No. 744,599. PATENTED NOV. 17, 1903.

J. A. NORTON.

RAILWAY SIGNALING APPARATUS.

APPLICATION FILED MAY 13, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

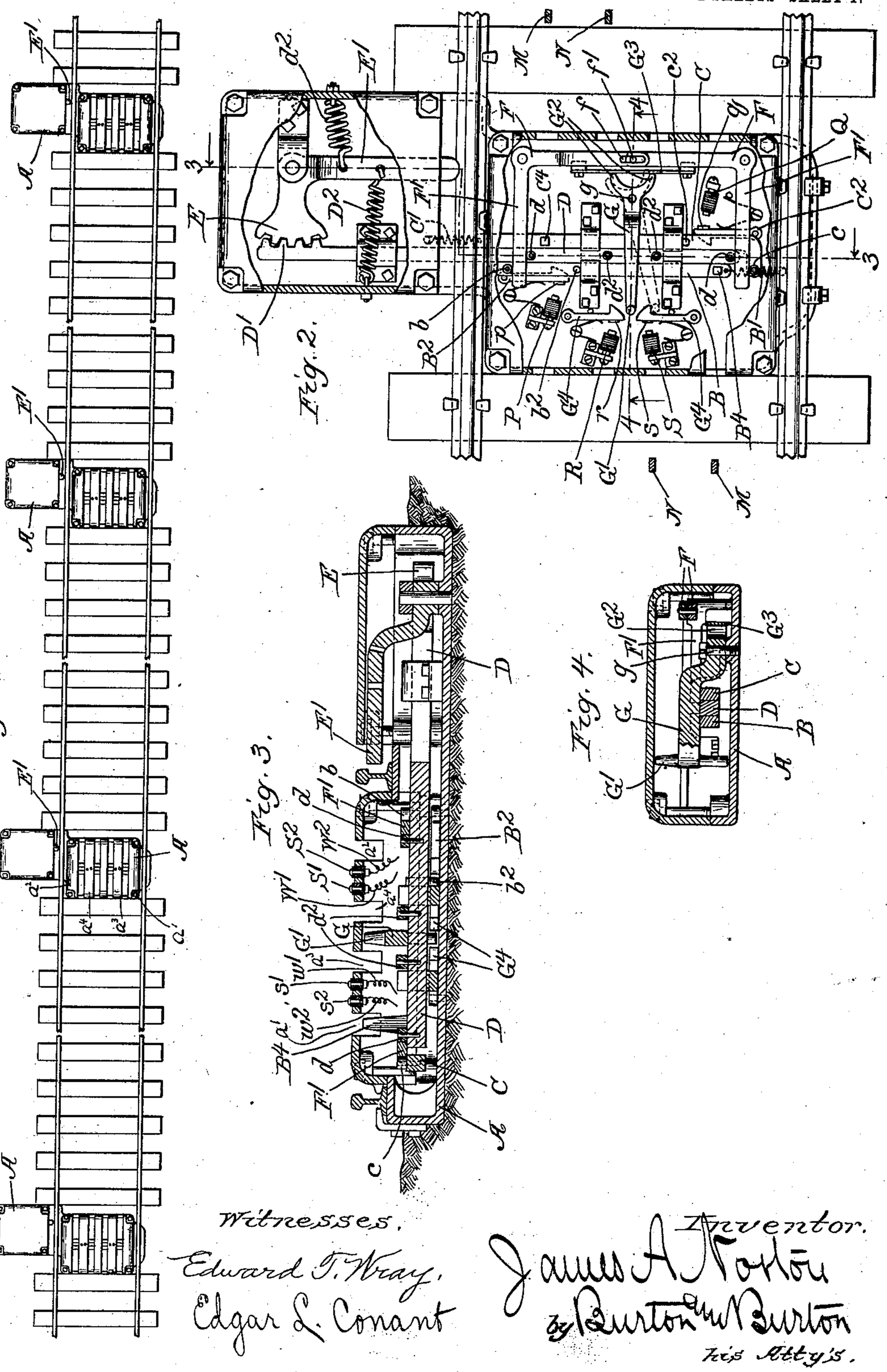

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Witnesses.

Edward T. Wray.

Edgar L. Conant

Inventor.

James A. Norton

by Burton & Burton

his Atty's.

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NO MODEL. 2 SHEETS—SHEET 2.

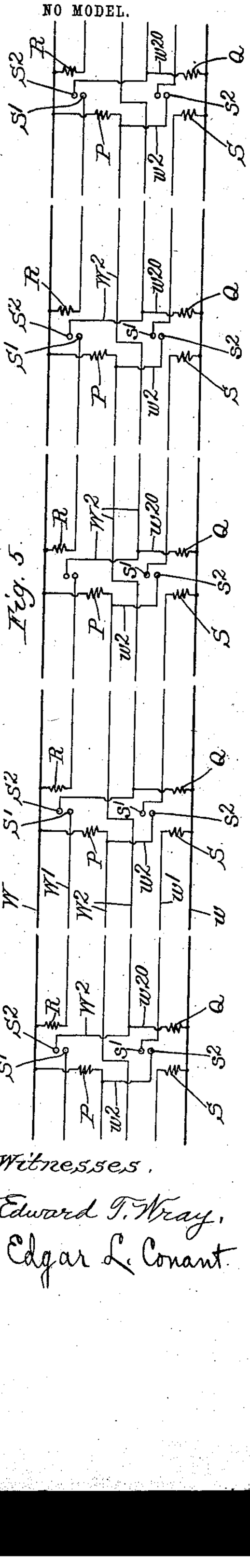

Fig. 5.

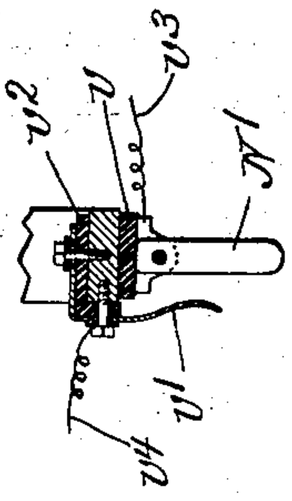

Fig. 9.

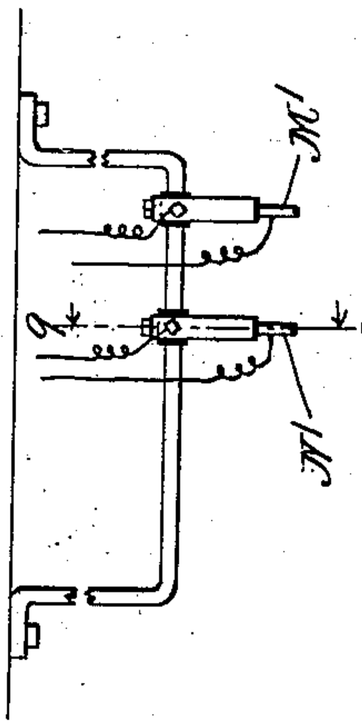

Fig. 8.

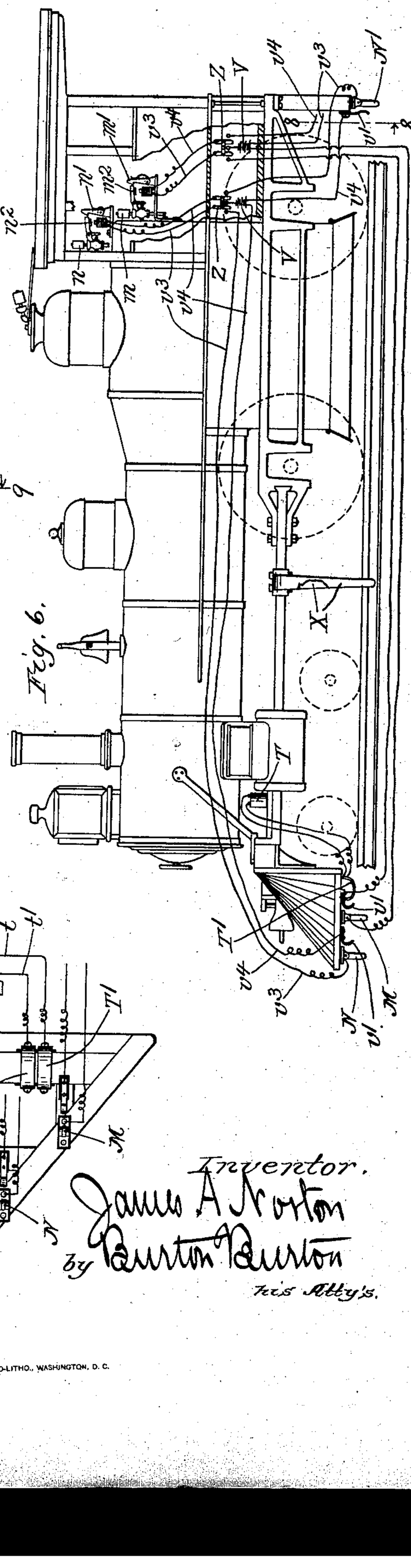

Fig. 6.

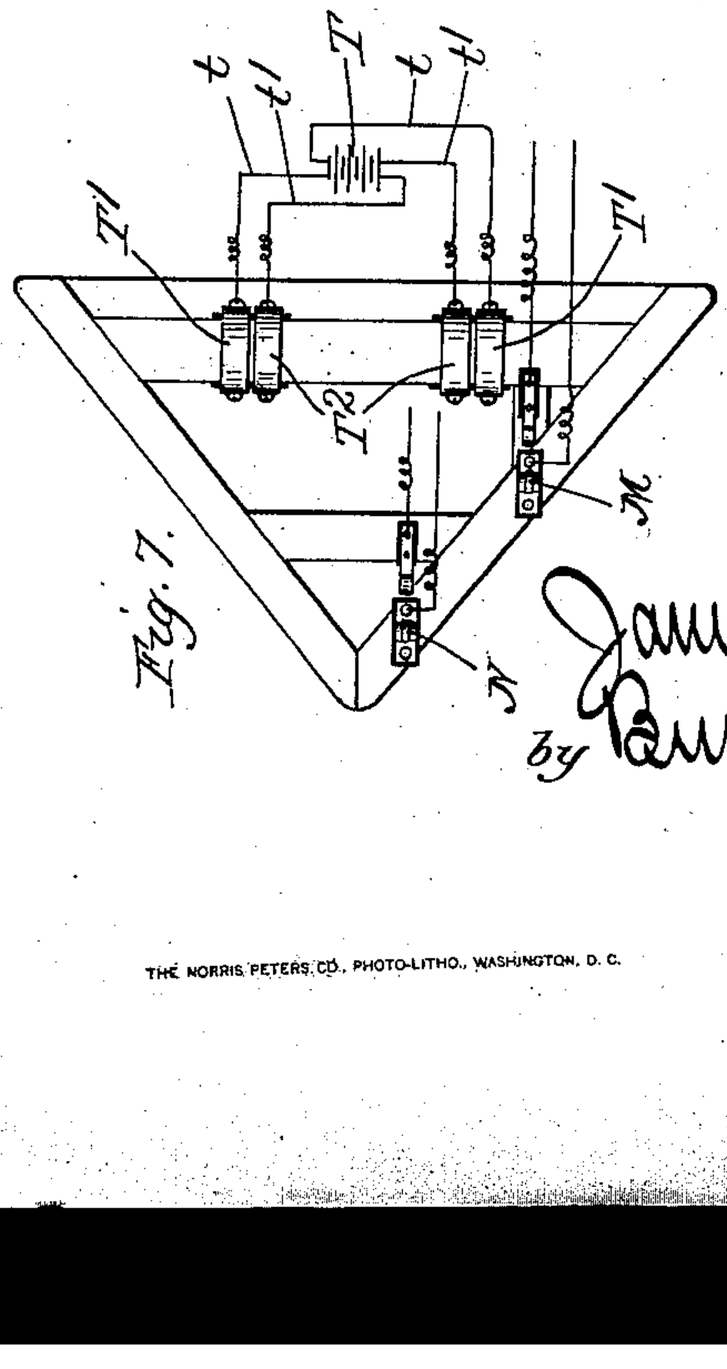

Fig. 7.

Witnesses.

Edward T. Wray.

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No. 744,599. Patented November 17, 1903.

UNITED STATES PATENT OFFICE.

JAMES A. NORTON, OF ODEBOLT, IOWA, ASSIGNOR OF ONE-HALF TO PATRICK T. FLINN, OF DENISON, IOWA.

RAILWAY SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 744,599, dated November 17, 1903.

Application filed May 13, 1901. Serial No. 59,927. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. NORTON, a citizen of the United States, residing at Odebolt, in the county of Sac and State of Iowa, have invented certain new and useful Improvements in Railway Signaling Apparatus, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide apparatus to be located along the track of a railway by which trains may automatically cause trains which may be following them and trains which may be approaching in the opposite direction to receive warning of the proximity of the train setting the signal, such warnings to be given by devices located on the locomotive of the train receiving the signal and preferably to include audible signals by sounding devices, whether or not visible signals are also operated by the same devices for the purpose of giving like warning.

The invention consists in the mechanism particularly defined in the claims for mechanically operating the signal-setting and signaling devices as the trains arrive at and pass the signal-stations successively and for electrically operating the controlling-signal devices one or more sections in advance and in the rear of the train and in the combination of these mechanically-operated and electrically-operated devices for the purposes indicated.

It consists also in the combination, with the electric circuits extending along the track and comprising the signal-controlling electro magnets or motors, of batteries or other generators carried by the train and introduced into the track-circuits to energize the motors by the train passing the stations successively.

In the drawings, Figure 1 is a diagrammatic plan of a portion of a railroad-track, showing the situation with respect thereto of the signaling device of my invention. Fig. 2 is a detail plan of the mechanism at any one signal-station, a portion of the casing being broken away to disclose the mechanism within. Fig. 3 is a section at the line 3 3 on Fig. 2 transversely with respect to the track. Fig. 4 is a section at the line 4 4 on Fig. 2. Fig. 5 is a diagram of the electric circuits employed in operating my devices. Fig. 6 is a diagrammatic view in the nature of an elevation of a portion of a locomotive, showing the position thereon of the audible signaling devices and the means by which they are operated from the signaling-stations pertaining to the track. Fig. 7 is a detail bottom plan of the pilot of the locomotive, showing diagrammatically the electric wiring of the contact-shoes thereon. Fig. 8 is a section at the line 8 8 on Fig. 6. Fig. 9 is a section at the line 9 9 on Fig. 8.

On the locomotive there are provided two audible signaling devices, one to indicate the proximity of a preceding train moving in the same direction and the other to indicate the proximity of a train approaching in the opposite direction. One of these may be the usual steam-whistle. The other may be an additional whistle of different pitch, or any two differently-sounding devices may be employed. In the drawings I have shown two whistles, one of which may be taken as the ordinary whistle of the locomotive. These two sounding devices are operated by connections which terminate in trip-fingers projecting over the track at different positions in respect to the width of the latter, so that they may be encountered and operated by differently-situated tripping devices projecting in their paths, respectively, as the locomotive travels. Along the track at substantially uniform intervals—as, for example, half a mile—there are located signaling-stations, at each of which there are three tripping devices, each adapted to be moved transversely with respect to the track, so as to bring them independently into or out of range of the tripping-fingers of the sounding devices on the locomotive. One of these tripping devices in the track is arranged to stand normally entirely out of range of the trip-fingers on the locomotives, but so that it may be set and secured in either of two positions, to encounter in one position the trip-finger of the sounding device indicating a precedent train or a locomotive going in one direction and in the other direction the corresponding trip-finger of a locomotive going in the other direction. This trip is designed to be set mechanically in one of said positions by loco-

motives passing it in one direction and in the other by a locomotive passing in the other direction, and when set is intended to signal any locomotive which follows so long as it remains thus set. This trip is released from the device which retains it in the position in which it is thus mechanically set by means of an electromagnet withdrawing the retaining-dog, such magnet being energized through a circuit which extends to the next signal-station in advance in the direction in which the locomotive which set it is moving, the locomotive itself carrying the generator which supplies the current and completing the circuit for the purpose of operating the releasing-magnet when it passes such next succeeding station. A second one of the three tripping devices at each station is arranged to stand in position to encounter the trip-finger of the second sounding device on a locomotive going in one direction until forcibly withdrawn from that position and to return thereto when released from detention, and the third of said tripping devices is arranged to stand in position to encounter the trip-finger of the second sounding device of a locomotive going in the other direction until forcibly withdrawn from that position and to return thereto when released from detention, and connections are provided at each station for moving the second and third tripping devices mechanically out of operating position and for locking them thus out of position, the locking devices being arranged so as to be disengaged by the action of an electromagnet energized in a circuit which is completed by the locomotive passing the second (or more remote) preceding station. Being thus released, these tripping devices at the second (or more remote) station in advance of the locomotive which causes their release will come into operative position and will give the warning-signal on a locomotive approaching from the opposite direction. The locomotives each have projections which as they pass the station operate the mechanism thereat mechanically, setting them in the positions from which they are released by the electrically-controlled device operated by the current furnished by the locomotive passing a station more or less remote.

I will now describe the devices in detail. At each station there is a case A, which extends transversely across the track under the rails. In this case there are mounted and adapted to slide crosswise of the track two bars B and C, and adjacent to them, preferably between them, a third bar D, which extends beyond the track at one side and is provided with a rack D′, which is engaged by a segment E, from which a lever-arm E′ extends in right angles to the track in the normal position of the lever, terminating very near the outer side of the rail in position to be encountered by a rigid arm X, which may project from the pilot or any other convenient part of the locomotive, each locomotive having such a projection at each side, so that whichever way it is traveling one or the other of such projections will be in position to encounter the lever-arms E′, which are preferably located all upon the same side of the track. Springs D^2 d^2 are provided, operating upon the arm E′ of the segment E, tending to hold said parts in the normal position referred to (shown in full line in Fig. 2) and resisting the movement of said parts in either direction from that position. These springs should preferably be such as to offer very strong resistance to the movement of the parts from their normal position, because it is important that the apparatus should be not easily tampered with by unauthorized persons and the resistance of the springs may be such as to require the force of a locomotive encountering the arm E′ to overcome it and operate the devices. In the case A are fulcrumed two bell-crank levers F F, having each an arm F′ extending across the bars B, C, and D, their other arms being interlocked, one of the bars being slotted at *f* and the other provided with a pin *f*′, working in the slot to effect the connection at this point. The bar D has two abutments *d d*, each being preferably a stud and roll standing just inside the arms F′ F′ at the normal or intermediate position of the latter, (shown in Fig. 2,) and the bars B and C have abutments *b* and *c*, respectively, just outside the arms F′ F′ of the bell-crank levers, respectively. It will be seen that from this construction when the bar D is moved in either direction it causes the arms F′ F′ to separate and the bars B and C to be thrust in opposite directions outward. Springs B′ C′ are provided, connected with the bars B and C, respectively, tending to hold them inward—that is, in the direction opposite to that in which they are thrust by the action of the bell-crank levers F F when the bar D is thrust in either direction.

B^2 C^2 are spring-controlled dogs pivoted on the bottom of the case A underneath the bars B and C, respectively, and in position to become engaged back of the abutments b^2 and c^2, projecting downward from the bars B and C, respectively, when the bars are thrust in the direction opposed by their springs B′ C′, respectively, and thus to lock the said bars at the positions to which they are thus thrust in opposition to their springs.

G is a bar pivoted to the case at *g* and extending across the bars B, C, and D and having an upturned finger G′ at the end remote from its pivot. The pivoted end is expanded laterally in two toes G^2 G^2, which bear against a flat spring G^3, which is supported at its ends and adapted to be flexed in the middle by the rocking of the bar, causing one toe or the other to crowd the spring back at the middle point. The spring thus operates to hold the bar normally projecting directly across the

bars B, C, and D, as shown in Fig. 2, and to return it to that position whenever it is forcibly deflected in either direction.

d^2 d^2 are abutments projecting up from the bar D at opposite sides of the bar G and at equal distances therefrom at the normal position of the parts shown in Fig. 2.

G^4 G^4 are spring-actuated dogs located at opposite sides from the normal position of the bar G and adapted to become engaged with the latter whenever it is deflected to one side or the other by the thrust of the bar D.

In Fig. 2 adjacent to the representation of the devices described I have shown as in horizontal section the trip-fingers M and N projecting from the two locomotives, one approaching from each direction for operating the sounding devices on the locomotives, respectively. From the bars B and C, respectively, projecting upward there are trippers B^4 and C^4, which stand the former in the path of the trip-finger M of the locomotive headed and moving in one direction and the latter in the path of the same trip-finger M of the locomotive headed and moving in the opposite direction when the bars B and C occupy the positions shown in Fig. 2, but which are out of said paths, respectively, when the bars B and C are thrust outward by the action of the bar D through the bell-crank levers F F and locked by the dogs B^2 C^2, respectively, as described. The case A has slots a' a^2 for the trip-fingers M of locomotives moving in the two directions, respectively, and slots a^3 and a^4 for the trip-fingers N of such locomotives, respectively. The finger G′ of the lever G at the normal position of said lever (shown in full line) is midway in the track and in the breadth of the locomotive; but when a locomotive moving in one direction causes the bar D to be thrust to deflect the lever G to the position to which it is locked by one of the dogs G^4 the finger G′ stands in the path of the trip-finger N on the locomotive next following in the same direction, and when deflected in the opposite direction and locked by the opposite dog G^4 by the encounter with the lever E′ of an engine traveling in the opposite direction the finger G′ stands in the path of the projection N of a locomotive next following in such opposite direction. The trip-finger M operates the signal-whistle m, which gives warning of an approaching train ahead, and the trip-finger N operates the signal-whistle n, which gives warning of a preceding train ahead, which is still in the section. Thus the locomotive will receive one sort of signal when it enters a section in which there is still a train which has preceded it and will receive a different signal if a train approaching it on the same track has passed the second station in advance. The means by which the fingers operate their respective whistles may be widely varied. I have shown electric connections merely for convenience of illustration, and they are hereinafter described in detail. The necessity for arranging so that trains approaching from opposite directions shall signal from two stations distant arises from the possibility that they might arrive simultaneously at consecutive stations, and thus each would fail to set the signal for the other in time for it to be received.

The means by which the fingers M and N operate their respective whistles may be readily understood from the diagram of electric circuits on Fig. 6. The finger (N or M) is pendent and free to swing in either direction, but is insulated and checked as to swinging by the rubber backing v. (See Fig. 9.) When it encounters the trip-finger at the station, it is swung into contact with the spring v', which is also secured with insulation v^2 and closes a circuit by the way of wires v^3 v^4, connected to the pendent finger and contact-spring, respectively, such circuits containing the batteries V or V′ and the appropriate whistle m or n. When the engine is reversed and backing, the fingers M and N come into contact with the trips and swing away from their contact-springs, respectively, and no signal is received. In order that a locomotive running backward over sufficient distance to require signals may receive them, if desired, I provide at the rear of the locomotive duplicates of the trip-fingers M and N, which are lettered M′ and N′, respectively, and which are similarly in circuit with the appropriate whistles. One battery energizes the circuits controlled by both the fingers M and M′, and one battery also energizes the circuits controlled by both the fingers N and N′, double switches Z Z, diagrammatically shown in Fig. 6 and requiring no specific description, being employed to throw the rear or front fingers into circuit with the batteries, respectively, as desired, according to whether the locomotive is moving backward or forward. Since a mere momentary signal might fail to attract the engineer's attention or leave him in uncertainty as to which signal had been sounded, it is desirable that the momentary closing of the circuits which operate the whistles should operate to open the whistles and leave them open and sounding until they are closed by the engineer. For this purpose I have shown the whistles provided with dogs m' n', adapted to lock the whistle-levers open when they are pulled open by the electromagnets, respectively, attracting the armatures m^2 and n^2 on the whistle-levers.

For the purpose of operating the dogs B^2 and C^2 to release the bars B and C, respectively, and permit them to come into position for operating the locomotive sounding devices and for the purpose of releasing the dogs G^4 G^4 and permitting the bar G to move out of position for operating the locomotive sounding device for which it is provided, I provide electromagnets P Q R S, whose armatures p q r s, respectively, are connected to the dogs B^2 C^2 G^4 G^4, respectively, and when the magnets, respectively, are energized withdraw the dogs from their respective en-

gagement and release the bars which were detained by them. The electric circuits which energize these electromagnets comprise a battery or other generator mounted on the locomotive having contact-pieces connected with its two poles carried by a shoe on which said contact-pieces are insulated, which as the locomotive travels past the signal-station come into contact with corresponding contact-pieces in the circuits, respectively, about to be described, and complete said circuit through the battery, causing said magnets in the respective circuits to be energized. T represents the battery on the locomotive, from whose poles wires $t\,t'$ extend to the contact-shoes T′ T², mounted on the pilot and insulated from each other in position to make contact with the contact-pieces S′ S² or s' s^2 in the circuits, which will now be described.

W w are continuous conducting-wires extending the whole length of the track. Considering any station, which will be referred to as a "specimen" station, and describing first with reference to a train headed and moving in a given direction, which may be called "north," it will be noticed that from the contact-piece S′ a wire W′ extends to the coil of the electromagnet R, which controls one of the dogs G^4 at the preceding station, and from the other end of said coil connection is made to the continuous wire W. From the other contact-piece S² a wire W² extends to the coil of the magnet P, which controls the dog B² of the second station in advance—that is, north—and from the other end of the coil of said magnet P connection is made back to the continuous wire W. Whenever the shoes T′ T′ of a locomotive strike the contact-pieces S′ S², and thereby introduce the battery carried on the locomotive into the circuit, the magnet R at said preceding station and the magnet P at the second station in advance are energized, with the result that the dog G^4 at said preceding station is operated by the magnet R and the bar G is released and returns to inoperative position, thus permitting a following train to enter a section which the first train is just leaving, and at the same time the dog B² at the second station in advance is operated by the magnet P, releasing the bar B at that station and permitting it to return to operative position and to give a signal to any train moving south entering the second section in advance of the specimen station. Now considering the circuits with respect to the action of a train headed and moving southward from the contact-piece s' at the specimen station the wire w' extends to the coil of the electromagnet S of the next preceding station, (north,) from the other end of which coil connection is made to the continuous wire w, and from the other contact-piece s^2 of the specimen station the wire w^2 is spliced onto the wire W^2 at the same station, which thus serves as a connection forward to the second station in advance, (south,) where a splice w^{20} extends from said wire W^2 to the coil of the magnet Q of said second station in advance, from which coil connection is made also to the continuous wire w. From this connection there arises when the shoes T′ T² of a locomotive headed and moving south strike the contact-pieces s' and s^2 a similar result as that before described, the signal for a following train being moved out of operative position at the next preceding station and a signal for an approaching train being moved into operative position at the second station in advance. It will be seen that there are practically six wires over the entire length of the track, two of them continuous and the other four interrupted, two at each station.

It will be noticed that the signal-receiving means, the fingers M and N or M′ and N′, are located in advance in the direction of movement of the locomotive of the position of the operating-arm X, which displaces the signal-carrying devices at the station. This is necessary in order that signals which have been set for the train to come into the station may be received by that train before its own action might disturb them.

I claim—

1. A railway signal mechanism comprising two distinguishable signaling devices on each train; two signal-operating devices at each signal-station along the track, each adapted to be set at two positions, said two operating devices corresponding respectively to and adapted at one of said positions to operate the distinguishable signaling devices; means carried by the train for setting the signal-operating devices at the signal-stations respectively at one of their said two positions as the train passes; electrically-operated devices for changing the setting of said signal-operating devices to the other position; electric circuits for operating said changing devices, extending from said devices which pertain to one of the signal-operating devices at each station to a preceding station and from said changing devices which pertain to the other signaling devices at the same station to the succeeding station; an electric generator carried by each train; contact-pieces connected with the poles of such generator, said track-circuits comprising and extending from terminal contact-pieces at said preceding and succeeding stations respectively, said station contact-pieces being in position to be encountered by the terminal contact-pieces carried by the train to close said circuits respectively as the train passes the respective stations.

2. A railway signaling mechanism comprising two distinguishable signaling devices on each train; two signal-operating devices at each signal-station on the track, corresponding to and adapted to operate the distinguishable signaling devices on the train, adapted to be set at two positions; means on the train for setting the signaling devices at the signal-

stations respectively, at one of said two positions, as the train passes; electrically-operated means for changing the setting of the signal-operating devices to the other position; electric circuits for operating such changing means, extending from said means pertaining to one signal-operating device at each station to and comprising separated contact-pieces at a preceding station, and from said means pertaining to the other signaling device at the same station to and comprising separated terminal contact-pieces at a succeeding station, whereby said circuits are rendered open at said preceding and succeeding stations respectively; an electric generator carried by each train, and contact-pieces connected with the poles respectively of such generator carried in position to make contact with said terminals of said open circuits and close such circuits to introduce the generator thereinto and operate the means for changing the setting of the signal-operating devices at the preceding and succeeding stations as the train passes the intermediate station.

3. In a railway signaling mechanism, two distinguishable signaling devices on the train; two signal-operating devices at each station along the track adapted to be set respectively in position to operate the distinguishable signaling devices of the train, one of said signal-operating devices being normally in signal-operating position, and the other normally out of signal-operating position; means on the train for setting said devices out of normal position as the train passes the stations; means for automatically locking them out of their normal positions respectively, and automatic means tending to return them to normal position; electrically-operated means for releasing the locking devices to permit return to normal position; electric circuits for operating said releasing means, extending one from the devices which are normally in signal-operating position to the preceding station, and the other from the devices which are normally out of signal-operating position to the succeeding station; and means on the train for closing the circuits at the stations respectively as the train passes them.

4. In a railway signaling mechanism, two distinguishable signaling devices on the train; two signal-operating devices at each station along the track, adapted to be set respectively in position to operate the distinguishable signaling devices of the train, one of said signal-operating devices being normally in signal-operating position, and the other normally out of signal-operating position; means on the train for setting said devices out of normal position as the train passes the station; means for automatically locking them out of their normal positions respectively; and automatic means tending to return them to normal position; electrically-operated means for releasing the locking devices to permit return to their normal position; electric circuits for operating said releasing means, extending one from the devices which are normally in signal-operating position to the preceding station, and the other from the devices which are normally out of signal-operating position to succeeding stations, such circuits being open at said preceding and succeeding stations respectively; an electric generator on the train, and contact-pieces connected with the poles respectively of such generator, carried in position to make contact with the terminals of said open circuits to close the same and introduce the generator thereinto as the train passes such preceding and succeeding stations respectively.

5. In a railway signaling device, in combination with an electric generator carried by the train and contact-pieces connected with its poles respectively overhanging the track; signal-operating devices at signal-stations along the track, and electric circuits for operating the same extending therefrom to preceding and succeeding stations; signaling devices on the train adapted to be operated by the operating devices at the stations; the electric circuits extending between the stations having contact-pieces adapted to be reached by those carried by the train; whereby the battery on the train energizes said circuits and controls the signal-operating devices at the stations.

6. In a railway signaling system, distinguishable signaling devices on the train and trip-fingers for operating the same overhanging the track; mechanism at signal-stations along the track comprising trippers adapted to be adjusted into and out of the path of the trip-fingers respectively; mechanically-operated means for adjusting the trip-fingers in one of said positions, and an operating-arm projecting from the train to engage and operate said mechanical means as the train passes; electrically-operated means for adjusting said fingers in the other of said positions; circuits controlling such electrical means, extending from the stations respectively to other stations; and means carried by the train for closing the circuits at such other stations as the train passes.

7. In a railway signaling system, an electric generator carried by the train, and contact-pieces connected with its poles respectively overhanging the track; distinguishable signaling devices on the train, and trip-fingers for operating the same overhanging the track; mechanism at the signal-stations along the track, comprising trippers adapted to be adjusted into and out of the path of the trip-fingers respectively; mechanically-operated means for adjusting the trip-fingers in one of said positions, and an operating-arm projecting from the train to engage and operate said mechanical means as the train passes; electrically-operated means for adjusting them in the other of said positions; circuits controlling such electrical means extending from the stations respectively to other stations; and contact-pieces in said circuits at such

other stations in position to be reached by the contact-pieces carried by the train as the latter passes the stations.

8. In a railway signaling system, signaling-stations along the track comprising at each station two signal-operating devices adapted to be adjusted to operative and inoperative position, said devices being provided with springs tending to hold one of them in operative position and the other in inoperative position; operating mechanism connected with said devices for adjusting them in opposition to their springs respectively, and automatic locking devices for detaining them when thus adjusted; an arm carried by the train for actuating said operating mechanism as the train passes; electrically-operated means for releasing the locking devices to permit return to normal position; electric circuits controlling said releasing means, extending from the stations respectively to, and open at other stations; an electric generator on the train and terminals from its poles respectively arranged to make contact with terminals in said circuits in the track to close the same and introduce the generator thereinto as the train passes.

9. In a railway signaling system, in combination with signaling devices on the train, mechanical devices at the signaling-stations for tripping said signaling devices on the train, comprising the bars B, C and D and the levers F, F, connected together and extending by the bar D; abutments on said bar D arranged to encounter one of said levers when the bar is thrust in one direction and the other when it is thrust in the opposite direction; and abutments by means of which the levers respectively engage and actuate the bars B and C, whereby the thrusting movement of the bar D in either direction spreads the levers F and thrusts the bars B and C each always in the same direction; springs operating on the bars B and C to resist such thrust, and dogs which detain the bars in opposition to the resistance of the springs; means for operating the bar D by the train as it passes the station, and electrical means for releasing the dogs, comprising circuits extending to other stations; and mean on the train for closing the circuits at such other stations.

10. In a railway signaling system, signaling-stations comprising signaling devices on the train and trip-fingers for operating the same overhanging the track; a case at each station extending under the track, and devices therein for tripping the trip-fingers, the case being slotted in the path of the trip-fingers to permit them to reach the tripping devices, the latter being adjustable to operative and inoperative positions; mechanical means for adjusting them to one of said positions only, comprising a bar extending outside the case and an arm carried by the train, adapted to encounter the bar to operate it as the train passes, and yielding means resisting the adjustment of the tripping devices; whereby the means resisting the movement of the bar may be sufficient to require the power of a train to move it, and the resistance to the movement of the tripping devices may be slight.

In testimony whereof I have hereunto set my hand at Denison, Iowa, in the presence of two witnesses, this 30th day of April, A. D. 1901.

JAMES A. NORTON.

In presence of—
W. M. McLENNAN,
J. T. CAREY.