No. 826,256. PATENTED JULY 17, 1906.

C. M. KIRWAN.

RAILWAY BLOCK SIGNAL SYSTEM.

APPLICATION FILED APR. 18, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

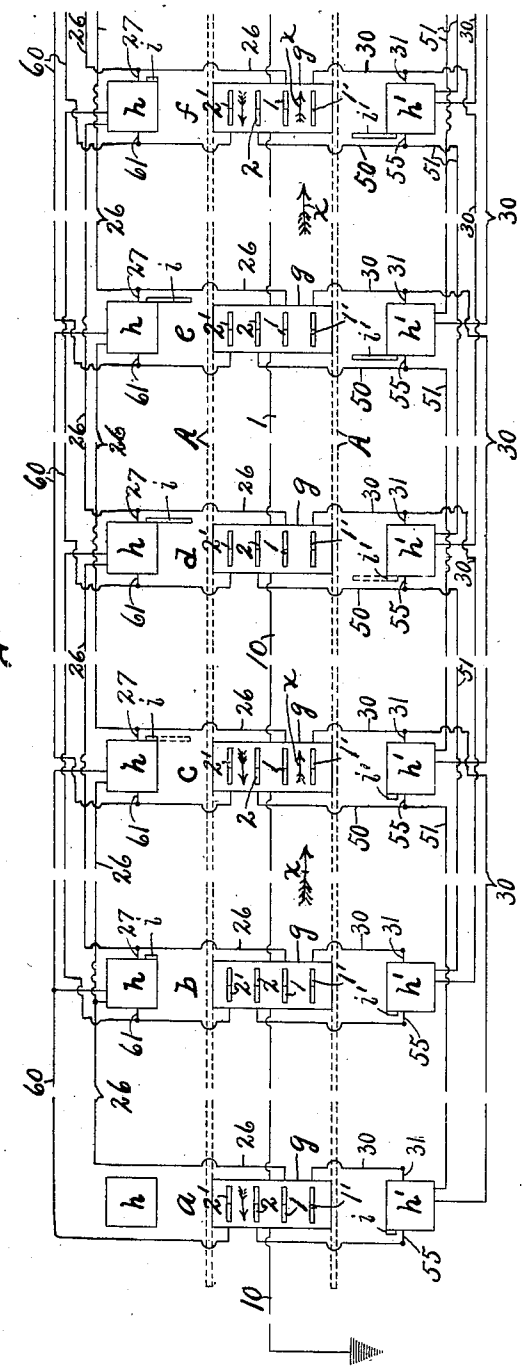
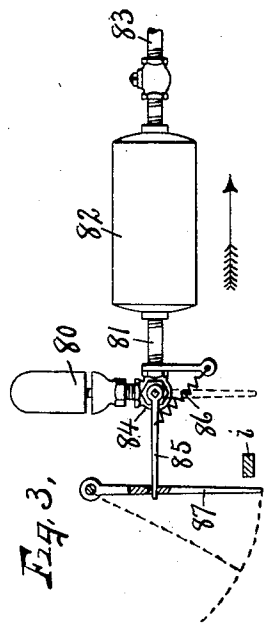


Fig. 3.



WITNESSES:

B. E. Robinson.

R. M. Wheeler

INVENTOR:

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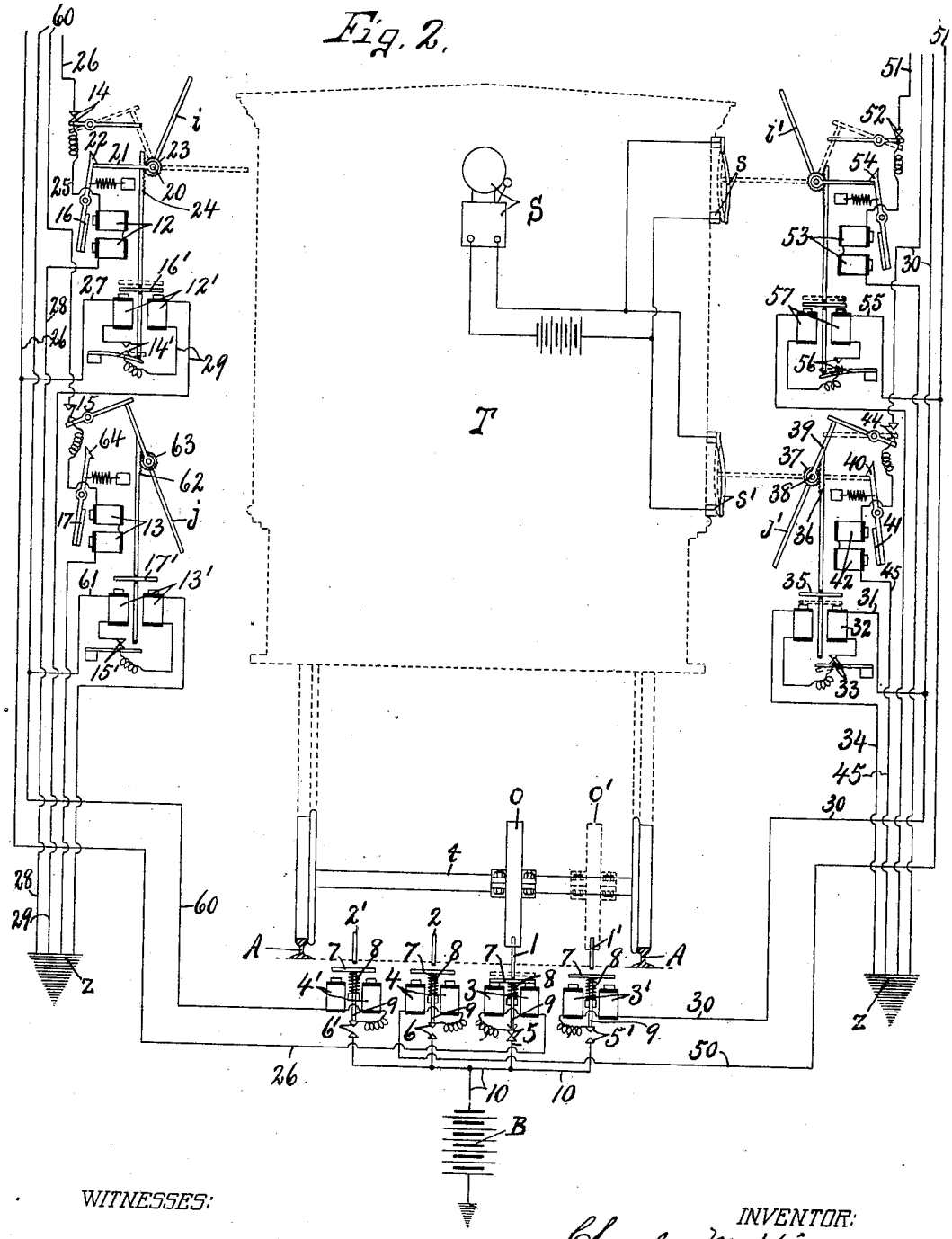
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

CHARLES M. KIRWAN, OF BALDWINSVILLE, NEW YORK.

RAILWAY BLOCK-SIGNAL SYSTEM.

No. 826,256. Specification of Letters Patent. Patented July 17, 1906.

Application filed April 18, 1905. Serial No. 256,263.

To all whom it may concern:

Be it known that I, CHARLES M. KIRWAN, of Baldwinsville, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Railway Block-Signal Systems, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to improvements in railway block-signal systems in which the railway is divided into blocks by a series of stations which are spaced a suitable distance apart and are each provided with movable signal-arms which are brought into action by the moving train to prevent "head-on" or "rear-end" collisions.

One object is to provide means whereby the moving train causes the successive operation of one or more of the signal-arms at one or more stations in advance and at the rear of the moving train to operate an alarm or signal in the engineer's cab of an approaching or following train, so that the engineers of such trains may be warned of the presence of a train somewhere in the block ahead.

Another object is to provide means, also brought into action by the moving train, for successively restoring the previously-operated signal-arms to their normal inoperative positions.

These or other more specific objects will be more clearly brought out in the following description.

In the drawings, Figure 1 is a diagrammatic plan of a portion of my improved railway block-signal system, showing in this instance a series of six stations. Fig. 2 is a diagrammatic end elevation of the parts of one of the stations, showing a car or train in dotted lines. Fig. 3 shows a modified form of alarm.

In Fig. 1 of the drawings, I have shown a portion of my improved block-signal system comprising a series of six stations *a*, *b*, *c*, *d*, *e*, and *f*, which are spaced a suitable distance apart along the line of railway A and are electrically connected in such manner that a train moving in one direction will cause the operation of a signal-arm *i* at the next station but one ahead of the train, thereby maintaining two signal-arms in operative position in advance of the train and at the same time causing the successive restoration of the signal-arm of each station while the train is passing such station. This moving train also causes the operation of a signal-arm *j* at the station just passed and restores the signal-arm *j* at the next station but one at the rear of the moving train, thus maintaining two signal-arms in operative position at the rear of such train. Each station is therefore provided with two pairs of signal-arms *i* and *j* and *i'* and *j'*, one pair at each side of the track, the arms *i* and *i'* being shown in Fig. 2 as located above the arms *j* and *j'* and serve to operate an alarm, as S, in the engineer's cab, as T, of an approaching train, while the signal-arms *j* and *j'* serve to operate in the same manner a similar alarm in the cab of a following train.

The mechanisms for operating the signal-arms for each station are substantially the same for trains moving in either direction, and I will therefore describe the mechanisms at one station, together with the means on the engine for bringing such mechanism into action.

The front end or engine of each train is equipped with a contact device, as a small wheel *o*, Fig. 2, which is preferably secured to one of the axles, as *t*, of the front engine-truck, while a similar contact device *o'* (shown by dotted lines in Figs. 2) is secured at one side of the line of travel of the wheel *o* to one of the car-axles (not shown) at the rear end of the train.

The contact device *o* controls the action of the signal-arms *i* at the left and in advance of the moving train, and the contact device *o'* controls the action of the signal-arms *j'* at the right and rear of said train.

Each station is provided with two pairs of spring contact-shoes 1 1' and 2 2', which are located side by side between the rails of the track A and are preferably mounted on a suitable supporting-case *g*, so as to project slightly above the surface of the road-bed into the path of the moving contact devices *o* and *o'*, respectively. The shoes 1 and 1' are therefore successively engaged and depressed by the contact devices *o* and *o'* as the train moves in the direction indicated by arrow X, Fig. 1, while the shoes 2 and 2' are engaged and depressed by the same devices *o* and *o'* when the train is moving in the opposite direction.

The casing *g* is located between the rails of the track A directly beneath the spring-shoes 1 and 1' and 2 2' and contains a series of in this instance four electromagnets 3 3' and 4

4′, one for each contact-shoe, and a corresponding number of electric switches or circuit-closers 5 5′ and 6 6′, one for each of the electromagnets above mentioned.

Each electromagnet is provided with an armature 7, which is normally held up away from the poles of its magnet by a suitable spring 8, and is connected by a rod 9 to the movable member of its corresponding electric switch in the casing *g*.

Each of the electric switches 4 4′ and 5 5′ of each station is electrically connected to a main conductor 10 or source of electric energy B and is also electrically connected to its corresponding electromagnet in the casing *g*.

At each station I provide two towers or upright casings *h* and *h*′, one at each side of the track, and in and upon each tower are mounted two pairs of electromagnets 12 12′ and 13 13′ and a corresponding number of electric switches or contact make-and-break devices 14 14′ and 15 15′, the electromagnets 12 12′ and 13 13′ being provided, respectively, with armatures 16 16′ and 17 17′.

The signal-arm *i* is secured to the rock-shaft 20 on the tower *h* and has a finger 21, which is normally engaged by a catch 22 for holding the signal-arm *i* in its up or normal inoperative position, as seen in Fig. 2. The catch 22 is mounted on the armature 16 of the magnet 12 and is arranged so that when this armature 16 is actuated by the energizing of its magnet 12 the catch 22 is moved to release the signal-arm *i*, which drops by gravity to the horizontal position shown by dotted lines, Fig. 2, and at the same time elevates the finger 21 into engagement with the movable member of the electric switch 14 to open said switch and break the circuit through the magnet 12.

All of the signal-arms *i i*′ and *j j*′ of each station are normally held in their inoperative positions, as seen in full lines, Fig. 2, when no trains are moving along the track, and therefore the switch 14 of each station is normally closed by the gravity of its movable member or by other means if desired.

The rock-shaft 20 is provided with a pinion 23, which meshes with a toothed rack 24, and this toothed rack carries the armature 16′ of the magnet 12′, and has its lower end engaged with the movable member of the switch 14′, said member being spring-actuated to close the switch 14′, but is normally held open by the toothed rack 24 and catch 22 for a purpose presently described.

One terminal of the switch 14 is connected by a wire 25 to the magnet 12 and the other terminal is connected by a wire 26 to the electromagnet 5 at the second station ahead, or, in other words, assuming that Fig. 2 represents station *c* and that the train is moving from station *a*, then the electromagnet 5 at station *a* is connected by the wire 26 to one terminal of the switch 14 at station *c*, the magnet 5 at station *b* is connected by a similar wire 26 to the switch 14 at station *d*, and so on, the magnet 5 of each station being connected by a wire 26 to the next station but one in advance in the direction of the moving train, (indicated by arrow X.) Now if the head of the train is at, say, station *a*, so that the part *o* closes the switch 5, an electric circuit will be established through the electromagnets 3 and 12 of stations *a* and *c*, respectively, thereby energizing the magnets 3 to hold the armature 6 down until the armature 16 is attracted and its catch 22 moved by the magnet 12 to release the signal-arm *i* at station *c*, which arm drops by gravity and causes the finger 21 to engage and open the switch 14, thereby breaking the circuit through the electromagnet 12 and at the same time causing the elevation of the toothed rack to permit the closing of the switch 14′ at station *c*.

When *a* is a terminal station, as shown in Fig. 1, it is electrically connected to station *b* in the same manner as described above for station *c*, thereby causing the operation of the signal-arm *i* at both stations *b* and *c* when the switch 5 at station *a* is closed, the signal-arms *i i*′ and *j j*′ and their controlling means at the terminal station *a* being unnecessary, and are therefore omitted. It is now clear that two signal-arms *i* at the left and in advance of the moving train at stations *b* and *c* are down or in operative position to engage and close an electric switch, as *s*, Fig. 2, on the engine of an approaching train to operate its alarm, as an electric bell S, Fig. 2, and that as the moving train reaches each station successively it causes a signal-arm *i* at the second station ahead to be thrown down, thereby maintaining the signal-arms *i* of two stations ahead in position to warn an approaching train of the presence of a train ahead. As the head of the train reaches each station—say station *b*—its signal-arm *i*, which was previously allowed to drop by the operation of its catch 22 from station *a*, is restored to its normal up position by the closing of the switch 5 at station *b*, whereby a circuit is closed through a wire 27, leading from the wire 26 and in which the local magnet 12′ and switch 14′ are connected, thereby energizing the magnet 12′ to draw down the armature 16′ and its rack 24 and rock its signal-arm *i*′ up to its normal position until engaged and held by its catch 22, as shown by full lines, Fig. 2. As the signal-arm *i* is restored the switch 14′ is opened by the descent of the rack 24, thereby breaking the circuit through the magnet 12′, while the switch 14 of the same station is closed for completing the circuit through the magnets 12 when the switch 5 at the station *a* is again closed by a following train, the circuits from the magnets 12 and 12′ being completed to the ground 2 by wires 28 and 29.

I have now described the means for throw-

ing down the signal-arms *i* in front of a moving train and for restoring and holding said arms to their normal positions, and I will now describe the means for operating the signal-arms *j'* at the rear and at the right of said train. For this purpose each station is provided with the electromagnet 3' and switch 5', which is adapted to be closed by the contact device *o'* on the rear end of the train moving in the direction indicated by arrow *x*, Fig. 1, to close the electric circuit through wires 30 and 31, thence through an electromagnet 32 and switch 33 and wire 34 to the ground *z*, this circuit being completed at the station where the switch 5 is closed for elevating the arm *j'* into position to engage an electric switch, as *s'*, of a following train to operate an alarm, as S, in said following train. There being no need for a signal-arm *j* at the terminal station *a*, such arm, together with its operating mechanism, is omitted, and for convenience of description the rear end of the train moving from station *a* may be assumed to be at station *d*, with the contact device *o'* in position to close the switch 5' at said station. Then the circuit from the main feed-wire 10 is closed through the wires 30 and 31, magnet 32, switch 33, and wire 34 to the ground, thereby energizing the magnet 32 and drawing down its armature 35, to which is attached a toothed rack 36. This rack 36 meshes with a pinion 37 on a rock-shaft 38, which carries the signal-arm *j'* and a finger 39, and as this arm is normally down by its own gravity it is evident that when the magnet 32 is energized to draw its armature 35 it also draws the rack 36 down, and thereby rotates the pinion 37 and rock-shaft 38 to elevate the signal *j'* to the position shown by dotted lines, Fig. 2, ready to cause the operation of an alarm, as *s'*, in a following train. When the arm *j'* is thus elevated, its finger 39 interlocks with a movable catch 40, which is mounted upon an armature 41 of an electromagnet 42, with which each, except the terminal station, is provided, the arm *j'* being held in this position by the catch 40 until released by the energizing of the magnet 42, which is only accomplished, as at station *d*, when the member *o'* closes the switch 5' two stations ahead, or at station *f*, or, in other words, when the contact member *o'* is closing the switch 5' at station *d* a circuit is established through the wire 30, switch 44, and magnet 42 of station *b*, which magnet is grounded by a wire 45. This energizes the magnet 42 at station *b* to attract its armature and draw its catch 40 from holding engagement with its finger 39, thereby allowing its signal-arm *j'* to drop by gravity to its inoperative position, as shown by full lines, Fig. 2. As the signal-arm *j'* falls its finger 39 engages and opens the electric switch 44, and thereby breaks the circuit through its corresponding electromagnet 42, this switch 44 remaining open until the signal-arm *j* is again operated by the energizing of the magnet 32, as previously described.

The electric switch 5 and magnets 3 at station *a* are connected by the wire 26 to the electric switches 14 and at magnets 12 at stations *b* and *c* to cause the release of the signal-arms *i* at the latter stations. The electric switch 5 and magnets 3 at station *b* are connected by a second wire 26 to the switch 14 of station *d* to cause the release of the signal-arm *i* at the latter station and is also connected by a wire 29 to the switch 14' and magnet 12' at its own station *b* to cause the restoration of its signal-arm *i* to its normal inoperative position. In like manner and for similar purposes the magnet 3 of a station *c* is connected by a third wire 26 to the switch 14 and magnet 12 of station *e* and by a wire 29 to the switch 14' and magnet 12' of its own station *c*. The magnet 3 of the station *d* is connected by a fourth wire 26 to the magnet 12 of station and also by a wire 29 to its own magnet 12' and the magnet 3 of station *e* by a fifth wire 26 to the magnet 12 of the next station from *f* and to its own magnet 12' by a wire 29, and so on. To operate the signal-arms *j'*, the magnet 3 and its switch 5' of each station are connected by wires 30 and 31 to the magnets 32 and switch 33 of its own station to bring said arm *j'* into operative position, and are also connected by wires 30 and 43 to the switch 44 and magnet 42 of the next station but one back of the one where the arm *j'* is moved to its operative position to release the raised arm *j'* at said back station and allow it to gravitate to its inoperative position. For example, one wire 43 leads from station *c* to station *a*, a second wire 43 from station *d* to station *b*, a third wire 43 from station *e* to station *c*, a fourth wire 43 from station *f* to station *d*, and so on. Now if the train is moving in the opposite direction, or from station *f* toward station *a*, the contact devices *o* and *o'* will be in position to engage and depress the shoes 2 and 2', respectively. If the switch 6 at station *f* is closed by the contact device *o*, a circuit will be closed through the magnet 4 at station *f*, and thence by wires 50 and 51 through a switch 52 and magnet 53 at station *d*, thereby operating a catch 54 and releasing the signal-arm *i'* at said station *d*, and at the same time opening its switch 52 and closing a local circuit from the wire 50 through a wire 55, switch 56, and magnet 57 at its own station *f* to restore its arm *i'* to its normal inoperative position. Now as the train continues to move from station *f* toward station *a* the contact device *o'* operates to close the switches 6' of the successive stations, thereby successively closing the local circuit through the magnets 4', wires 60, magnets 13', and switches 15' and elevating the signal-arm *j* through the medium of a rack 62 and pinion 63, similar to the rack 36

and pinion 37 for the arm j', the arm j being held up by a catch 64. This causes the opening of the local switch 5′ by the depression of the rack 62 and allows the closing of the switch 15 to close a circuit through the wire 60 and through the magnet 13 at the station back of the one where the switch 6′ is closed. For example, if the switch 6′ at station d is closed the circuit is then closed through the magnet 13′ of said station and also through the magnet 13 of station, thereby elevating the signal-arm at station d and restoring the one at station f to its normal position. The electromagnets 13 and 13′ are grounded at z by wires 34′ and 45′ and the magnets 53 and 57 are grounded at z by wires 28′ and 29′.

I have now clearly shown and described a means for carrying out the main object of my invention—viz., to provide means brought into action by a moving train to throw out one or more arms at some distance ahead and also to throw out additional arms immediately in the rear of the train, whereby an alarm of an approaching train is brought into action and audibly warn the engineer of the latter train of the proximity of a train ahead.

I do not confine myself to the operation of a bell alarm, and in Fig. 3 I have shown a whistle 80 as connected by a conduit 81 to a steam or compressed reservoir 82, to which fluid under pressure may be supplied through a pipe 83.

The conduit 81 is provided with a valve 84, having an operating-lever 85, which is held in position to close the valve and against action of a spring 86 by a movable detent 87. This detent 87 is preferably hinged at one end and its free end projects into the path of one of the out-thrown arms i, j, or i' or j', as the case may be, and is tripped by contact with said arm, thereby releasing the lever 85 and allowing the spring to operate said lever to close the valve 84 and permit the steam or compressed air to operate the whistle 80, it being understood that the parts 80 to 87, inclusive, are placed upon the engine or other part of the train to take the place of the electric alarm S and contacts s and s' (seen in Fig. 2) and that these contacts s and s' are substituted by the detents 87 and valve-operating levers 85. Otherwise the operation is fully set forth in the foregoing description.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a railway block-signal system, a series of stations spaced a considerable distance apart and dividing the railway into blocks, each station being provided with a movable signal-arm, and means at each station brought into action by a moving train to cause the operation of a signal-arm at a station ahead of the train, and additional means at each station brought into action by the moving train to restore said arm to its normal inoperative position when the train reaches such station, an additional signal-arm at each station and means brought into action by the moving train for causing the operation of said additional arm at the station which the train has just passed, and further means for restoring said additional arm to its normal position when the train reaches a station ahead.

2. A railway block-signal system comprising a series of stations dividing the railway into blocks, each station having a pair of signal-arms, one at each side of the track, separate electric circuits each including an electric switch and means for controlling the operation of one of said arms, whereby the signal-arms at one side of the track are caused to move to their operative positions in advance of the moving train while the other arms are caused to be moved to their operative positions at the rear of the train, and separate devices on the train for closing said switches.

3. In a railway block-signal system, a series of stations dividing the railway into blocks, and each provided with a signal-arm, an electromagnet and a normally open electric switch, the switch of one station being electrically connected to the electromagnet of another station, a movable catch for each signal-arm to hold it in its inoperative position, an armature for each electromagnet connected to trip said catch and release its signal-arm, and means on the moving train for closing the switch of each station when the train reaches such station and a signal on an approaching train controlled by said arm.

4. In a railway block-signal system, a series of stations dividing the railway into blocks and each provided with a signal-arm, an electromagnet and a normally open electric switch, the switch of one station being electrically connected to the electromagnet of its own station, means on the train to close one switch at a time, and additional means brought into action by the energizing of the magnet to operate its signal-arm and a signal on an approaching train controlled by said arm.

5. A railway block-signal system comprising a series of stations dividing the railway into blocks, each station having a movable signal-arm, a normally open electric switch, and separate electromagnets, each switch being electrically connected to one of the magnets of its own station and to the other magnet of a distant station, and means brought into action by a moving train to close the switch of each station successively to energize the magnets in circuit with the closed switch, each energized magnet causing the operation of its signal-arm and a signal on an approaching train controlled by said arm.

6. A railway block-signal system comprising a series of stations dividing the railway into blocks, each station having a movable

signal-arm, a normally open electric switch, and separate electromagnets, each switch being electrically connected to one of the magnets of its own station and to the other magnet of a distant station, and means brought into action by a moving train to close the switch of each station successively to energize the magnets in circuit with the closed switch, one energized magnet causing its signal-arm to be thrown to its operative position, and the other energized magnet causing its arm to be restored to its normal position and a signal on an approaching train controlled by said arm.

7. A railway block-signal system comprising a series of stations dividing its railway into blocks, each station having separate normally open electric switches and a pair of movable signal-arms, one on each side of the railway, and each arm having associated therewith a pair of electromagnets, each switch of each station being electrically connected to one of the magnets of each pair at that station and to one of the magnets of each pair at a distant station, separate devices brought into action by the moving train for closing the switches of each station successively for energizing the magnets in electrical connection with the closed switches, separate holding devices for the signal-arms, said holding devices being tripped by the energizing of one of the magnets of each pair, whereby the released arms are caused to move in one direction.

8. A railway block-signal system comprising a series of stations dividing its railway into blocks, each station having separate normally open electric switches and a pair of movable signal-arms, one on each side of the railway, and each arm having associated therewith a pair of electromagnets, each switch of each station being electrically connected to one of the magnets of each pair at that station and to one of the magnets of each pair at a distant station, separate devices brought into action by the moving train for closing the switches of each station successively for energizing the magnets in electrical connection with the closed switches, separate holding devices for the signal-arms, said holding devices being tripped by the energizing of one of the magnets of each pair, whereby the released arms are caused to move in one direction, and means brought into action by the other energized magnets of each pair for causing the same signal-arms to move in the opposite direction.

In witness whereof I have hereunto set my hand this 4th day of March, 1905.

CHARLES M. KIRWAN.

Witnesses:
H. E. CHASE,
M. M. NOTT.