(No Model.) 4 Sheets—Sheet 1.

D. H. WILSON.

RAILWAY SIGNAL.

No. 531,986. Patented Jan. 1, 1895.

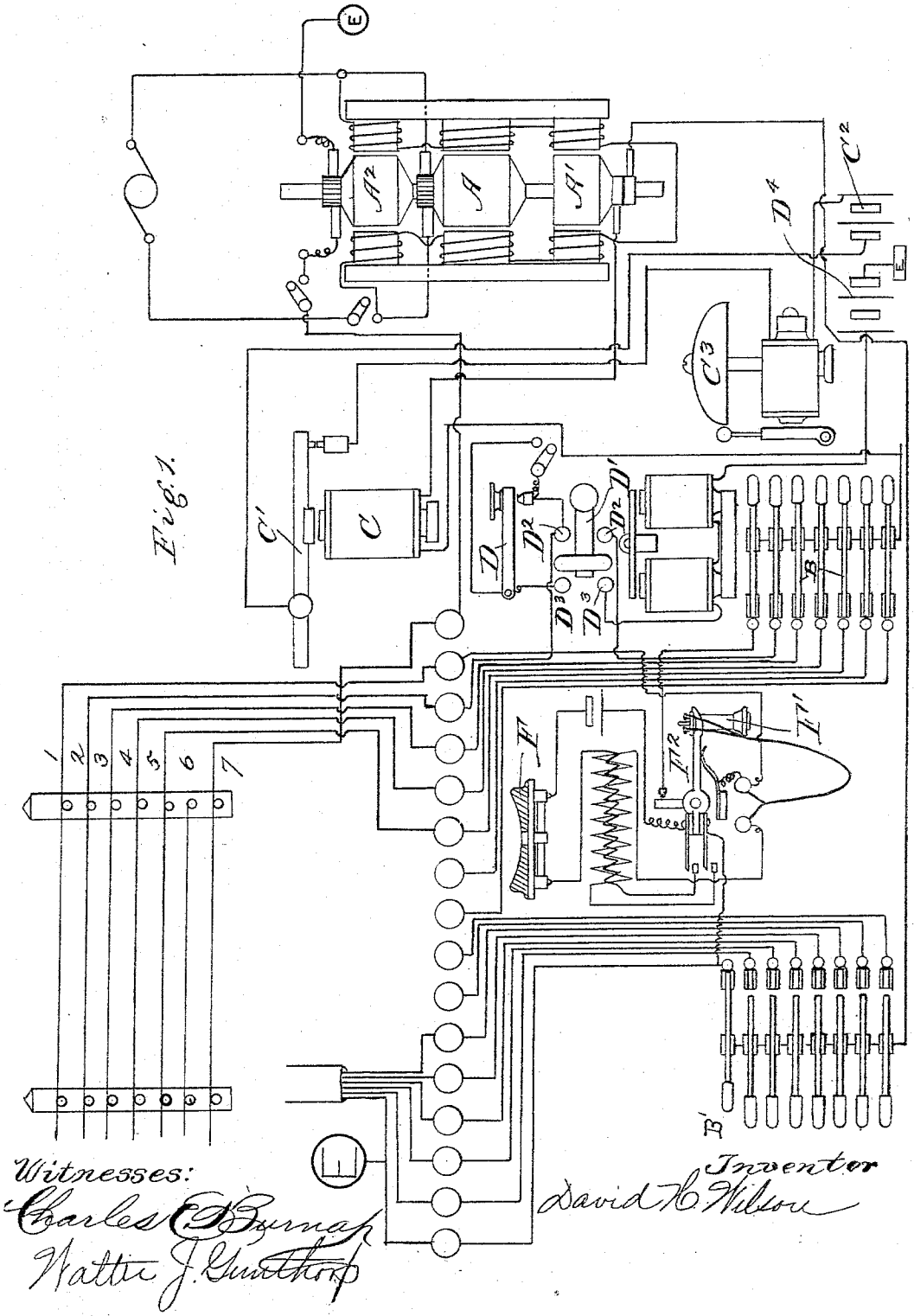

Fig. 1.

Witnesses:
Charles E. Burnap
Nattie J. Gunthorp

Inventor
David H. Wilson

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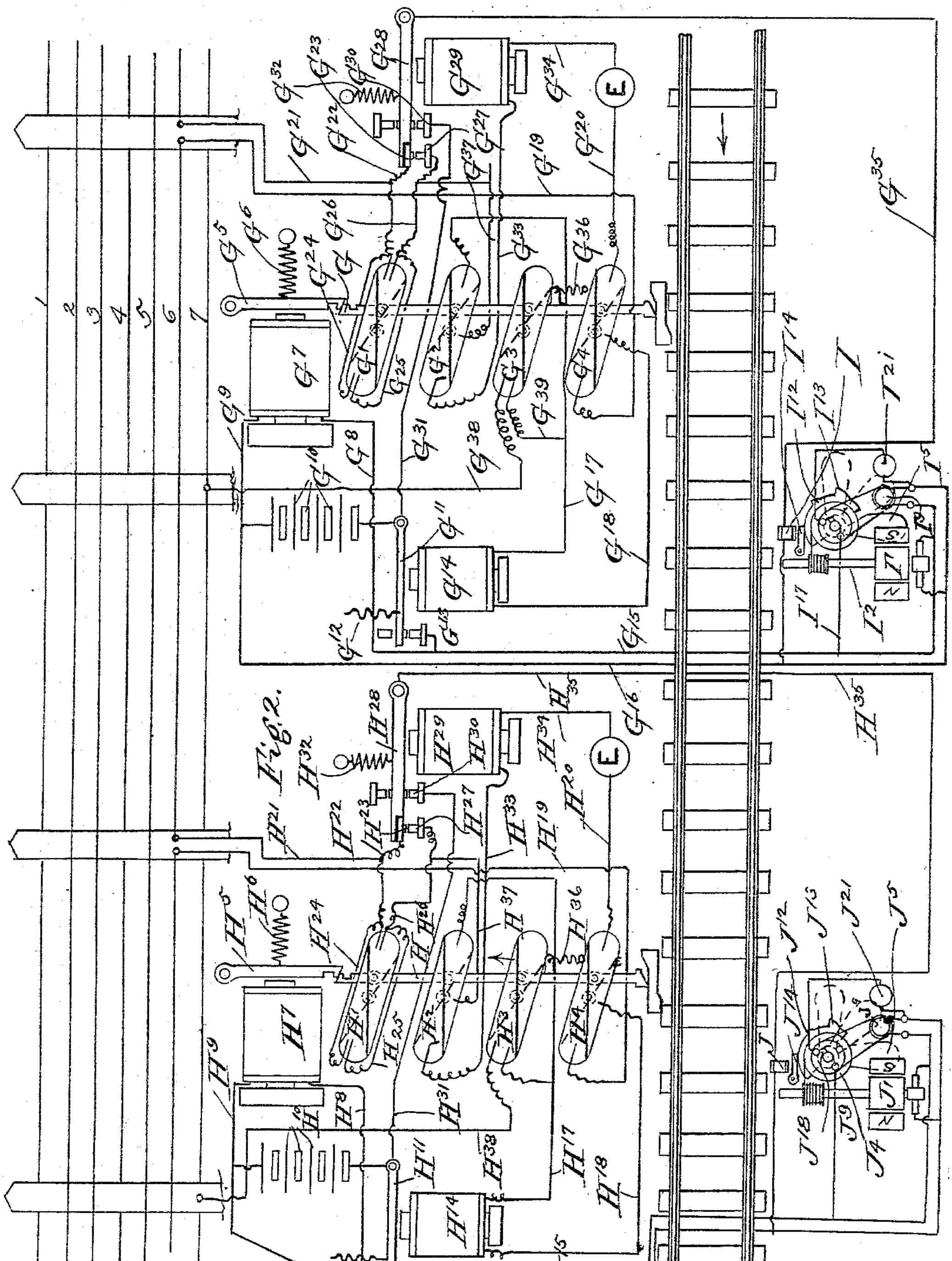

Fig. 2.

Witnesses:
Charles E. Burnap
Walter J. Gunthorp

Inventor
David H. Wilson

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D. H. WILSON.

RAILWAY SIGNAL.

No. 531,986. Patented Jan. 1, 1895.

Fig. 3.

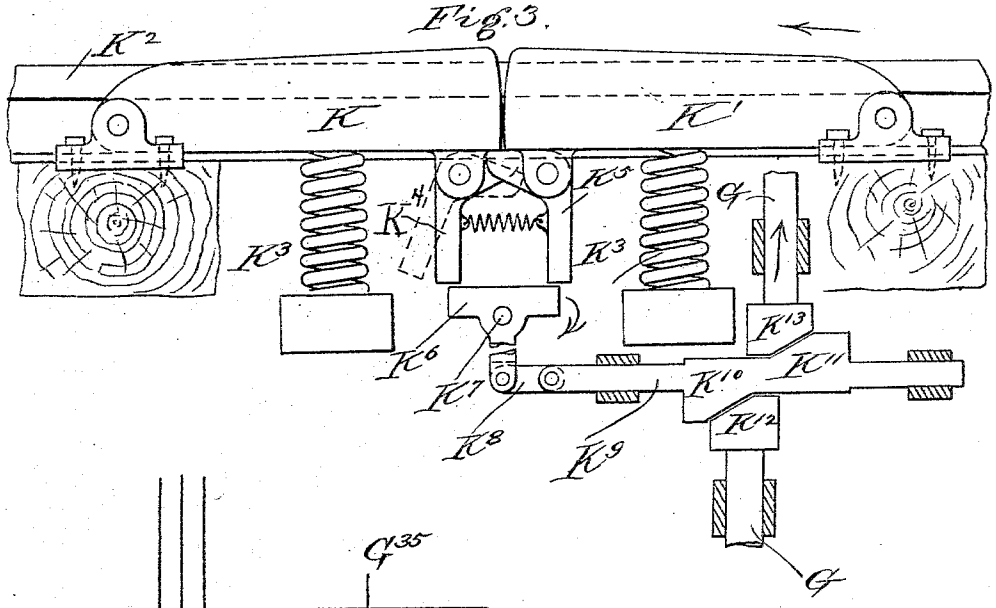
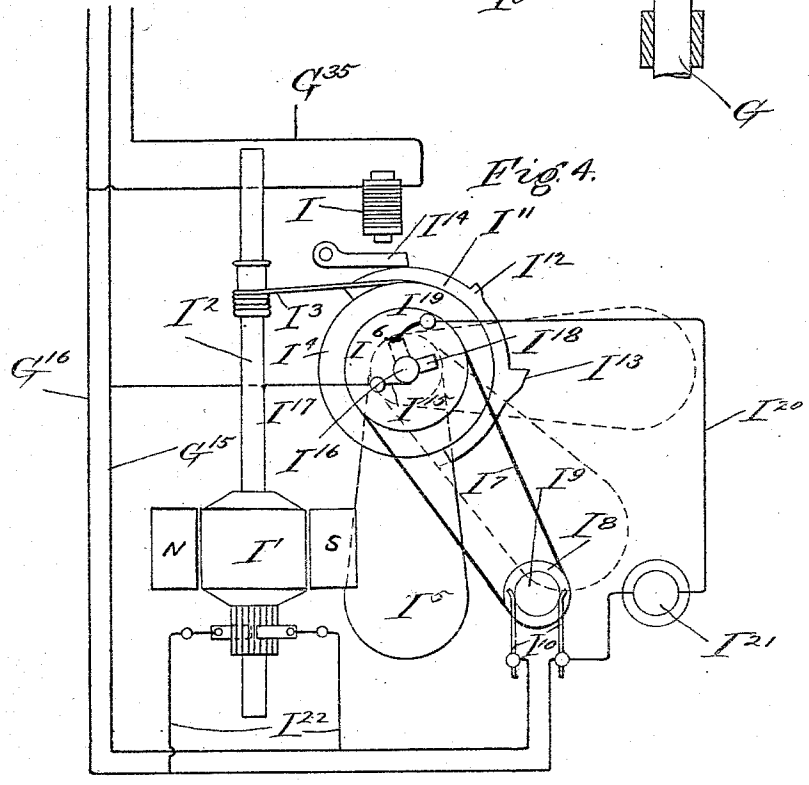


Fig. 4.



Witnesses:
Charles E. Burnap
Walter J. Hawthorp

Inventor:
David H. Wilson

(No Model.) 4 Sheets—Sheet 4.

D. H. WILSON.

RAILWAY SIGNAL.

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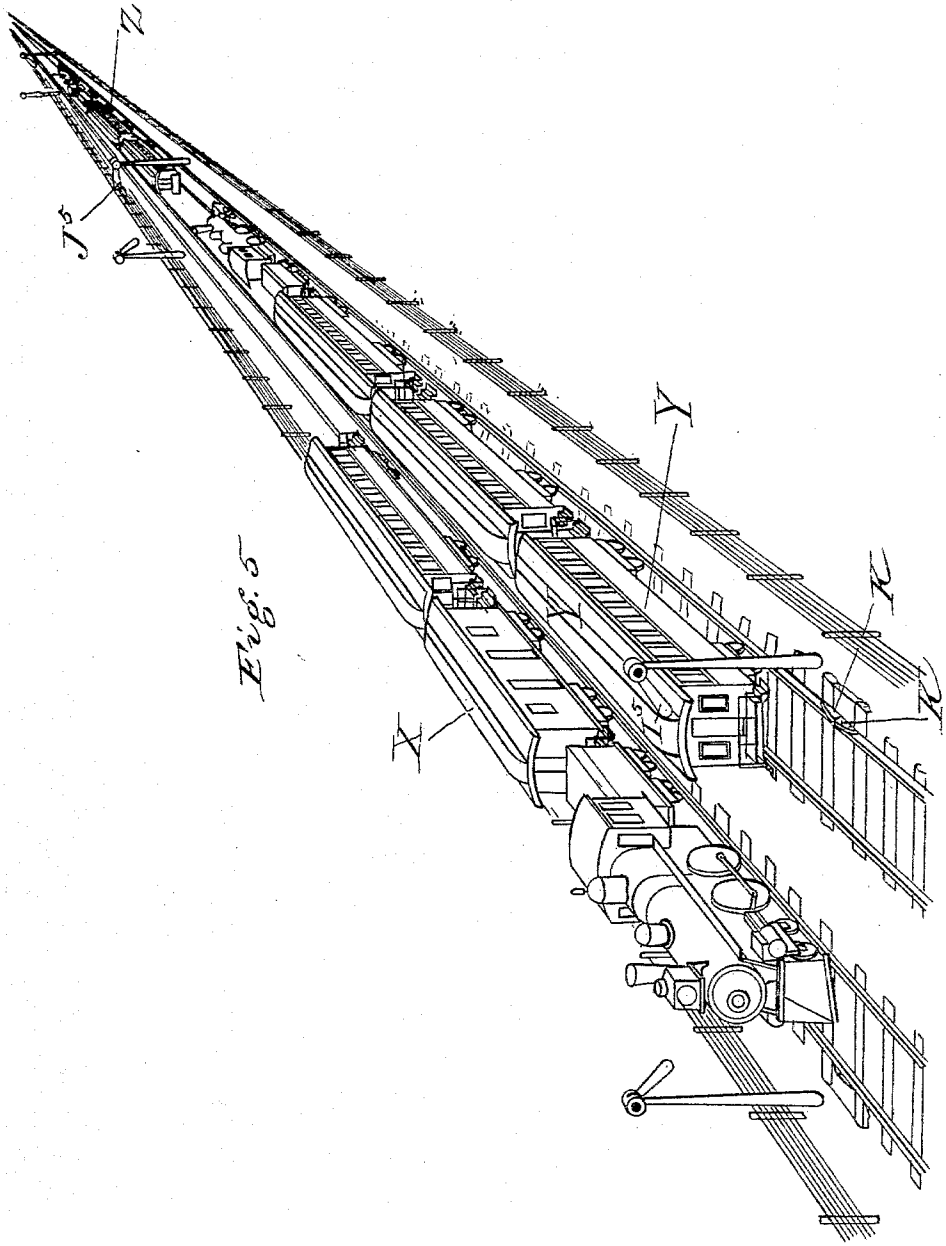

Fig. 5.

Witnesses:
Walter J. Smithorp
Alice B. Geddes

Inventor
David H. Wilson

UNITED STATES PATENT OFFICE.

DAVID H. WILSON, OF CHICAGO, ILLINOIS.

RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 531,986, dated January 1, 1895.

Application filed February 10, 1894. Serial No. 499,733. (No model.)

To all whom it may concern:

Be it known that I, DAVID H. WILSON, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Railway-Signals, of which the following is a specification.

My invention relates to electric railway signals and has for its object the production of an improved system of signals or "block system" to be used in connection with railways and the like.

A further object is to combine the said system of signals with an electric fence which may extend along the track, for the purpose of preventing animals, such as horses and cattle, from getting in the way of the trains upon such track.

Referring to the accompanying drawings, Figure 1 is a diagrammatic view of the switch-board for the fence and signaling apparatus. Fig. 2 is a diagrammatic view of the signaling apparatus. Fig. 3 is a detail view of the rail attachment by which the circuits are operated. Fig. 4 is a detail view of the semaphore controlling apparatus. Fig. 5 is a perspective view of a double track supplied with my system of signals.

Like parts are referred to by like letters and numerals throughout the several figures.

Fig. 1 is a diagrammatical view of the switch-board for the fence and system of signals and a combined motor and generator for operating the same. This combined motor and generator consists of three machines combined in one, viz: a motor, a continuous generator, and an alternate current generator and is designed and constructed for use with my system of signals in combination with an electric fence.

A is the motor armature; A′, the alternate current armature which is connected to the fence wires, and A^2 the continuous current armature which furnishes current for the signaling device. This switch-board is similar to the one I have described in detail in my application filed September 8, 1893, Serial No. 485,102, and hence I will give only a general description of the same.

One brush of the armature A′ is connected to the different fence wires 1, 2, 3, 4, 5 by means of the switches B and the other brush is grounded at E. The wires at the left side of the switch-board, except the grounded wire, are the return wires of the fence. The fence wires extend along one side of the track and back on the other side, the length depending on the generator. It will be noticed that the series of switches B′ on the left are open, with the exception of the one connected to the ground, and hence no current will flow unless the fence wires are grounded by an animal coming in contact with them or in some other manner. These switches B′ are used to test the fence wires. When one of the fence wires is grounded, the current flowing through the magnet C causes it to attract its armature C′ and complete a local circuit through the battery C^2 and magnet of bell C^3 and sound an alarm.

D is a telegraph instrument arranged on the switch-board in such a manner that by moving the switch D′ from the contact points D^2 D^2 to contact points D^3 D^3, the fence wire 2 is cut out of circuit with the generator and cut in circuit with the telegraph instrument.

D^4 is the battery for the telegraph instrument having one of its poles grounded at E′.

A telephone F is arranged on the switch-board in such a manner that by removing the receiver F′ from the support F^2, the fence wire 1, is cut out of circuit with the generator and in circuit with the telephone. By this arrangement a person supplied with a hand telephone or telegraph instrument can communicate with the station operator from any point along the fence. By means of a prearranged set of signals sounded by the bell C^3, the operator's attention can be attracted. The armature A^2 has one of its brushes grounded at E^2 and the other connected to the wire 7 on the fence.

Referring to Fig. 2, which is a diagrammatic view of the signaling apparatus applied to a portion of track, the apparatus is shown in its normal position when no trains are on the track. This figure shows two sets of similar apparatus, one at each end of a portion or "block" of the road.

It will be understood that each "block" along the road is supplied in the same manner and that there will be a set of signals on each side of the road The signals on one side will be operated by the trains going in one

direction and the signals on the other side by trains going in the opposite direction. One generator will work the signals for a number of blocks, the length of wire receiving current from each generator depending of course upon the voltage of such generator, as in other systems of distribution.

As the two sets of apparatus shown are alike, a description of one will be sufficient. I will, however, use different letters in the two sets to facilitate the explanation of their operation.

G is a bar to which are pivoted the hermetically sealed tubes G′, G², G³, G⁴. These tubes are partially filled with mercury and are also pivoted to some stationary object so that a motion of the bar G will rock them so as to shift the mercury from one end to the other. This bar G is shifted by the wheels of the train through the agency of the mechanism shown in Fig. 3. These tubes have contact points sealed into them as shown.

G⁵ is a catch by which the bar G is held in position when moved in the direction of the arrow by the passing train. This catch is normally held out of engagement with the bar G by the spring G⁶ and is held in engagement with said bar by the electro-magnet G⁷ which is connected by the wires G⁸ G⁹ with the battery G¹⁰. This battery G¹⁰ has in circuit a switch G¹¹ normally held open by the spring G¹². This switch makes contact with the contact point G¹³ and is the armature of the electro-magnet G¹⁴.

G¹⁵ G¹⁶ are the wires leading from the battery G¹⁰ to the semaphore apparatus.

G¹⁷ G¹⁸ are wires connecting the electro-magnet G¹⁴ with the tubes G² and G⁴.

G¹⁹ is a wire leading from tube G⁴ to fence wire 6. G²⁰ leads from said tube to ground.

G²¹ is a conductor leading from fence wire 6 to wire G²² which connects the insulated contact G²³ and one of the contacts of the tube G′. Said tube G′ is supplied as shown with two contact points at each end, the opposite contact points being connected by the wires G²⁴ and G²⁵. The contacts connected by the latter wire are connected by conductor G²⁶ to contact point G²⁷. Contact G²³ is fastened to but insulated from the armature G²⁸ of the electro-magnet G²⁹. G³⁰ is another contact connected by wire G³¹ to armature G¹¹. Armature G²⁸ is normally held free from the contacts G²⁷ G³⁰ by the spring G³². The electro-magnet G²⁹ is connected by the wire G³³ with the tube G² and by wire G³⁴ with the ground. G³⁵ leads from the armature G²⁸ through the electro-magnet I to wire G¹⁶. A spring G³⁶ tends to keep the bar G in its normal condition. G³⁷ is a conductor leading from G²⁶ to tube G². A conductor G³⁸ leads from the fence wire 7 to the tube G³.

Referring to the apparatus for controlling the semaphore, an enlarged view of which is shown in Fig. 4, I′ is an electric motor the armature of which is connected to the shaft I² carrying a drum upon which is wound the rope I³. This rope I³ has its other end fastened to a drum I⁴ connected with the semaphore I⁵. Rigid with the drum I⁴ is a pulley I⁶ provided with a belt I⁷ which also passes around a pulley I⁸ on the base of the lamp I⁹. This lamp is so arranged that it will show a white light in one direction and a red light in the opposite direction and is normally out of circuit, only being in circuit when the circuit is closed through the motor I′; but when it is revolved by means of motor I′, the circuit is completed through it by means of the brushes I¹⁰ I¹⁰ and suitable contact rings. I¹¹ is a piece attached to the drum I⁴ and is provided with the two lugs I¹² I¹³ which are of different sizes as shown. A pawl I¹⁴ is situated so as to act as the armature of the magnet I and to engage the lugs so as to limit the amount of motion of the drum I⁴. I¹⁵ is a brush in contact with the shaft I¹⁶ and connected by wire I¹⁷ to conductor G¹⁵. I¹⁸ is a lug on the shaft I¹⁶ adapted to engage the brush I¹⁹ when the shaft is rotated through an arc of ninety degrees from its normal position. From the brush I¹⁹ leads the conductor I²⁰ through lamp I²¹ to conductor G¹⁶. The armature of the motor I, is connected with the wires G¹⁵ G¹⁶ by conductors I²².

Referring to Fig. 3, which shows the track attachment by which the bar G carrying the tubes G′, G², G³, G⁴, is moved, two pieces K, K′ are pivoted at opposite ends in proximity to the rail K² as shown. These pieces are beveled so that the free ends reach above the top of the rail as shown and hence when a train passes along the track, they will be depressed. These pieces are held in position by the springs K³ K³. Pivoted to the free ends of the pieces K, K′, are the bell crank levers K⁴, K⁵. The horizontal arm of each of these levers is of such length as to extend beyond the end of the piece to which it is pivoted so as to be beneath the other piece as shown. Beneath the vertical arms of the levers K⁴, K⁵, is a "T" shaped piece K⁶, pivoted at K⁷ and connected by the link K⁸ to the rod K⁹ which has the enlarged parts K¹⁰ K¹¹ having beveled surfaces as shown. K¹² K¹³ are blocks on the ends of the bars G and have beveled surfaces similar and in proximity to the beveled surfaces on the enlarged parts K¹⁰, K¹¹. It will be noticed that there are two bars G shown in this figure. One is for the signals on one side of the road which will be operated by the trains going in one direction, and the other for the signals on the other side of the road which will be operated by trains going in the other direction.

Fig. 5 shows a double track supplied with my system of signals and also shows three trains, X, Y, Z, in different positions and the corresponding position of the signals.

It is evident that the form, construction and arrangement of these several devices may be changed without departing from the spirit of my invention and I therefore do not wish to be limited to the exact construction and arrangement shown.

The use and operation of my invention are as follows: When the apparatus is in the position shown in Fig. 2, no current is flowing, as the circuit leading from the fence wire 7 is broken in the tubes G^3 and H^3. Suppose a train is traveling along the track in the direction of the arrow. When it comes opposite the tubes G' G^2, &c., or rather when its wheels come in contact with the piece K' (see Fig. 3) said piece will be forced downwardly and since it comes in contact with the horizontal arm of the bell crank lever K^4, said lever will be rotated on its pivot and its vertical arm will be moved to the left so as to be out of the way of the piece K^6. The lever K^5 will move downwardly with said piece and, coming in contact with the piece K^6, will cause it to rotate in the direction of the arrow, which motion will cause the rod K^9 to be moved to the left and by means of the beveled surfaces on K^{11} and K^{13}, the bar G will be moved in the direction of the arrow. If a train should be moving in the opposite direction, the action will be just the reverse of that described and the lower bar G will be moved while the upper bar remains stationary, thus working the signals on the other side of the track. When the bar G is moved in the direction of the arrow, the position of the tubes G', G^2, G^3, G^4 will be changed so as to shift the mercury from the right end to the left end. To avoid confusion, I have not shown the tubes in this shifted position but have indicated the position of the mercury in this position by dotted lines, the position of the mercury in the normal condition being shown by full lines. When the mercury is in the position shown by the dotted lines, a circuit will be completed through the armature A^2 of the generator and will be traced as follows: from generator to fence wire 7, thence by wire G^{38} to tube G^3, thence through mercury and wire G^{39} to conductor G^{17}, thence through magnet G^{14}, energizing said magnet so as to complete the circuit through the battery G^{10}, thence by conductor G^{18} to tube G^4, thence through mercury and conductor G^{19} to fence wire 6, thence by wire H^{21} to wire H^{22}, thence through mercury in tube H' to conductor H^{26}, thence through conductor H^{37} to tube H^2, thence through conductor H^{17} to magnet H^{14}, energizing said magnet so as to complete the circuit through the battery H^{10}, thence by conductor H^{18} to tube H^4, thence by conductor H^{20} to ground and thence back to generator. When the magnet G^{14} is energized it attracts its armature G^{11} and completes the circuit through the battery G^{10}. There will be several circuits from said battery and they may be traced as follows: from battery G^{10} to armature G^{11}, thence through contact G^{13} and conductors G^{15} and G^8 to magnet G^7, thence by wire G^9 back to battery. When magnet G^7 is energized it attracts its armature G^5 and causes it to engage the bar G by the notches on the end of each and hold said bar from being moved back to its normal condition by the spring G^{36}. After the train has passed a second circuit through battery G^{10} is as follows: from battery through armature G^{11}, contact G^{13} and conductor G^{15} to armature of electric motor I', thence by wire G^{16} back to battery. When the current is completed through the motor I', and lamp I^9 said motor revolves and by means of rope I^3 and drum I^4 (see Fig. 4) moves the semaphore I^5 from its vertical position to a position at an angle of forty-five degrees with the vertical position as shown in dotted lines. When the semaphore has been moved through an angle of forty-five degrees, its further motion is prevented by the pawl I^{14} engaging the lug I^{12}. The pulley I^6 is revolved at the same time and by means of the belt I^7 revolves the lamp I^9 so as to show a white light. This semaphore acts as a rear signal for the train that has just entered the block and shows a following train that there is a train in the block ahead. In the meantime, as we have seen above, the electro-magnet H^{14} is also energized so as to complete the circuit through the battery H^{10}. The circuits through said battery are similar to the circuits through battery G^{10} and hence need not be traced. The action of the semaphore apparatus in this case will also be the same as that described above and the semaphore will be at an angle of forty-five degrees with the vertical and will act as a forward signal for the oncoming train. The lamp J^9 will be revolved so that it will show a red light forward to warn a train coming in the opposite direction, when the signals are used on a single track. When the train comes opposite the bar H, said bar will be moved in the direction of the arrow, as has been described above in relation to bar G. When the tube H' is in a horizontal position, the circuit will be momentarily broken on account of the arrangement of the four contacts in tube H'. This will cause the circuit through the magnet G^{14} to be broken and the spring G^{12} will move the armature G^{11} so as to break the circuit through battery G^{10} and allow the semaphore I^5 to drop. The magnet G^7 will then be demagnetized and the spring G^6 will move the armature G^5 so as to release the bar G and allow the spring G^{36} to pull said bar back to its normal position. The mercury in the tubes H' H^2 H^3 and H^4 will now be in the position designated by the dotted lines and the circuits will be similar to those traced above in connection with the tubes G' G^2, &c., and the semaphore J^5 which has momentarily dropped on account of the breaking of the motor circuit will be again moved to a forty-five-degree position and act as a rear signal for the train. Suppose now a second train enters the block which the first train has just left. The semaphore J^5 which is now acting as the rear signal for train No. 1, must also act as a forward signal for train No. 2. If the said semaphore remained at a forty-five-degree position it would not warn train No. 2 that there was a train in the block ahead of it. This difficulty is avoided in the following manner:

When train No. 2 moves the tubes G′ G² G³ G⁴ so that the mercury takes the position shown by the dotted lines, the circuits will be the same as described in connection with train No. 1 until conductor H²² is reached, *i. e.*, starting with fence wire 7, by conductor G³³, through tube G³, &c., to fence wire 6, thence through conductors H²¹ and H²², thence through conductor H²⁴, mercury in tube H′, wire H²⁵ to wire H²⁶, thence by wire H³⁷ to tube H², thence by wire H³³ to magnet H²⁹, thence by wire H³⁴ to ground. When magnet H²⁹ is energized it attracts its armature H²⁸ so as to make contact between said armature and the contact H³⁰ and also between the two contacts H²³ and H²⁷. The completion of the circuit between the latter two contacts cuts out the tube H′ and connects conductors H²² and H²⁶. When contact is made between the armature H²⁸ and contact H³⁰, a circuit is completed through the battery H¹⁰ as follows: from battery to armature H¹¹, thence through wire H³¹, contact H³⁰, armature H²⁸ and wire H³⁵ to electro-magnet J, thence to wire H¹⁶ and back to battery. When magnet J is energized it attracts its armature to the pawl J¹⁴ and moves said pawl so it will be free from the lug J¹². The motor J′ is now free to move the drum J⁴ and semaphore J⁵ until the pawl J¹⁴ comes in contact with the large lug J¹³. The latter lug is of such size that the pawl engages it even when attracted by the magnet J. The semaphore is now at right angles to its normal position and the lug J¹⁸ being now in contact with its associated brush, the circuit is completed through the lamp J²¹ and a red danger signal is shown. The lamp J⁹ is revolved so as to also show a red light to the rear. It will be understood that this lamp J⁹ which shows a red light in one direction and a white light in the other direction, always shows a red light forward when the semaphore is at an angle of forty-five degrees (45°) and to the rear when the semaphore is at an angle of ninety degrees (90°) and would of itself be sufficient, the lamp J²¹ being used only as an additional precaution to prevent trouble in case the lamp J⁹ fails to work. When the semaphore is in this position and the danger signal shown, the engineer knows that there is a train in the block ahead. When train No. 1 reaches the end of its block, the circuit through magnet H¹⁴ is broken in the same manner as was the circuit through magnet G¹⁴ so as to demagnetize magnet H⁷ and allow the tubes H′, H², H³ and H⁴ to be brought back to their normal position. The current is now broken through magnet H²⁹ and diverted so as to pass through magnet H¹⁴. This change is brought about by the arrangement of contacts in the tube H². The contact in the left end of said tube is bent downwardly so that the current can be changed from conductor H³³ to H¹⁷ without being interrupted, for if it were interrupted tubes G′ G², &c., would be brought back to their normal position while train No. 2 was still in the block and then the semaphore I⁵ would cease to act as its rear signal and a third train following train No. 2, would not be warned as to the position of No. 2. When the circuit is broken through magnet H¹⁴, the circuit is also broken through the motor J′ by spring H¹² and semaphore J⁵ drops to its normal position and the red light J²¹ is extinguished and as the current is changed from magnet H²⁹ to magnet H¹⁴, the circuit through the motor is again completed and the semaphore brought to the forty-five degree position and acts as a forward signal for train No. 2.

If when a train passes a semaphore and it is neither at the forty-five degree or ninety-degree position, the train crew know the signals are out of order and can tap on to the fence wire and telephone or telegraph to the station and get or give information as the case may be.

It will be seen that I have here a system of signals that will show each train the exact condition of the track ahead, and will also make the fact of any trouble or disorder in the system known to the trains as they pass along.

Fig. 5 shows a double track equipped with my system of signals. The left hand track shows the position of the semaphores when one train is on the track and the right hand track shows the position of the semaphores when two trains are in adjoining blocks.

I claim—

1. The combination with an electric fence and a system of railway signals of a combined motor and generator having three armatures on one shaft and connections whereby the two generator armatures supply current for the fence and system of signals, substantially as described.

2. The combination in a block system of a railway track divided into sections, a signal at the end of each section operated by an electric device, the signal between any two adjoining sections being acted upon through the same motor mechanism by each of two trains, when they are in said adjoining sections, the action of the last or rear train causing the signal to take a position different from that due to the first train.

3. The combination in a block system, of a railway track divided into sections, a signal at the end of each section operated by an electric device and a series of switches and connections so arranged that as a train leaves a section, the signal at the rear end of the section just left is brought to normal position and the signal at the forward end of the section just entered is set, and the signal between the two sections remains set, and means by which the last mentioned signal is moved to a different position when a train enters the rear section before the forward section is clear, substantially as described.

4. The combination in a block system, of a track divided into sections, a signal at the end of each section, electric motors for oper-

ating said signals, a circuit changer at the end of each section operated by the passing trains, and a system of circuits and electro-magnets so arranged that when one of said circuit changers is moved by a passing train, a circuit will be completed through an electro magnet which closes the motor circuit of the corresponding signal; through a second electro-magnet which holds said circuit changer in its new position and through a third electro-magnet which completes the circuit of the motor operating the next forward signal.

5. The combination in a system of railway signals, of a signal operated by an electric device in an independent circuit, hermetically sealed tubes containing mercury, and having the air exhausted therefrom, suitable contacts sealed into said tubes, electro-magnets in circuit with said tubes and means whereby a passing train rocks said tubes so as to change the circuits and energize the magnets, causing one of said magnets to close the independent circuit and operate the signal, and the other magnet to hold said tubes in their changed position, substantially as described.

6. In a switch actuating device for a system of railway signals, the combination of a railway rail, two flat pieces associated with said rail and pivoted at opposite ends, a bell crank lever pivoted on each of the adjacent ends of the said pieces so that the horizontal arm of the lever of one piece projects beneath the end of the other piece, substantially as described.

7. In a switch actuating device for a system of railway rails, the combination of a railway rail, two flat pieces associated with said rail and pivoted at opposite ends, a bell crank lever pivoted on each of the adjacent ends of the said pieces so that the horizontal arm of the lever of one piece projects beneath the end of the other piece, a pivoted "T" shaped piece beneath the vertical arms of the bell crank levers, said "T" shaped piece connected to the reciprocating rod, provided with the enlarged beveled pieces K^{11} K^{11} in proximity to similar pieces K^{13} K^{13} on the bars G, whereby said bars G are moved when a train passes along the track, substantially as described.

8. The combination in a block system, of a track divided into sections, a signal at the end of each section, electric motors for operating said signals, a circuit changer at the end of each section operated by the passing trains, and a system of circuits and electro-magnets so arranged that when one of said circuit changers is moved by a passing train, a circuit is completed through an electro-magnet which closes the motor circuit of the corresponding signal; a second circuit is completed through an electro-magnet which holds said circuit changer in its new position and a third circuit is completed through an electro-magnet which closes the circuit of the motor operating the next forward signal; and the circuit is broken through an electro magnet, which holds the first circuit closer to the rear, in the position to which it was moved by said train, allowing said circuit changer and corresponding signal to regain their normal position.

9. The combination in a system of railway signals, of a semaphore operated by means of an electric motor and drum, a piece attached to said drum provided with two lugs of unequal length, a pawl adapted to engage the lugs to limit the motion of the drum, an electro-magnet in proximity to said pawl and connections whereby said magnet is energized when two trains are in adjacent sections so as to attract said pawl, free it from its engagement with the short lug and allow a further movement of the drum, substantially as described.

10. A system of railway signals comprising a number of circuit changers each circuit changer consisting of a series of hermetically sealed tubes containing mercury and having the air exhausted therefrom, suitable contacts sealed into said tubes, means associated with said tubes by which they are rocked by a passing train, each circuit changer being connected to a common source of electrical supply in such a manner that as they are successively rocked, the movement of one of said circuit changers causes the preceding one to be moved to its normal position.

DAVID H. WILSON.

Witnesses:
WALTER J. GUNTHORP,
ALICE H. GEDDES.