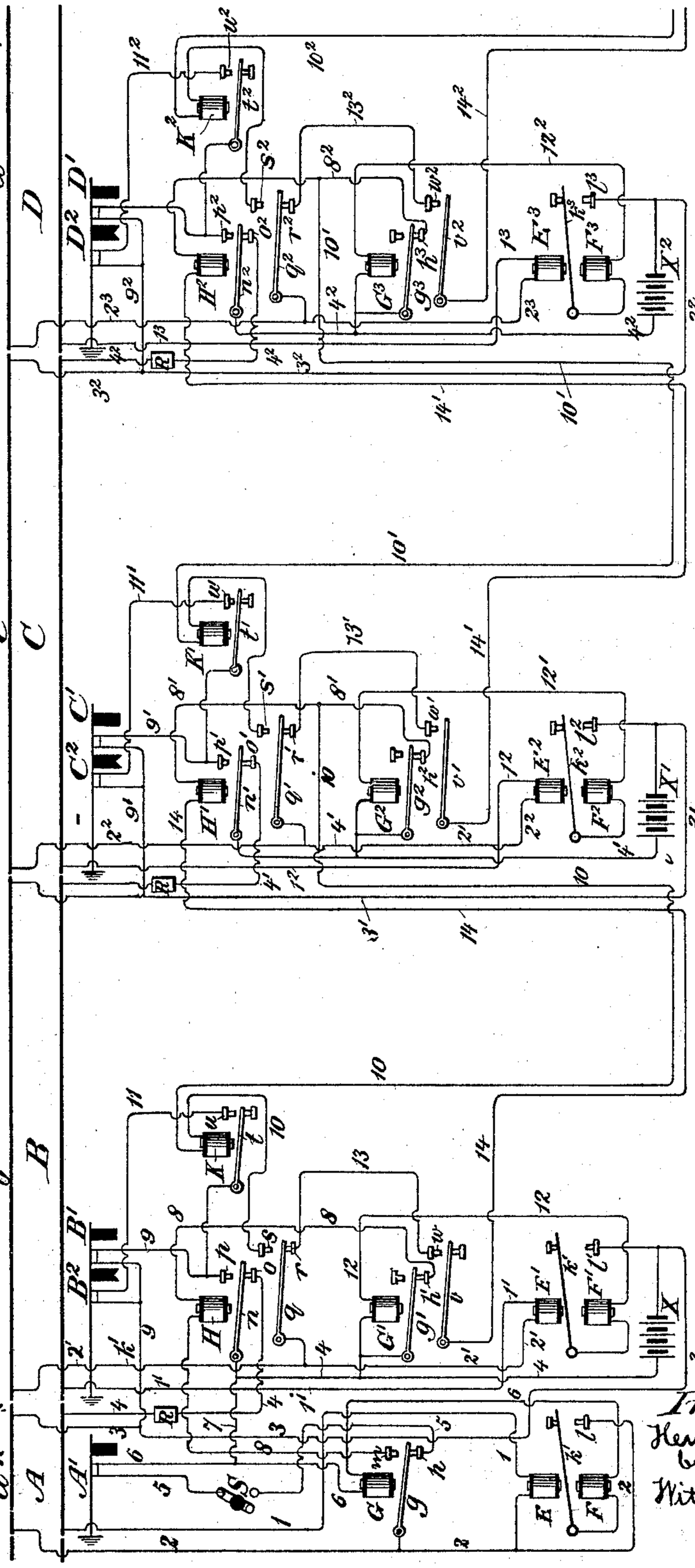
(No Model.)

H. BEZER.

RAILWAY SIGNALING SYSTEM.

No. 585,733. Patented July 6, 1897.



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RAILWAY SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 585,733, dated July 6, 1897.

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To all whom it may concern:

Be it known that I, HENRY BEZER, a subject of the Queen of Great Britain, and a resident of New Rochelle, in the county of Westchester and State of New York, have invented a new and useful Improvement in Railway Signaling Systems, of which the following is a specification.

This invention relates to railway signaling systems; and the object of the invention is to attain a higher degree of safety than has heretofore been attained in prior systems.

The invention consists principally in so arranging and connecting the signals that when a signal for a block remains at "safety" when it should go to "danger," owing to some failure, then the signal for the block immediately in the rear of said signal and the signal for the block immediately in advance of said signal will be locked at "danger."

It also consists in improved electric means for connecting a detaining-signal and a despatching-signal, so that the despatching-signal cannot go to "safety" until the detaining-signal has gone to "danger" and the detaining-signal cannot go to "safety" until the despatching-signal has gone to "danger."

It also consists in improved circuit connections for a track-circuit system whereby the track-circuit of a section is broken while a train is on the section after the advance-signal has been set to "safety," and in various minor improvements hereinafter shown and described.

The drawing shows a diagram of an electric signaling system embodying my invention, and in which the signals are controlled by track-circuits in the form of rail-circuits.

The track is suitably divided into blocks A B C D, &c., guarded by the signals A′, B′ B^2, C′ C^2, and D′ D^2, of which the signals B′, C′, and D′ are the home signals and the signals B^2, C^2, and D^2 are the distant signals for the blocks. The signal A′ may be termed a "detaining-signal" because it would be located near some starting-point for traffic, such as a station, and only a short distance, say a train's length or an engine's length, behind the signals B′ B^2, and the train would not advance past signal A′ till the signal A′ was put to "safety," say by a train-despatcher at the station. If the train should advance upon block A and the home signal B′ should then go to "safety," as it would if there were no train in the block B, the train could proceed. The signal B′ may therefore be called the "despatching" or "starting" signal with respect to the signal A′. The main purpose of the detaining-signal is to prevent a second or third of two or three trains that may be waiting for signal B′ to go to "safety" from advancing if the signal B′ should fail to return to "danger" behind the first train. The signals A′ and B′ are so interlocked by their controlling-circuits, as will hereinafter appear, that signal A′ cannot go to "safety" till signal B′ has gone to "danger" and signal B′ cannot go to "safety" for, say, the first train until signal A′ has gone to "danger" to detain the following train. The rails of the blocks at their rear ends are connected by the wires 1 2, 1′ 2′, 1^2 2^2, 1^3 2^3 to the track-magnets E, E′, E^2, and E^3 and at their advance ends by wires 3 4, 3′ 4′, 3^2 4^2 to the batteries X, X′, and X^2, the wires 4, 4′, and 4^2 from the batteries including the normally-closed contacts n o, n' o', n^2 o^2 and the resistances R. These circuits are the track-circuits in the form of rail-circuits, which operate or control the signal-circuits. The batteries energize not only the track-circuits, but also the signal-circuits, as will be shown. The purpose of this resistance R is to reduce the current from the strong batteries through the rails to the strength required for the rail-circuits.

The track-circuits are so combined with the signal-operating circuits, as will hereinafter appear, that after a train has shunted a track-circuit and thereby actuated the advance-signal to set the advance-signal at "safety" the track-circuit is broken, thus preventing further shunting of the battery-current while this train is on the section and effecting a great saving in battery-power.

The signal-circuits are preferably arranged as shown in the drawing, and can, perhaps, be most easily understood by describing their operation when a train passes over the track.

The signals and circuits being in their normal position, with the signals at "danger," as shown in the drawing, and, say, two trains waiting behind the signal A′ and ready to

start, the operation is as follows: The despatcher closes the switch S and completes the circuit for the signal A′, thereby enabling the signal to go to "safety." This circuit is as follows: from battery X, through wire 3, to rail *a* of the block A, wire 2, contacts *g h*, wire 5, signal A′, wires 6 and 7, wire 4, to battery X. The train now advances upon block A and shunts the track-magnet E, dropping the armature-contact *k* upon contact *l* and closing the normally open signal-circuit as follows: from X, through wire 3, rail *a*, wire 2, contacts *k l*, magnet F, wire 6, magnet G, wires 6 and 7, wire 4, to battery. A strong current from battery X is now employed to energize magnet F, and thereby to reinforce the weight of armature *k* and hold it firmly against contact *l* and pass through any dust that may be between them, and also to energize magnet G, thereby breaking the circuit for signal A′ and permitting it to go to "danger," and also closing contacts *g m* and completing circuit through magnet H as follows: from X, through wire 3, rail *a*, wire 2, contacts *g m*, wire 8, magnet H, wire 8, contacts *h′ g′*, wire 4, to battery X. This circuit through the magnet H is normally open at *g m*, and through the magnet H controls the circuit for the signals B′ B², which is now closed by armature-contact *n*, breaking from contact *o* and closing upon contact *p*. The breaking of contacts *n o* simply breaks the track-circuit through magnet E and prevents the magnet E from breaking contacts *k l*, so as to prevent signal A′ from going to "safety" until signals B′ B² have returned to "danger," but the breaking of this track-circuit also prevents further consumption of current through the shunting of the battery by the train. The closing of contacts *n p* enables the signal B′ to go to "safety" by closing the circuit as follows: from battery X, through wire 3, wire 9, signal B′, wire 9, contacts *p n*, wire 4, to battery. The magnet H also at the same time breaks armature-contact *q* from contact *r* and closes it upon *s*. The breaking of contacts *q r* locks signals C′ C² at "danger," as will be hereinafter explained, and the closing of contacts *q s* closes the circuit through magnet K, so as to close another circuit for the distant signal B². The circuit of the magnet K is as follows: from battery X′, through wire 3′, rail *b*, wire 2′, contacts *q s*, magnet K, wires 10 and 8′, contacts h^2 g^2, wire 4′, to battery X′, thereby energizing magnet K and closing contacts *t u*. This closes a branch from the circuit for the signal B′, already traced from battery X, this branch being from contacts *n p*, through contacts *t u*, wire 11, signal B², to wire 9, and on to battery X, and enables signal B² to go to "safety." The train now advances upon block B and first shunts the track-magnet E′. The armature *k′* thereupon closes with contact *l′*, closing the circuit through magnets F′ and G′ as follows: from battery X, contacts *l′ k′*, magnet F′, wire 12, magnet G′, wire 4, to battery. The contact of *k′* and *l′* are intensified and insured by magnet F′, and magnet G′ breaks contacts *g′ h′*, thereby deënergizing magnet H, which causes *n* to drop from *p* upon *o*, and *q* to drop from *s* upon *r*. The circuits through signals B′ B² are therefore broken and the signals go to "danger" behind the train. The break at *n o* being now closed, the track-circuit through the magnet E will, when the train has passed entirely off the block A, be again energized to break at *k l* the circuit through the magnet G. This restores *g* upon *h* and permits the signal A′ to go to "safety" for the next train. If, however, the despatcher wishes himself to continue to control this signal, he will have broken the circuit for the signal A′ at S and will close it when he is ready. It is to be noted here that whenever signals B′ B², or only B′, are at "safety" there is a break at *n o* through magnet E and that at such times magnets G and H will be energized and *g h* broken, so that the signal A′ will be held at "danger." Thus when B′ B² are at "safety" A′ is locked at "danger," and *n o* must close and B′ must go to "danger" before A′ can go to "safety." The train on block B, moreover, having closed *q r* and armature *v* upon contact *w*, closes a circuit as follows: from battery X′, wire 3′, rail *b*, wire 2′, contacts *q r*, wire 13, contacts *w v*, wire 14, magnet H′, wire 8′, contacts h^2 g^2, wire 4′, to battery X′. This circuit initiates the operation that enables the signals C′ C² to go to "safety" by energizing magnet H′. This magnet breaks *n′ o′*, thereby breaking the track-circuit of the section occupied by the train, and closes *n′ p′*, thereby completing the circuit for signal C′ from battery X′, through 3′, 9′, signal C′, *p′*, *n′*, 4′, to battery, so that C′ may go to "safety." It also closes *q′* and *s′* and completes circuit for magnet K′ from battery X², through 3^2, *c*, 2^2, *q′*, *s′*, K′, 10′, 8^2, h^3, g^3, 4^2, to battery X². Magnet K′ then closes *t′ u′* and completes circuit for signal C² by closing the branch from circuit for signal C², going through *n′*, *p′*, *t′*, *u′*, 11′, signal C², 9′, and on to battery X′. The signals C′ and C² are therefore enabled to go to "safety" as soon as the train enters block B. It is to be noted that these signals C′ C² could not go to "safety" while signals B′ and B² were at "safety." This is because magnet H′ must be energized to put signals C′ C² to "safety," and magnet H′ cannot be energized unless *q r* and *v w* are closed; but *q r* are always broken when signals B′ and B² are at "safety." When the signals B′ and B² are at "safety," therefore, the signal A′ in the rear and the signals C′ C² in advance are locked at "danger." The train now advances upon block C and shunts track-magnet E², closing at k^2 l^2 the circuit from X′, through l^2, K², F², 12^2, G², and 4′, to battery, breaking g^2 from h^2 and hence deënergizing magnet H′ and putting signals C′ C² to "danger." It also closes *q′* and *r′*, and *v′* and *w′* being already closed by

magnet G^2 circuit is closed from battery X^2, through 3^2, c, 2^2, q', r', $13'$, w', v', $14'$, H^2, 8^2, h^3, g^3, 4^2, to battery X^2, and signals D' D^2 will be enabled to go to "safety." If, however, a train should be already in block D, then track-magnet E^3 would have been shunted and circuit X^2 l^3 k^3 F^3 12^2 G^3 4^2 would have been closed, and consequently there would have been a break at g^3 h^3 and the signals D D' would have remained at "danger." Thus it is that a train in a block prevents a second train from putting to "safety" the signals guarding the first train. When the train entering the block C has entirely passed out of block B, the home signal B' can go to "safety," but the distant signal B^2 will remain at "danger" as long as the train is in block C. This is because the circuit through magnet K, which must be closed before signal C^2 can go to "safety," is broken at g^2 h^2 by train in C, because, as before stated, this train by shunting E^2 completes circuit through G^2. When the train enters block D, it operates upon the circuits for this block in the same way as in entering block C and enables signals D' D^2 to go to "danger" and the signals in advance to go to "safety." When the train has passed entirely out of block C, it has yielded up its control over signals B^2 and C', and these signals, and also B', can go to "safety" at the proper time for a following train, but distant signal C^2 will be held at "danger" until the train has passed beyond block D.

From the above description it will be evident that the detaining-signal A' and the despatching-signal B' are each controlled by a circuit make-and-break device in a circuit of the other signal. The circuit make-and-break device, including the contacts g m, controlled by the magnet G, breaks the circuit of the magnet H, thereby preventing that magnet from raising its armature and closing the contacts n p, and thus preventing the closing of the circuit which would permit the despatching-signal B' to go to "safety." The break at g m is caused by the movement which closes the contact g h, thereby closing the circuit of the detaining-signal A' and permitting that signal to go to "safety." So long therefore as the contacts g h are closed and consequently the detaining-signal A' is at "safety" the despatching-signal B' cannot go to "safety." The circuit make-and-break device, including the contacts n o, controlled by the magnet H, breaks the track-circuit through the magnet E, and thereby prevents the magnet E from breaking the contacts k l in the circuit of the magnet G, and thus prevents the dropping of the armature g and the consequent closing of the circuit, which would permit the detaining-signal A' to go to "safety." The break at n o is caused by the movement which closes the contacts n p, thereby closing the circuit of the despatching-signal B' and enabling that signal to go to "safety." So long as the contacts n p are closed and consequently the despatching-signal B' is at "safety" the detaining-signal cannot go to "safety." It will also be observed that the train-despatching switch S is in the circuit of the detaining-signal. It will also be observed that the track-circuit for each signal at the advance end of a block or section, as of the signal B' at the advance end of the section A, such circuit running from the battery X through wire 3, track a, wire 2, magnet E, wire 1, the other track, wire 4, contacts n o, and wire 4 back to battery X, includes a current-interrupter, as, in this instance, the contacts n o, under the control of the magnet H, interposed between the track and the source of electric current. The signal B' is actuated through the energization of the magnet H, and when the signal is thus actuated the contact at n o is broken, and thus the track-circuit is broken between the battery and the track and the electric current is shut off from the track while the train is on the section A after the advance-signal B' has been actuated. Thus further short-circuiting of the track-battery through the wheels and axles of the train is prevented by the responsive action of the signal.

It will be seen, as above described, that in accordance with this invention whenever a signal is at "safety" both the signal immediately in the rear and the signal immediately in advance are locked at "danger." For example, when signal C' is at "safety" contacts n' o' are broken and contacts q' r' are broken, so that signals B' and D' will be locked at "danger" and also the distant signals B^2 and D^2. This is the principal object of the invention. In all signaling systems some failure is possible, and in order to provide against the failure of a signal to indicate danger behind a train a rule of running has been adopted on some roads requiring an engineer when compelled to pass a signal at "danger" to proceed at "caution," and if the next signal is at "safety" he must take it as a caution-signal. If under this rule a train should be compelled to pass a signal at "danger," say signal B', and the signals were not locked in accordance with my invention, it would continue running at "caution" till it reached signal C', when if this signal were at "safety" it would continue at "caution," but upon the engineer's righting D' at "safety" he could put on speed. Suppose signal D' were out of order and remained at "safety" behind another train broken down or held by a danger-signal in block D. Then the following train, although proceeding at "caution" in block B, under the rule, and finding both C' and D' at "safety," due to failures on the part of these signals, would run at full speed into block D and probably collide with the train already in block D. This rule of running does not, therefore, afford the protection intended in case of such failures of the signals; but if the signals are interlocked in such a manner that when a signal is at "safety" not only the sig-

nal immediately in the rear, but also the signal immediately in advance is locked at "danger" in accordance with this invention then the protection desired will be assured. For example, suppose C′ were out of order and permanently indicating "safety." This failure as long as it lasted would hold B′ and D′ at "danger." If now a train compelled to pass D′ should stop in block D, then a following train, after waiting the time-limit, would pass B′ at "caution," and if running under the rule above indicated would pass C′ at "caution." It would find D′ at "danger," and if passing the signal at all would do so at "caution," and thus avoid collision with the train already in block D. Thus it will be seen that not even the above rule affords certainty of protection in case of two signals remaining at "safety" behind a train and that the interlocking of the signals in accordance with this invention is necessary to afford the protection desired.

If preferred, the wires 13, 13′, and 13^2 can be run through contacts of a commutator operated by the signal blades or disks, the contacts of the commutator being so arranged that they will open when the signals are at "safety," so as to lock the signals in advance at "danger," and will close when the signals are at "danger," so that the advance-signals may go to "safety." The wires 4, 4′, and 4^2 may also run through other contacts of the commutator, the contacts being so arranged as to separate when the signals are at "safety" to lock the rear signals at "danger" and to close when the signals are at "danger" to permit the rear signals to go to "safety."

So far as I am aware no system of signals, whether electric, manual, pneumatic, or of any other character, has been heretofore proposed in which a signal when at "safety" locked the signal immediately in the rear and the signal immediately in advance at "danger," and I do not therefore wish to be limited to an automatic, electric, automanual, or any other character of signaling system in accomplishing this result. Various means may be adopted for the purpose, various arrangements of circuits may be utilized, and various forms of signals may be employed without departing from the spirit of my invention.

What I claim, and desire to secure by Letters Patent, is—

1. In a block-signaling system for traffic in one direction only, a series of signals arranged in blocks, each intermediate signal of each overlapping group of three signals having locking means controlling the end signals of the group, whereby such intermediate signal locks such end signals at "danger" when it fails to go to "danger" behind a train, substantially as set forth.

2. In a block-signaling system, a series of signals arranged in blocks, each intermediate signal of each overlapping group of three signals having circuit make-and-break devices controlling the end signals of the group, whereby such intermediate signal locks such end signals at "danger" when it fails to go to "danger" behind a train, substantially as set forth.

3. In a block-signaling system, a series of signals arranged in blocks, circuit-controllers controlled by the operation of each intermediate signal of each overlapping group of three signals and controlling the circuits of the end signals of such group, whereby such intermediate signal locks such end signals at "danger" when it fails to go to "danger" behind a train, substantially as set forth.

4. In a block-signaling system, a series of signals arranged in blocks, train-operated means for controlling the circuits of said signals, and circuit-controllers controlled by the operation of each intermediate signal of each overlapping group of three signals and controlling the circuits of the end signals of each group, whereby such intermediate signal locks such end signals at "danger" when it fails to go to "danger" behind a train, substantially as set forth.

5. In an electric signaling system, the combination of a track-circuit, a signal-circuit controlling the operation of the signal, said signal-circuit including a pair of normally open contacts and also including a magnet controlling the said contacts, and another magnet in the track-circuit also controlling said contacts, whereby when the contacts are closed the signal-circuit magnet will be energized to make more certain the electrical connection between the contacts, substantially as set forth.

6. In a signaling system, a detaining-signal and a despatching-signal and electric circuits controlling said signals, said circuits including a circuit make-and-break device of the detaining-signal controlling the despatching-signal whereby the detaining-signal when in the "safety" position prevents the despatching-signal from going to "safety," and another circuit make-and-break device of the despatching-signal controlling the detaining-signal whereby the despatching-signal when in the "safety" position prevents the detaining-signal from going to "safety," substantially as set forth.

7. In a signaling system, a detaining-signal and a despatching-signal and electric circuits controlling said signals, said circuits including a circuit make-and-break device of the detaining-signal controlling the despatching-signal whereby the detaining-signal when in the "safety" position prevents the despatching-signal from going to "safety," and another circuit make-and-break device of the despatching-signal controlling the detaining-signal whereby the despatching-signal when in the "safety" position prevents the detaining-signal from going to "safety," and a train-despatching switch in the circuit of the detaining-signal, substantially as set forth.

8. In a block-signaling system, in combina-

tion, a track-circuit including a source of electric current, a current-interrupter interposed between the track and the source of electric current, a signal in proximity to the advance end of the block, and means for actuating said signal, said actuating means controlling said current-interrupter, whereby the electric current is shut off from the track while the train is on the section after the advance-signal has been actuated, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY BEZER.

Witnesses:

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