposite directions it will close the circuit to one or the other of the contacts 6, 6.

7 and 8 are branch conductors running respectively to pairs of stationary switching contacts 9, 9, and 10, 10.

11 is a circuit changing switch having switching arm of non-conducting material centrally pivoted and carrying at its free ends two yielding contacts adapted to contact with the stationary contacts 9, 10, either in the full line position or the dotted line position, as shown, said yielding contacts being connected through flexible conductors to signal operating or controlling conductors 12, 13 and main line conductors 30, 31.

m and *n* are signal operating or controlling electromagnets located respectively in circuit with the signal operating or controlling conductors 13, 12, and connected to the branch earth circuit 5, through movable contacts 20, 20, carried by armature levers 15, 16 of the magnets *n*; 14, 14 being rheostats located in shunt relation to said contacts, the functions of these parts being to adapt the electromagnets for use with currents of widely variable potential. The armature levers 15, 16 are provided at their free ends with operating pawls 17, 18, pivotally supported and having yielding springs for maintaining them in operative relation with a signal indicating wheel *w* having a definite number of—preferably—rectangular shaped teeth, shown in the drawings to the number of sixteen, the apparatus illustrated being adapted to admit at one time as high as 16 cars to the section under protection. In Fig. 3 I have illustrated an enlarged view of the signal indicating wheel *w*, showing also the dial-face and dial-hand *d* therefor, the dial-hand being carried by the same shaft which supports the signal indicating wheel and the normal position of said hand pointing to zero, as indicated. These parts thus illustrated in detail constitute a numerical indicator for giving a visual indication of the number of cars at any time standing upon or passing over any protected section of the roadway.

19 is a pivoted arm adapted to move in a guide-way and so arranged that its lower end may either rest in or out of the path of the second pivoted arm 21 carried by the circuit changing switch 11 and operatively connected by a link 22 with a triangular shaped operating arm 25 supported by the same pivot or journal which supports the switch 11.

The signal indicating wheel *w* is provided with an index adapted to move over a dial having sixteen numbers for indicating the position of said signal wheel as

shown in Fig. 3. It is also provided with an operating pin 26 adapted to move in a vertical slot in the upper arm of the triangular shaped arm 25.

g and r are two signal glasses, respectively of the colors green and red, said signals being carried by the arms 24, 23 and pivotally supported upon the switch 11.

27, 28 are pins carried by the arm 25 and adapted to rotate the signals g and r in accordance with the direction of rotation of said arm, said signals being moved thereby in one direction and by an independent force as gravity in a reverse direction and having limit stop pins in the signal box, as shown.

29 is an upwardly extending arm integral with the switch 11, the end of said arm being located in the path of the upper end of the pivoted triangular shaped arm 25, the arrangement being such that the switch 11 is always operated in either direction when the operating magnets are demagnetized, dependent upon the circuit relations of the several parts of the system and of the operation of the switches 4, 4, at either end of the section.

The operation is as follows—Both of the signals r and g at each end of the section are shown in their normal position with the lamps l at station B normally in circuit and the lamps l at station A normally out of circuit, the former for the purpose of illustrating the application of the system for night use and the latter for illustrating it for day use by the semaphores alone. Suppose a car to be entering from the right at station

A and that the overlap between switch 4 and the signal box is, say 200 yds., or a sufficient distance to enable a motorman to observe the operation of his home signal, as his car enters or withdraws from the section. When the trolley wheel 2 passes the switch 4 it closes the circuit a definite time between the trolley conductor and the branch conductor 7 to and through the stationary contacts 9, movable contact at left of switch 11 and flexible conductor, to the signal operating or controlling conductor 13; thence through magnet m , contact 20, branch circuit 5 to earth; thereby causing the armature lever 15 to be drawn forward into the position shown in dotted lines so that the hooked operating pawl 17 rotates the signal indicating wheel w through one notch, thereby imparting to the triangular shaped arm 25, through the agency of the pin 26, a motion to the left, and hence through the pin 28 and arm 24 to the signal g a movement sufficient to place the green glass in front of the lamps l ; thus displaying to the incoming motorman the fact that the

section is clear for him. When the armature lever 15 was drawn through its complete phase the circuit was interrupted at the contact 20 and sufficient current was allowed to flow through the rheostat 14 to enable the electromagnet m to hold the armature lever in its forward position, in the event of the car stopping in such position that the trolley wheel 2 holds the switch 4 permanently against the contact 6, such an arrangement making it impossible to burn out the magnet m , owing to the length of flow of current therethrough in the event of the car stopping as described.

After the trolley wheel passes the switch 4 in the direction described it drops to its normal position and interrupts the circuit; consequently, the armature lever 15 of the magnet m is restored to its normal position and the circuit remains interrupted with the green

semaphore g in position indicating that the motorman may proceed. At the same time that the current was closed through the switch 4 and contact 6 a branch circuit was closed over the main line conductor 31 to station B through the signal operating or controlling conductor 12, electromagnet n , contact 20, branch circuit 5 to earth, thereby energizing said magnet and lifting the armature lever 16 into the position shown in dotted lines, so that the free end of the pawl 18 is now lifted into a position such as will cause the signal indicating wheel w to be rotated in a reverse direction to the hands of a watch, when the circuit is broken at the switch 4 where the trolley wheel entered. When this occurs the triangular shaped arm 25 is moved through the agency of the pin 26 and hence the pin 27 is caused to act upon the signal supporting arm 23 carrying the red glass signal r in such manner as to place said glass before the lamps l , giving a danger signal to a motorman coming in a reverse direction. At the same time as the triangular shaped arm 25 was rotated to the right the free end thereof came into frictional contact with the upwardly extending arm 29 of the switching arm 11, causing said switching arm to be rotated into the position shown in dotted lines, thereby reversing the switching connections for effecting the operation of the signals at the distant station, as the car passes out. The signals at both stations, therefore, remain in this position until the car passes out at station B when the trolley wheel 2 actuates the switch 4 and circuit conditions are effected at that point and at station A whereby the signals are restored to safety as follows: Circuit is closed by branch conductor 8 to the left hand stationary contact 10, the yielding contact carried by the switching arm 11 in the position shown in dotted lines, flexible conductor, signal operating or controlling conductor 13, electromagnet m , contact 20, branch circuit 5 to earth, thereby causing the armature lever 15 and pawl 17 to rotate the signal indicating wheel w in a clock-wise direction, so that the pin 28 is brought against the arm 24 of signal g and the pin 27 is withdrawn from the arm 23 supporting the red signal r , allowing said signal to fall by gravity to safety position. At the same time a branch circuit was closed over the main line conductor 30 to the distant station, through the conductor 12, magnet n , contact 20, branch circuit 5 to earth, energizing the magnet n and causing the armature lever 16 and its pawl 18 to be drawn into the position shown in dotted lines, so that when the circuit is interrupted at the switch 4 in station B this armature is released and pawl 18 rotates the signal indicating wheel w to the left and the arm 25 in reverse direction, thereby allowing the green signal g to fall by its own weight into a safety position.

Suppose now that after the car entered the section it became necessary to reverse or back it out of the same. Under this condition the trolley wheel 2 will actuate the switch 4 at station A making circuit contact between the contact 6 and branch conductor 8, stationary contact 10, yielding contact carried by the switch 11, flexible conductor to branch conductor 12, through magnet n , contact 20, branch conductor 5 to earth, energizing said magnet and raising the armature lever 16 and its pawl 18 into the position shown in dotted lines; so that when the switch 4 is released and

breaks the circuit the pawl 18 will rotate the signal indicating wheel *w* one notch to the left, thereby forcing the triangular arm 25 into its normal position and releasing the green signal *g* so that it falls by its own weight to clear position. A branch circuit is closed at the same time through the main line conductor 30 to station B, branch conductor 13, electromagnet *m*, contact 20, branch conductor 5 to earth; this causes the armature lever 15 and its pawl 17 to be lifted into the position shown in dotted lines, rotating the signal indicating wheel *w*, one step to the right and restoring the triangular shaped arm 25 to its normal position, thus causing the operating pin 27 to release the red signal *r* and allow it to fall by its own weight to safety position. As the triangular shaped arm is moved to the left the link 22 operatively connected therewith and with the pivoted arm 21 causes the upper end of the latter to be moved into the path of the downwardly extending arm 19 at the free end of the armature lever 15, so that as this armature lever is released the arm 19, acting upon the pivoted arm 21, pushes or forces the pivoted switch 11 from its position in dotted lines into its original position in full lines, thus restoring all of the circuit relations between the switches, the operative magnets and the signaling apparatus into their normal or clear positions.

It will thus be apparent that the two pivoted circuit changing switches 11 are so interrelated with the circuits and circuit connections of the signal operating or controlling apparatus at the two stations, that no matter in which direction a car may enter or leave a section, on entering it will set a green signal at the entering end and a red signal at the departing end and when withdrawing from the section in either direction it will restore these signals at each end to their normal conditions, no matter what the direction of withdrawal. It will also be apparent on tracing the circuits that after a car has once entered a section any number of cars up to and including the limit of the ratchet-teeth on the signal indicating wheel *w*, in the present instance sixteen, may enter the section, and the signals will not be disturbed, but the indicating wheels will be rotated successively each time a car enters a section, no matter in which direction it may enter; thereby giving a cumulative indication at both ends of the section of the actual number of cars therein. In like manner, after a definite number of cars has entered the section, say sixteen in the present instance, any car on leaving the section will subtract or deduct upon the indicators one notch, thus giving a direct indication of the actual number of cars left, and this is true no matter from which end of the section the car may leave. Should the two cars enter from opposite directions at identically the same time, both of the switches 4 will be placed in operative connection with their respective contacts 6, and if the circuits be traced under these conditions it will be ascertained that neither the red nor the green signal at either station will be more than momentarily affected, thus giving to the motorman entering a section a clear white signal which he must know is wrong, for as before pointed out each motorman on entering the section from either end independently has displayed a green safety signal and there is displayed at the distant end simultaneously a red danger signal. Two motormen, therefore, have indication,

say 200 ft. in advance of them, of a clear signal, which they know to be wrong, and under instructions, therefore, one of them must back out. Whichever one backs out will, if the circuits be traced, display at his own end of the section a red or danger signal and simultaneously at the other end of the section a green or safety signal, thus indicating to the motorman at that end that the other car has backed out and he may proceed. In other words, the display, say 200 ft. in advance of each motorman, after he has entered the section, of a clear white signal means that there are two cars approaching each other and that one of them must back out and that as soon as one does back out a proper advance signal, namely, a green signal, will be displayed to the other motorman and a red signal to him who thus backs out.

It will be seen that our signal system embraces a compound signal and indicator in connection with compound reversing or circuit changing switches. The object of the compound indicator is to permit of indications being simultaneously given and held at both ends of the section or block, regardless from what end of said section cars should have entered, while the circuit changing switch serves to reverse the trolley wire or third rail switch circuits at that end of the section or block which displays the red light or semaphore, so that any and all cars now within the block when passing out will cause a simultaneous deduction or subtraction to be made from the indicators held at each end of the block, regardless of which end they had entered and are now passing out. For instance, a number of passenger cars may have entered the block from one end each following the other in the same direction, while opposed to them a number of, say work cars following one another, may have intentionally entered the block at the opposite end and gone off onto a side track or siding. This condition does not alter or change the signals originally set by the first car which entered the block, although their number has been indicated at both ends, regardless of the fact that they had entered from opposite directions. By reason of the circuit changing switch, it is immaterial in which direction any of these cars may now pass out of the block or section, though in passing out they each make a simultaneous deduction or subtraction from the indications previously taken and held at both ends. When all cars are out of the block a "white" field will become visible, thus indicating a clear, unoccupied block or section.

One important feature of this two wire signal and indicating system is found in the fact that it indicates with but one visible field or semaphore the condition of the block and the direction in which cars are passing through it. With one field or semaphore in view, it is impossible to become confused or to misinterpret a signal. A "white" field before entering, will indicate a clear unoccupied block. A car when passing into a block or section will change the "white" to a "green" when entering and the "white" to a "red" at the distant end, thereby indicating to motormen of cars, before entering at that end, of the approach of a car in the block, while the "green" to the rear of it will indicate to the motorman of cars following of the occupation and departure of a car ahead. When this car has passed through the distant end of the block or has backed out,

the colored targets or semaphores will disappear and the field at both ends of the block will again be restored to their normal "white." These targets or semaphores may be rendered visible from one or through both opposite sides of their boxes or inclosures, as may be desired and to render them visible at night or in dark places during daytime, they may be illuminated either by an oil lamp or more preferably by a number of electric lamps of high voltage, each connected "in multiple" across the leads of a separate circuit with the switch to throw them in or out of circuit, as shown and described. This lighting circuit is entirely independent of the signal circuits, neither having electric connections with the other. The object in connecting the lamps "in multiple" is to insure constant illumination should one lamp or the other burn out. This two wire signal system possesses another important feature in that both its line circuits, its semaphores, and compound indicator operating mechanisms are each and all independent of the other, permitting of opposing indications being simultaneously made from both opposite ends of the block at the same time as the following instance will explain: Suppose a car proceeding through a block should pass out the very instant a car in the rear of it should enter— With this system the first car having passed into the block has set a "green" signal when entering and a "red" signal at the distant end, while its indication has been taken and is held by the signal indicator at each end of the block. Now, as the car following in the rear and entering the block would repeat, by adding to both indications, the car ahead in passing out at the same instant would deduct from both indications, but in doing so it will leave the signals unchanged because a car is still in the block. This signal system can also be operated from another or separate source of electrical energy, transmitted specially for that purpose along the line or from independent batteries at each end of the section. The voltage in this instance not being subject to fluctuations would practically be uniform throughout the entire distance and would permit of magnet coils of much higher resistance, while the contacting terminal for the signal circuits which is operated either by the trolley wheel or shoe, would be directly connected to this special cable. We have illustrated in the drawings only a single section upon which cars may accumulate and display the signals and effect the operation of the indicators in the manner hereinbefore described as applicable to a single track road, where cars may travel in either direction. Should it be deemed necessary to apply this system on the block signal system it would, of course, only be necessary to duplicate the signals at each station having a pair of switches as closely related with relation to each other as possible, so that independent sets of signals would be displayed for each adjacent section. In this way each section would be operated in the manner described and the accumulation of cars properly indicated upon the indicators and the successive signals properly set and operated as the cars advance or recede.

We do not limit our invention to the especial details of construction hereinbefore described and illustrated in the accompanying drawings, as we believe it is broadly new with us to effect a simultaneous operation of signals at the opposite ends of a section of road to be

protected and to give indication of such operation and of the number of cars at any time which are located upon the same, and to operate the signals in such manner that no matter in which direction the movement of the cars may be effected the signals when once set will not be disturbed after a series of cars have entered the section, until the last car has been removed therefrom, and this without relation to the direction of motion, it being generically new with us to effect this simultaneous mode of operation of signals and indication of the location of the rolling stock of a railway under all possible conditions of operation but especially when cars simultaneously operate the controlling switches at the opposite ends of a protected section.

We believe it is broadly new with us to effect the operation of signals at the opposite ends of a section of roadway to be protected in such manner that it is not possible, by reason of the operation of the cars themselves, to disarrange or render inoperative the signals controlled or operated by the movement of such cars, no matter in what order of entry into the section or what number of cars enter the same within limits, to be determined by the capacity of the apparatus itself, and whether by the simultaneous entry from opposite ends, or the simultaneous withdrawal therefrom, a feature of novelty and utility which, so far as we are aware, has never before existed, and we wish it understood that our claims hereinafter directed thereto are to be construed as of the most generic nature, for that no system, so far as we are aware, has heretofore been devised which is adapted to effect these results.

Having thus described our invention what we claim and desire to secure by Letters Patent of the United States is—

1. In a railway signal system a section of roadway provided with two signals at each of its opposite ends; two signal controlling magnets therefor at each end, circuits, circuit connections and switching devices, whereby when a car enters at either end it sets signals of a definite nature at both ends and when it withdraws in either direction it restores them to normal, the circuit relations through the controlling magnets being such that cars may enter at either end of the section and in any order without disturbing the signals already set by the first car which entered substantially as described.

2. In a railway signal system a section of railway provided with two signals at each of its opposite ends, electromagnetic switches and electromagnetically controlled indicators, so arranged that any number of cars may enter the section, display independent signals at both ends of the section, and give correct indication at each end thereof of the exact number of cars in the section at any time; the arrangement being such that any car may leave the section from either end and give on both indicators definite indications and leave the signals still set so long as one or more cars remain on the section.

3. A combined railway signal and indicating system, embracing signals located in pairs at the opposite ends of a section of roadway to be protected and one indicator at each end of said section; in combination with operating electromagnets, circuits, circuit connections and switches so arranged that one of the two signals is always displayed at each end when any car is on the section and the indicators at both ends give increased or additive indication of the number of cars in the section as they enter and decreased or subtractive indication thereof as they leave, no matter in which direction the movements of the same may be, substantially as described.

4. A combined system of signals and indicators for a railway, embracing two signals and one indicator at each end of a section of roadway and controlling electromag-

- nets for the signals and the indicator; in combination with a current changing switch and an operating switch at each end, and means whereby the operating switches may be actuated by a car moving in either direction, the circuit relations through the controlling magnets being such that cars may enter at either end of the section and in any order without disturbing the signals already set by the first car which entered, substantially as described.
5. A safety system of signals and indicators, embracing signals, indicators, and operating or controlling magnets for the same; together with operating switches adapted to be moved by a car in either direction, and circuit changing switches and mechanical and electrical inter-connection all arranged and acting in such manner that no car can enter or leave the protected section without giving definite indication thereof substantially as described.
6. In a safety system for railways two companion signals, an indicator common to both, and controlling electromagnets for the signals and the indicator adapted to act thereon, one by the presence of its controlling current, and the other by the absence of its controlling current; in combination with a circuit changing switch and an operating switch, the latter being adapted to be moved in opposite directions by a moving car as it passes over the route, substantially as described.
7. In a safety system for railways, means for safeguarding a section of roadway, embracing two companion signals at each end of the section and a numerical indicator common to each pair of signals; two electromagnets for controlling the signals and the indicators; a circuit changing switch for each pair of signals and an operating switch at each end of the section adapted to be moved in opposite directions by a car, substantially as described.
8. In a safety system of railways a section of roadway provided at each end with an electromagnetically controlled indicator; in combination with switches at each end adapted to be operated by a car in opposite directions; together with circuit changing switches, circuits and circuit connections whereby when each car enters the section an indication is made on each indicator and the indications are cumulative always in the same direction so long as cars continue to enter, and subtractive always in a reverse direction so long as they continue to leave the section, no matter which way they move, substantially as described.
9. In a safety system of railways a section of roadway to be protected; a normally open two-wire control circuit; in combination with an electromagnetically controlled indicator at each end of the section, the arrangement being such that all cars entering the section give cumulative indications of the fact on both indicators, always in the same direction due to the presence of an electrical current through the controlling magnets at both ends of the section, and all cars leaving give subtractive effect thereon, always in a reverse direction when said controlling magnets are demagnetized whereby positive visual indications of the number of cars on the section are always had at both ends, substantially as described.
10. In a railway system a section of railway having an indicator at each end of the section; a normally open two wire control circuit; in combination with switches, circuits, circuit connections and electromagnetic controlling means for the indicators, all so interconnected and arranged that the entrance of all cars into the section effect a cumulative indication on both indicators, always in the same direction due to the presence of an electrical current through the controlling magnets at both ends of the section, and the departure of all cars produce a subtractive effect thereon, always in a reverse direction when said controlling magnets are demagnetized whereby positive visual knowledge is had at all times on both indicators of the number of cars on the section, substantially as described.
11. In a railway signal system a two wire control circuit extending over a part of the route; a source or sources of electrical energy for said circuits; a pair of signals and a switch at each end thereof, and circuit connections whereby cars on entering in either direction electrically effect the display of signals of a definite nature at each end dependent on the entrance of the first car and no matter in which direction, the signals at each end being restored to normal conditions by the application of an independent force which is established through the agency of a second electrical current on the departure of the car from the section and after such current has been interrupted, substantially as described.
12. In a railway signal system a two wire control circuit and signals and switches at each end of a section; in combination with a source of electrical energy and switches controlled by the movement of a car for varying the circuit relations of the two wire circuits in such manner that the first car to enter the section will establish a display of signals at both ends thereof which indicates its direction of movement and which will not be varied by successive cars within limits; and the first car to leave, no matter in which direction, will effect the restoration of the signals to normal by the application of an independent force which is established through the agency of a second electrical current on the departure of the car from the section and after such current has been interrupted, substantially as described.
13. A railway signal system having two signals at each end of each section; two main line control circuits and a circuit changing switch for each pair of signals; in combination with a source of electrical energy; together with a circuit controlling switch at each end of the section adapted to be actuated by a passing car, the arrangement being such that no matter in which direction cars may enter or withdraw from either or both ends of the section the signals will be properly displayed, substantially as described.
14. In a signal system for railways two signal control circuits; two signals at each end of a section to be protected; two control magnets and one controlling switch for each pair of signals; in combination with circuits, local circuit connections, and operating switches, one at each end of the section, adapted to be operated by a passing car and all so arranged that signals of different character are simultaneously displayed at the opposite ends of the section when a car enters from either end, and restored to normal when it leaves from either end, substantially as described.
15. In a railway signal system a two wire control circuit; a signal embracing a lamp located between two transparent signal disks of different color; in combination with two control magnets each adapted to place one of the disks before the lamp from opposite sides; one magnet acting positively on closure of its circuit and the other reversely on breaking its circuit, substantially as described.
16. A railway signal system embracing main signal control circuits and pairs of signals at the ends of each section to be protected; operating switches at each end adapted to be moved in opposite directions by a passing car; two control magnets for each pair of signals; electromagnetic switches and mechanical and electrical connections whereby when both operating switches are simultaneously actuated the signals are not moved from normal position, substantially as described.
17. In a railway signal system two signals at each end of a section of roadway to be protected; a normally open two-wire control circuit; a source of electrical energy; electromagnetic means of control, and circuits and circuit connections whereby, when two cars enter the section simultaneously from opposite ends thereof, signals are displayed at each end, due to current flow through both of the control circuits, and subsequently said signals are restored to normal by reason of the discontinuance of the current flow in the opposite direction through the said circuits.
18. In a railway system a signal at the entering end of a section of roadway to be protected; electrical circuits and circuit connections and means controlled by a car on entering the section for effecting the display of the signal; together with means at the distant end of said section controlled by the car on leaving the section for effecting the restoration of the signal to normal; the arrangement being such that said signal is displayed through the action of electrical energy on entering the section and restored

to normal by the application of an independent force electrically put into play, no matter in which way the car may leave the section after it has once caused the display of the signal, substantially as described.

- 5 19. In a railway system a signal at each end of a section of railway to be protected; electrical circuits and circuit connections, and means controlled by a car on entering the section for effecting the display of both signals, the one by a locally applied electrical current and
10 the other by a current transmitted over the section, the arrangement being such that when a car leaves the section, no matter in which direction the signals are both restored to normal condition by independent forces brought into play, one by a locally applied electrical current and the
15 other by a current transmitted over the section, substantially as described.

- 20 20. In a railway system a signal at each end of a section of railway to be protected; two electromotive devices for each signal and means controlled by a car on entering the section for effecting the display of both signals, the one by a locally applied electrical current and the other by a current transmitted over the section, the arrangement being such that when the car leaves the section no matter in which direction the signals are restored
25 to normal by independent forces brought into play, one by

a locally applied electrical current and the other by a current transmitted over the section, substantially as described.

21. In a railway system two signals at or near each end of a section of roadway to be protected; two electromotive devices for each pair of such signals, and means controlled by a car on entering the section in either direction for effecting the display of one signal of each pair, the first by a locally transmitted electrical current and the other by an electrical current transmitted over the space
30 between the pairs of signals, the arrangement being such that when a car passes directly through the protected section or backs out after having entered the same all signals are displayed by the direct current effects upon the electromotive devices, both local and distant, and restored to normal by independent forces brought into play by both local
35 and distant current effects, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WESLEY T. OVIATT.
EDWARD F. LATIMER.
WILLIAM GRUNOW, JR.

Witnesses:

WM. C. BENEDICT,
J. T. NOBLE.