E. C. SMITH.

AUTOMATIC RAILROAD GATE.

APPLICATION FILED MAY 28, 1906.

903,905. Patented Nov. 17, 1908.

4 SHEETS—SHEET 1.

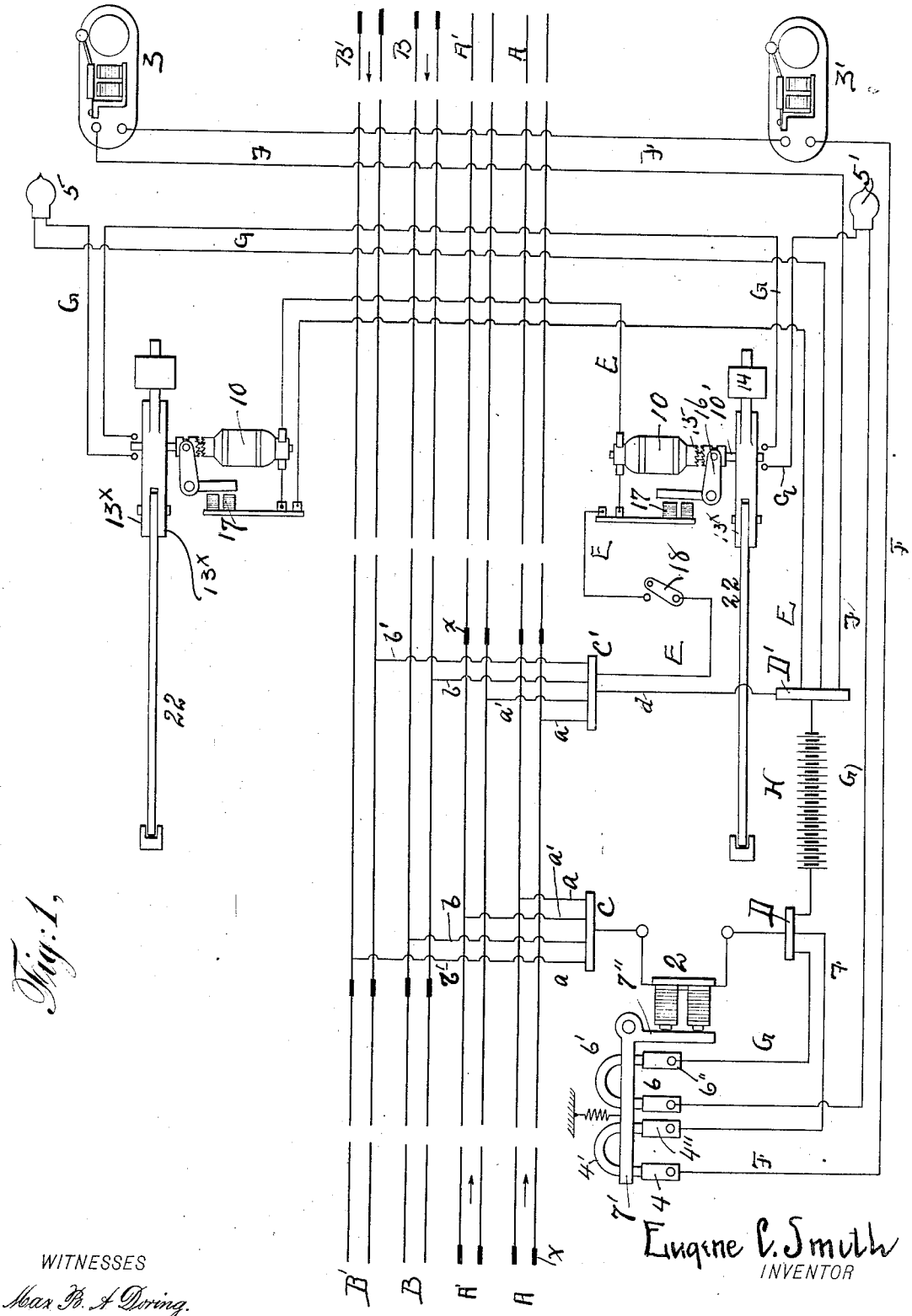


Fig. 1.

WITNESSES

Max B. A. Doring.

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4 SHEETS—SHEET 2.

Fig. 2.

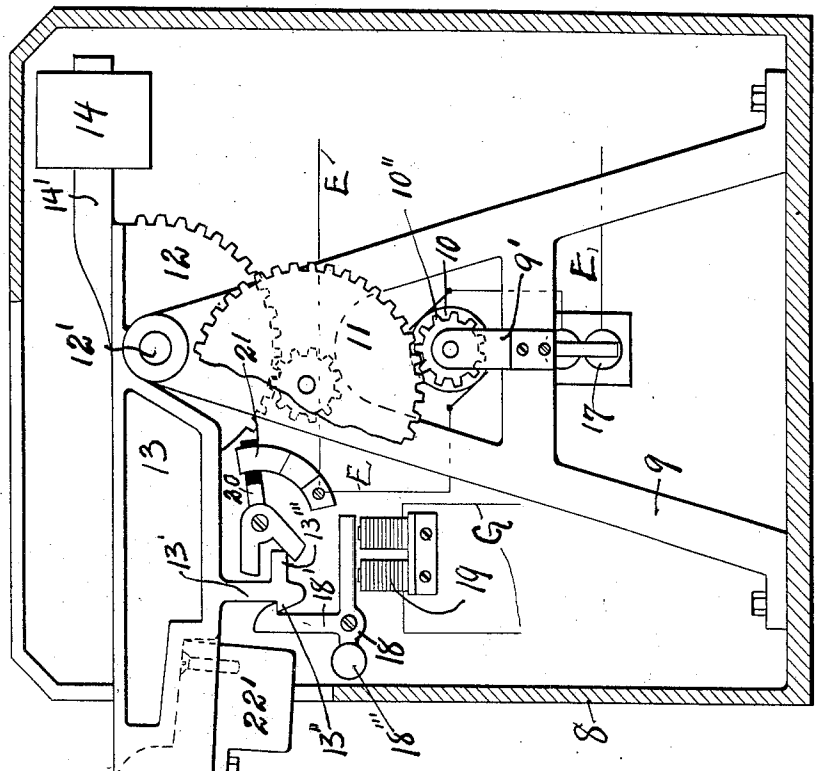
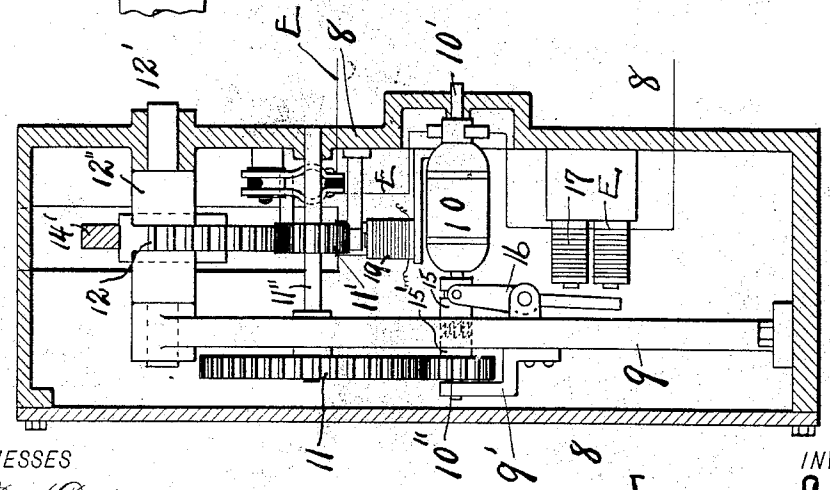


Fig. 3.



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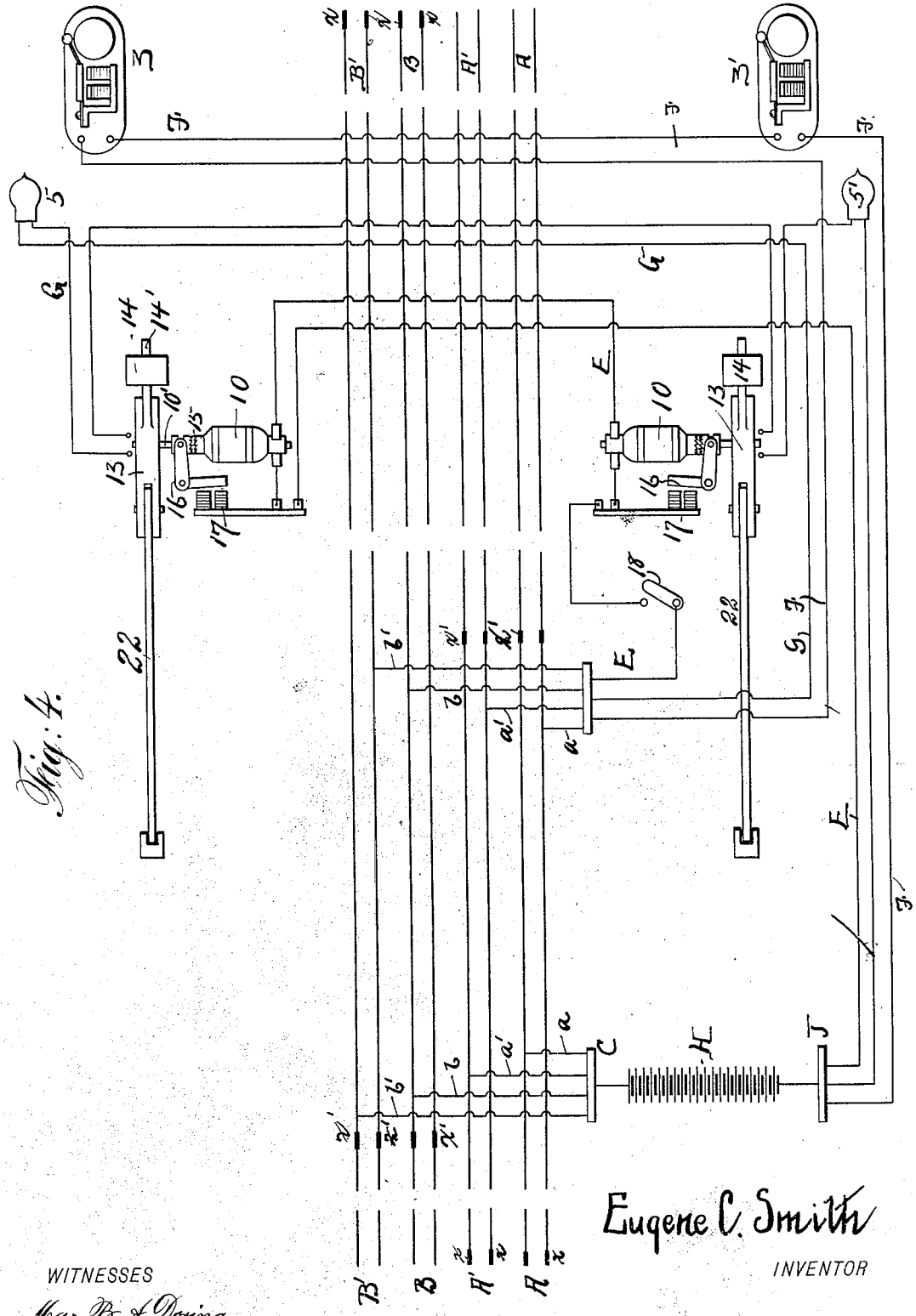


Fig. 4.

WITNESSES

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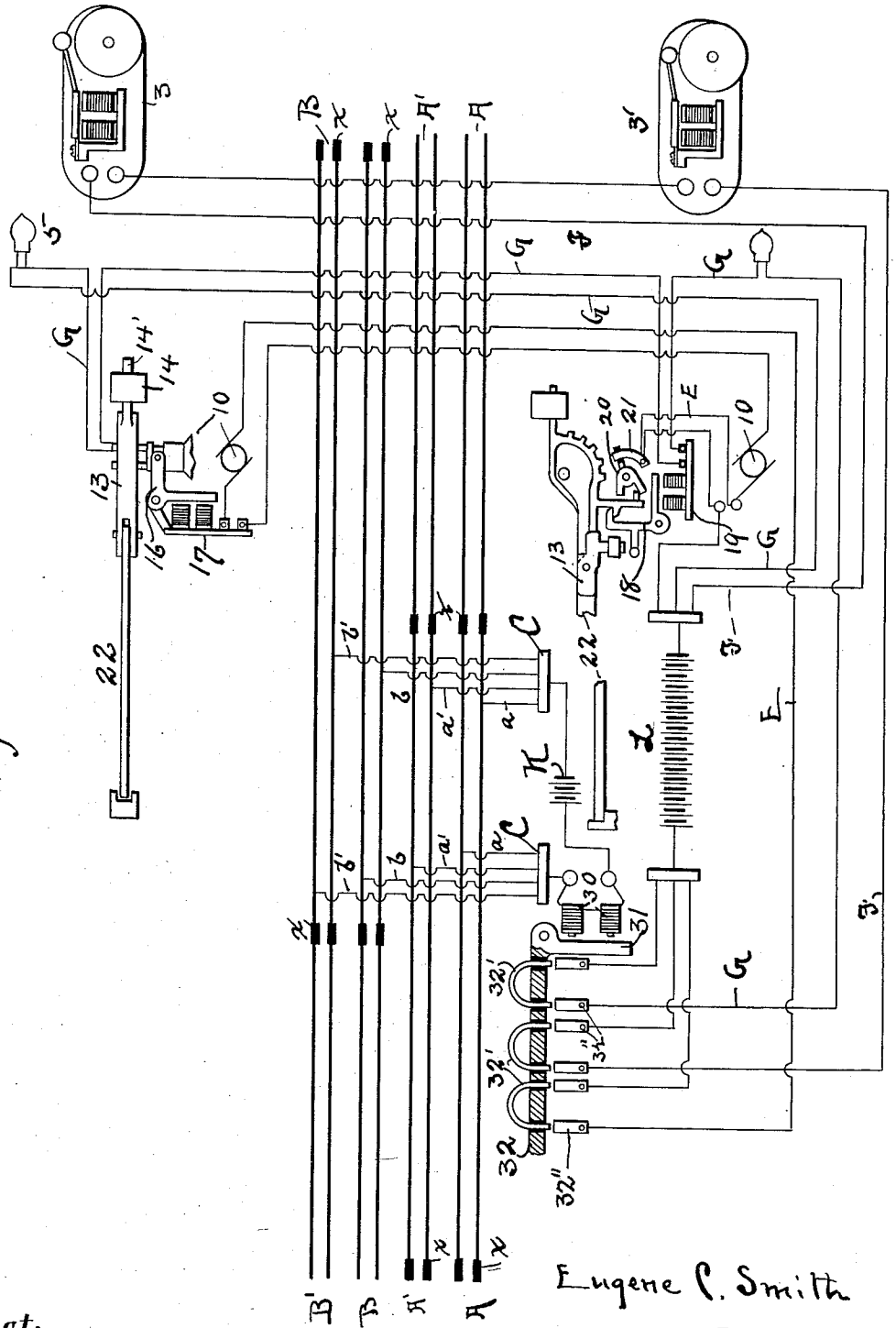


Fig. 5

Attest:

F. E. Alexander

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Inventor:

by his Atty's,

Henry Gough

UNITED STATES PATENT OFFICE.

EUGENE C. SMITH, OF NEW YORK, N. Y., ASSIGNOR TO LAWRENCE S. FOLGER, OF NEW YORK, N. Y.

AUTOMATIC RAILROAD-GATE.

No. 903,905. Specification of Letters Patent. Patented Nov. 17, 1908.

Application filed May 28, 1906. Serial No. 319,156.

To all whom it may concern:

Be it known that I, EUGENE C. SMITH, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Automatic Railroad-Gates, of which the following is a specification.

My invention relates to gates for railway crossings and particularly to gates electrically operated to close or open upon the approach to or departure of a train from said crossing, which shall be capable of use with a plurality of tracks, which shall give a visual and audible signal prior to the closing of said gates, and which shall be free from certain disadvantages incident to such gates as have been heretofore devised.

At present, railroad crossing gates are principally operated by hand upon a suitable signal from down the track, of the approach of a train. This is due to the fact that the automatic gates heretofore devised have been either too complicated in mechanism or uncertain in their action; that they have required considerable expenditure without knowledge or thought of the requirements of such gates, or the exigencies of railroading.

The requirements of a practical automatic railroad gate are that it shall operate under its own power, and not through the weight or movement of the train itself,—carried through long distances by shafts, pull rods and levers,—that the power necessary to operate it shall be as low as possible, that it shall be closed by the approach of a train at a distance of at least two miles, that it shall be operable with trains arriving and departing on a plurality of tracks, that it shall not be allowed to open on the departure of one train while another is approaching the crossings, that its operation shall not be liable to interference through the action of snow or rain, that it shall be capable of being independently raised by the passage of any vehicle which through accident shall be caught between the closing gates and that the lowering of a gate shall not injure anything which may be caught beneath it.

For the transmission of an impulse over long distances and instantaneously, there is nothing so advantageous as electric contacts and wiring. Mechanically operated shafts, pull-rods, levers, etc. while positive over short distances are not so when power has to be transmitted for two or more miles. There is always more or less lost motion, and besides that, the power required is great, and snow or ice interferes with the proper operation. Hence in this invention I have used an electric circuit as a means of starting the operation of the gate, and in order to avoid the necessity of long lines of wire, and of separate contacts actuated by the passage of the car I use the rails of the tracks, within a certain distance of the gate, as conductors for the electric impulse. Such an impulse is then used to complete a circuit which puts in operation an electric motor, which acts to close the gate.

Gates which slide laterally or vertically are open to the objection that they are of considerable weight, requiring considerable power to operate and that wind and snow acts upon them to impede their movement. The gate should be so counterbalanced as to require little power to operate it and of such construction as to present as little surface to the action of the elements as possible. It should also be positive in its closing, and not dependent upon the action of gravity. For this reason, I have used a pivoted arm gate, counterbalanced beyond its own weight and preferably moving vertically through a quarter circle, such gate being closed by the action of the electric motor before referred to, but raised by the action of the counterbalance when released by the passage of a train, thus doing away with the necessity of reversing the action of the motor, and also lessening the amount of battery power expended on the passage of a train. In connection with these instrumentalities, I use auxiliary signal circuits operated by the approach of a train to warn travelers of the impending closing of the gates.

My invention consists of the combination and arrangement of parts and the details of construction set forth in the appended claims.

My invention is shown in the accompanying drawing wherein:

Figure 1 is a diagrammatic view of a crossing over a plurality of tracks and the electrical connections from said tracks to the crossing gates. Fig. 2 is a side view of the

rear of the gate, the inclosing casing being in section. Fig. 3 is a rear end view of the gate actuating mechanism, the inclosing casing being in section. Fig. 4 is a diagrammatic plan view showing a modification of the wiring. Fig. 5 is a diagrammatic view of the crossing showing another modification of the wiring.

Like reference characters throughout the several views designate like parts.

A A′ designate one series of tracks over which the trains will move in one direction, and B B′ designate other series of tracks for trains moving in the opposite direction. It is, of course, understood, that any number of tracks may be used without in any way altering the principle of my invention which is applicable either to two tracks or any other number. The rails of a certain length of each of these tracks in front of and extending some distance before and a slight distance beyond the crossing are insulated by the insulating blocks X. This makes a "block" the rails of which complete a circuit with the gate-actuating mechanism when a train enters upon it, the circuit being completed through the wheels of a car as is common in electric signal mechanism. Preferably this block extends from the point some two miles above the crossing to a little distance beyond the crossing.

One of the rails of each track is connected in circuit with the gate and signal-operating mechanism and with the other rail of the same track by suitable conductors lettered *a*, *a′*, *b*, *b′*, the two rails of the track A being connected through conductors *a*, the rails of A′ through *a′*, those of B through *b*, and those of B′ through *b′*. These conductors lead to any common distributer, such as the distributer bars C C′. I have shown in Fig. 5 these distributer bars as being connected in a primary circuit but in the construction shown in Fig. 1 the primary circuit only acts to close a secondary circuit, but in this figure I have shown only the one circuit in which the rails and gate motor, lamp, etc., are placed.

In the arrangement shown in Fig. 1, the current passes from the distributer C through an electromagnet 2, whose function will be hereinafter described, to a distributer D and to a battery H; thence to a distributer D′ and thence by a wire *d* to the distributer C′ from whence it returns to the rails.

It is convenient before considering the motor circuit to trace the two signal circuits F and G. The circuit F runs from the distributer D′ to the electric bell 3 on the other side of the track, then back to an electric bell 3′ on the same side of the track as the battery, then to a contact 4 through connection 4′ and contact 4″ to distributer D. The lamp circuit G follows the same course as the bell circuit, passing from the distributer D′ to the lamp 5, then to gate latch electromagnets 19 of the opposite gate, then to the lamp 5′, then to one of the contacts 6 through the connection 6′ to the other contact 6″, and then to the distributer D.

In order to break the circuit in the bell and light circuits when the train passes out of the block, I have in the system shown in Fig. 1 mounted conducting connection pieces 4′ 6′ on an arm 7′ of the bell crank lever. The other arm 7″ of the said lever is adapted to be acted upon by electromagnets 2. A spring normally draws the arm 7′ of the bell crank lever away from the contacts 4, 4″, 6 and 6″, but when however a train enters upon the block and closes the circuit, current passes from C to D. The electromagnets are energized, drawing upon the arm 7″ and down upon the arm 7′. The lamp and bell circuits are thus completed through the contact pieces 4′ 6′ engaging with the contacts 4, 4″, 6, 6″. Under these circumstances the bells ring on both sides of the track and the signal lamps glow.

The motor circuit is as follows: from the distributer D′ to the binding screws of a clutch-shifter electromagnet 17 on the opposite side of the track; then to the brushes of a gate-operating motor 10; thence to the brushes of the motor on the opposite side of the track to the binding screws of the clutch shifting electromagnets 17 of that motor and from there to a gate latch circuit breaker 18 to the common distributer C′ and from thence to the rails. It will thus be seen that when the train passes on to anyone of the tracks the three several circuits which are arranged in parallel are closed and that the effect of the entrance of a train upon the block is to immediately actuate the signals, and at the same time operate the gate through a gate motor connection now to be described.

In Figs. 2 and 3, 8 designates a casing inclosing the operating mechanism of the gate and protecting it from the weather. 10 designates an electric motor of any suitable character, the shaft 10′ of which is carried at one end in bearings in the side of the casing and at the other end in a bracket 9′ mounted on the gate standard 9. On the motor shaft is a loose gear wheel 10″. This gear wheel 10″ might of course be connected directly to the sector gear of the gate but in order to reduce the speed transmitted by the motor, I prefer to provide intermediate gears 11, 11′ between the gear 10″ and the sector 12. The gear 11 is mounted on a shaft 11″ having bearing in the standard 9 and the side of the casing 8. In the upper end of the standard and casing is mounted the gate beam shaft 12′ which forms the pivot on which the gate beam turns. The rear section

13 of the gate beam may be made in one piece with the shaft 12′ and the sector 12, and I have so shown it though I wish it understood that it may be constructed in any other manner desired without departing from my invention. The sector 12 meshes with the pinion 11′ of shaft 11″ and rotation of the pinion 11′ acts to raise the gate beam. In order to counterbalance the gate beam I provide it at its rear with the projecting arm 14′ carrying a weight 14. This weight is sufficient to overweigh the gate beam and to lift it to a vertical position when the gate beam is free to move. I have designed my gate so that the motor shall close it on the approach of a train and that it shall rise of itself after the train has passed from the block. To the end that it may be free to rise I provide a shiftable clutch 15 splined on the shaft 10′ and engaging with the tooth of a second clutch member fast on the pinion 10″. This is a clutch connection common to a large variety of mechanisms and specifically forms no part of my invention. The sliding member of the clutch is actuated by a shifting lever 16 which may be moved into position to throw the two members of the clutch into engagement with each other through the action of electromagnets 17 of which the end of the clutch lever forms the armature, as will be seen clearly in Fig. 1.

The electromagnets 17 are in circuit with the motor and thus whenever the current passes along the motor circuit the electromagnets 17 are energized and the two members of the clutch are thrown into engagement with each other and thus the motor through its train of gears will act upon the sector 12 to lower the gate. When the current ceases in the motor circuit by reason of the circuit breaking mechanism to be hereinafter described, the magnets 17 are deënergized and the clutch teeth of the two members of the clutch are able to pass each other reversely, the gate beam being thus free to move upward to its vertical position by reason of the weight 14. I do not wish to limit myself to the location of the clutch 15 shown as this clutch might be as well placed upon the shaft 11″.

Inasmuch as when the circuit is broken in the motor circuit, the gate beam is free to rise, some means must be provided for holding the gate beam lowered so long as there is a train upon the block of any of the tracks. To this end I provide on the rear section 13 of the gate a detent over which a hook or latch may catch when the gate is in its horizontal position, this latch being drawn into position by the passage of a current through the mechanism thereof and released from the gate by the cessation of said current.

In detail the gate latch mechanism consists of a downwardly projecting lug 13′ having at its lower end a forwardly projecting tooth 13″ and the rearward projection 13‴. 18 designates a bell crank lever forming the latch proper. One of the arms 18′ of this lever has a tooth which engages with the tooth 13″. The other of said arms forms the armature of an electromagnet 19. A weight 18‴ acts normally to hold the arm 18 away from its latching engagement with the tooth 13″. As before stated, it is necessary that the latch should be held in engagement with the arm during the whole time that a train is upon the block. Hence I may place these electromagnets in either the bell or the light circuit, as these circuits are constantly closed while a train is upon the block. The latch engages the arm 13 until the current in the electromagnet 19 ceases, when immediately the counterweight 18‴ pulls the arm 18′ out of engagement with the tooth 13′ and the gate is at liberty to move upward under the action of the counterweight 14.

Of course, it is necessary that after the gate has been moved down to its horizontal position the action of the motor should cease, and to provide for this I break the motor circuit when the gate has reached its lowered position. This motor circuit breaker is shown very clearly in Figs. 2 and 3; it consists of a lever 20, pivoted at its middle, the forward end of which is formed of non-conducting material, and the rear end of which is bifurcated to engage with a projection 13‴ on the arm 13′.

21 designates two spring contact pieces normally in contact with each other but which may be separated by the introduction of the non-conducting end of the lever 20 between them, thus breaking the motor circuit E. These contact pieces are arranged in the arc of a circle, each piece being connected with the terminal of the circuit E and at the lower end are separated widely apart. When the gate rises from the position shown in Fig. 2 the bifurcated end of the lever 20 is moved upward, moving the non-conducting finger downward into the widened portion of the spring contacts and thus the spring contacts close upon each other and complete the circuit. When, however, the gate is brought downward, the insulated finger of the lever 20 is moved upward and between the spring contacts, thus separating them and breaking the circuit E.

In order that the beam of the gate may be lifted easily in cases of emergency and that it may not crush anything beneath it, when it is being brought down to its lowered position, I preferably make the gate 22 in two or more sections. In the drawings one section is shown as forming the rear end of the gate beam; the other section forming the beam

itself. This beam section 22 is pivoted to the rear section 13 as at 13× and has a rearwardly projecting portion which engages under a forwardly projecting portion of the rear section. Beneath the rearwardly projecting portion of the forward section and rearward of the pivot 13× is a counterweight 22′ just sufficient to nearly counterbalance the beam section 22. I have shown only one counterbalance beam section but it is to be understood that a number may be used, thus dividing the beam of the gate into a number of sections, each one of which may be easily raised. Preferably, however, I use one beam section as shown. This may be easily raised, or if it strikes an obstruction when lowered it will be kept lifted by reason of the delicacy of its counterbalance even though the motor continues to act and the rear section therefore is turned to the position shown in Fig. 2.

The operation of the construction just described as a whole is as follows: Assuming that a train enters upon the tracks A, when the train has passed the insulating pieces X the circuit of the block is closed and the circuit completed from the common connection C through the electromagnets 2, the distributer bar D, the battery H, the distributer bar D′, and thence to the bar C′, and from thence again to the rail A′. The completion of this circuit sends current through the lamp circuit, giving a visual signal, at the same time, completing the current through the bell giving an audible signal and sending current through the motor, whereby the rotation of the motor operates to turn down the gate beam until it is engaged by the latch. As this occurs, current is shunted through the electro magnets, and the clutch between the motor shaft and the gate beam is thrown out of engagement with the motor. As long as the train is upon the block, this condition remains, but the passage of the train from the block, releases the latch and allows the counterweight to lift the beam to its vertical position, the mechanism taking the position first assumed.

In Fig. 4, I show a modification of the wiring used with my gate. This is a much simpler system than is shown in Fig. 1 and differs from Fig. 1 only in that the battery H is connected directly to the dstributer C. The current passes from a battery H to a distributer J from which proceed the three several circuits in exactly the manner shown in Fig. 1, to a distributer C′, and from thence to the tracks. With this arrangement there is no necessity of having special means whereby the bell and light circuits may be broken as the passage of a train off the block of itself breaks the bell and light circuits, the motor circuit having been previously broken upon the descent of the gate. In the system shown in Fig. 1 the lamp and bell circuits have to be separately broken because the battery would else have formed a closed circuit with the lamp and bell circuits at all times without regard to the passage of a train.

By the arrangement of wiring heretofore described, the current passes through practically the entire block of any of the tracks immediately upon the arrival of the train upon said block. It is only cut off when the train finally clears the block. As each track is connected in circuit with the motor and bell mechanism, the departure of a train from one of the tracks of the block does not affect the gate or signal mechanism so long as there is another train either coming on to the block or standing thereon. As this block, however, would ordinarily extend two miles in front of the crossing and as high voltage currents would have to be used in order to operate the motor, there would be great leakage from the rails. In order to use low voltage rail currents and a high voltage motor current, I provide the following modification which is shown in Fig. 5 and which I regard as preferable to the arrangement just described. In this the rails A, A′, B, B′ of the tracks are connected to distributers C, C′; these distributers in turn being connected to each other through a low voltage battery K therein. The rails, battery, etc. thus form a primary circuit which is closed by the arrival of a train upon the block. In this primary circuit is an electromagnet 30 which when energized acts to draw to it an armature 31 connected to a switch 32. I have shown this armature in the form of one arm of a bell crank lever, the switch forming the other arm of said lever. This switch 32 carries upon it the connecting pieces 32′ which when the switch is actuated each close a gap between the contact pieces 32″ in the light, bell and motor connections. It will thus be seen that the secondary circuit which includes the light, bell and motor connections is normally broken but is closed by the actuation of the switch 32 through the electromagnets 30. In this secondary circuit is a battery L. In all other respects the construction is precisely similar to that shown in the other drawings described heretofore. The operation is evident. When a train arrives upon the block the primary circuit is closed, thus energizing the magnets 30. This closes the switch 32 and completes the secondary circuit and current passes immediately to the bell, to the light, and through the motor to depress the gate. When the train passes off the block, the electromagnet 30 is demagnetized, the armature is drawn away therefrom and the switch 32 opened; thus the bell and light circuits are broken, the gate latch 18 in the

light circuit is released and the gate rises to its upright position as before described. It will be understood that the electric current in this secondary circuit for operating the motor, light and bell, may come from any suitable source, but I do not wish to confine myself to the use of a battery L for this purpose, the battery L being merely shown for the sake of clearness.

Having described my invention what I claim is:

1. In a railway gate operating system, a series of tracks, a main circuit normally open, a battery in said circuit, means for closing said circuit on the approach of a train on any of the tracks, a motor in said circuit, a gate arm counterbalanced to rise, a clutch for engaging the motor with the gate arm for lowering the same, means for disengaging the clutch from the motor when the arm has reached its lowered position, means for shunting out the motor from the main circuit, a latch for holding the gate in its lowered position, and means for holding the latch in engagement with the gate as long as the main circuit is closed and for releasing the latch when the circuit is broken, thus allowing the gate to rise.

2. In a railway gate operating system, a series of tracks, a main circuit normally open, a battery in said main circuit, a bell circuit and a light circuit connected in series with the main circuit, means for closing said circuit on the approach of a train on any of the tracks, a motor in said circuit, a gate arm counterbalanced to rise, a clutch for engaging the motor with the gate arm for lowering the same, means for disengaging the clutch from the motor when the arm has reached its lowered position, means for shunting out the motor from the main circuit, a latch for holding the gate in its lowered position, and means for holding the latch in engagement with the gate as long as the main circuit is closed and for releasing the latch when the circuit is broken thus allowing the gate to rise.

3. In a railway gate operating system, a series of insulated blocks of track, a main circuit normally open, a battery in said main circuit, means connected to the two rails of the insulated blocks of tracks for closing said circuit on the arrival of a train on any of said insulated blocks, a motor in said main circuit, a gate arm counterbalanced to rise, a clutch for engaging the motor with the gate arm for lowering the same, means for disengaging the clutch from the motor when the arm has reached its lowered position, means for shunting out the motor from the main circuit, a latch for holding the gate in its lowered position, and means for holding the latch in engagement with the gate as long as the main circuit is closed and for releasing the latch when the circuit is broken, thus allowing the gate to rise.

4. In a railway gate operating system, an insulated block of track, electrical connections between the rails of said block, a battery in circuit with said rails, an electromagnet in circuit with said rails, a main circuit normally open, a battery in said main circuit, a switch actuated by the electromagnets of the track circuit to close said main circuit when the electromagnet of the track circuit is energized, a motor in said main circuit, a gate arm counterbalanced to rise, a clutch for engaging the motor with the gate arm for lowering the same, means for disengaging the clutch from the motor when the arm has reached its lowered position, means for shunting out the motor from the main circuit, a latch for holding the gate in its lowered position, and means for holding the latch in engagement with the gate as long as the main circuit is closed and for releasing the latch when the circuit is broken thus allowing the gate to rise.

5. In a railway gate operating system, a plurality of tracks, connections from one of the rails of each track to a distributer, and connections from the other rail of each track to a distributer, and a connection from one distributer to the other forming a track circuit, a battery in said track circuit, an electromagnet in said track circuit energized when the track circuit is closed, a main circuit normally open, a battery in said main circuit, a switch for closing said main circuit operated by the energizing of the electromagnet in the track circuit, a lamp in said main circuit, a bell in said main circuit, and a motor in said main circuit, a gate arm counterbalanced to rise, a clutch for engaging the motor with the gate arm for lowering the same, means for disengaging the clutch from the motor when the arm has reached its lowered position, means for shunting out the motor from the main circuit, a latch for holding the gate in its lowered position, and means for holding the latch in engagement with the gate as long as the main circuit is closed and for releasing the latch when the circuit is broken, thus allowing the gate to rise.

6. In a railway gate operating system, a series of tracks, a main circuit normally open, a battery in said circuit, means for closing said circuit on the approach of a train on any of said tracks, a motor in said circuit, a gate arm counterbalanced to rise, a clutch for engaging the motor with the gate arm, means for disengaging the clutch from the motor when the arm has reached its lowermost position, a latch for holding the gate in its lowered position, means for holding the latch engaged with the gate as long as the main circuit is closed and for re-

leasing the latch when the circuit is broken, spring contact pieces in the main circuit normally in contact with each other, and an insulated pin connected to the gate arm acting to interpose between said contact pieces and separate the same when the gate has reached its lowermost position.

7. In a railway gate operating system, a series of tracks, a main circuit normally open, a battery in said circuit, means for closing said circuit on the approach of a train on any of said tracks, a circuit independent of the main circuit normally open, but closed by the closure of the main circuit through a train arriving on any one of the series of tracks, a motor in said main circuit, a gate arm counterbalanced to rise, a clutch for engaging the motor with the gate arm, electromagnets in the main circuit adapted to hold the clutch into engagement between the gate beam and the motor when energized by the passage of a current through the main circuit, contact pieces normally in electrical contact with each other in the motor circuit, and an insulating finger adapted to be moved to separate the said contact pieces, to break the current in the main circuit when the gate beam arrives at its lowermost position, a latch for holding the gate beam at its lowermost position, and electromagnets for holding said latch in engagement with the lowered beam, said electromagnets being on the said independent circuit.

8. In an automatic gate for railroad crossings, a gate beam pivoted at its rear end and counterbalanced to rise, an electric motor in circuit with the source of electrical energy, a gear wheel engaging with said gate whereby it may be turned upon its pivot, a pinion loose on the motor shaft engaging with said gear wheel, a clutch longitudinally shiftable on said motor shaft but turning therewith, means for shifting said clutch into engagement with said pinion when a current passes in the motor circuit, contact pieces normally in engagement with each other in the motor circuit, and an insulating finger adapted to be moved to separate said contact pieces and to break the current in the motor circuit, said finger being operated by the arrival of the gate beam at its lowermost position, thus breaking the motor circuit and allowing the gate to return to its original position.

9. In an automatic gate for railroad crossings, a gate beam pivoted at its rear end and counterbalanced to rise, an electric motor in circuit with the source of electrical energy, a gear wheel engaging with said gate whereby it may be turned upon its pivot, a pinion loose on the motor shaft engaging with said gear wheel, a clutch longitudinally shiftable on said motor shaft but turning therewith, means for shifting said clutch into engagement with said pinion when a current passes in the motor circuit, contact pieces normally in engagement with each other in the motor circuit, an insulating finger adapted to be moved to separate said contact pieces and to break the current in the motor circuit, said finger being operated by the arrival of the gate beam at its lowermost position, thus breaking the motor circuit and allowing the gate to return to its original position, a detent on the gate beam, a latch for engaging said detent when the gate is lowered, a counterbalance for normally holding said latch out of engagement with said detent, an auxiliary circuit, means for interrupting the current in the auxiliary circuit when a train has passed the gate, and means acted on by the current in said auxiliary circuit for drawing the latch into position to engage with said detent.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this second day of April 1906.

EUGENE C. SMITH.

Witnesses:

FREDERIC B. WRIGHT,

LAWRENCE S. FOLGER.