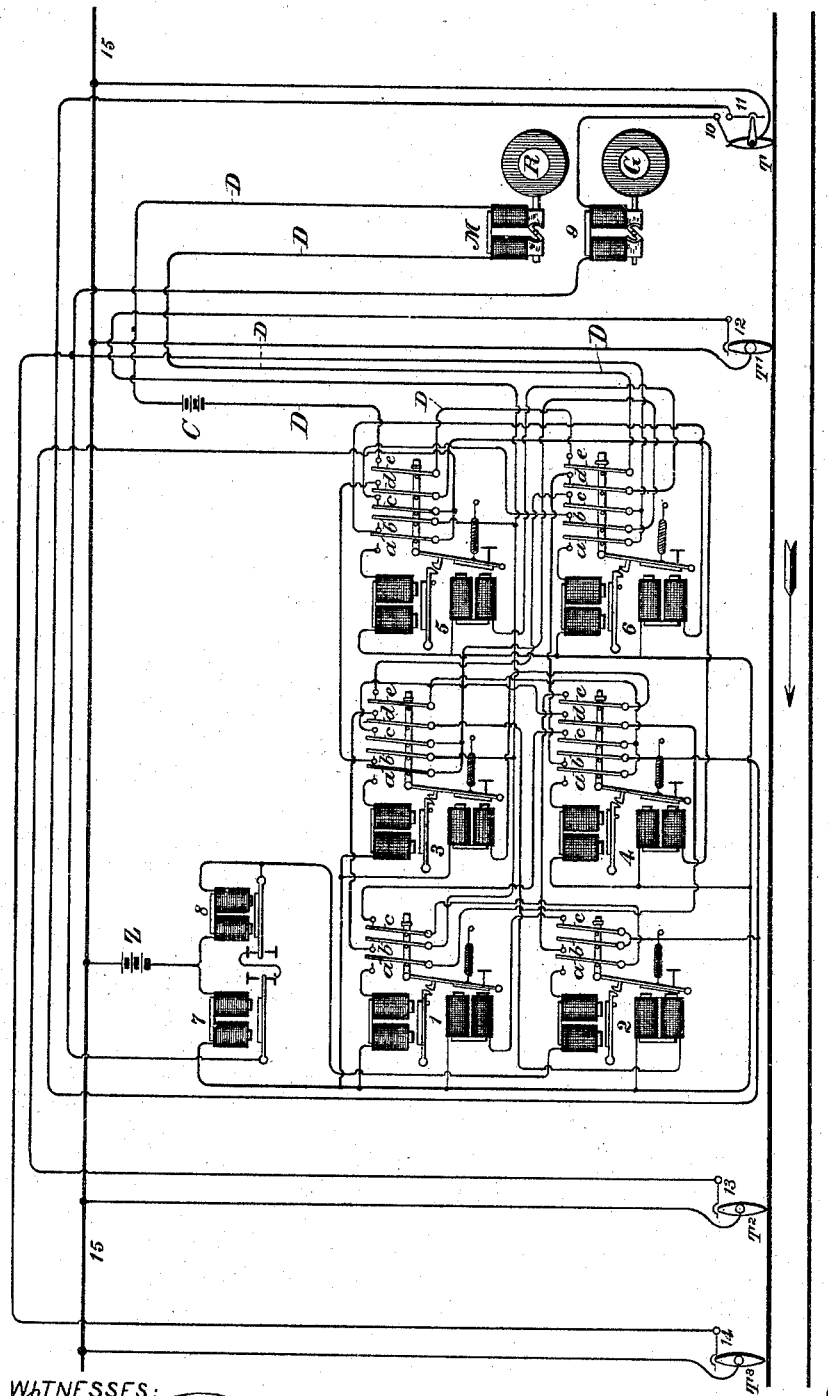
(No Model.)

W. H. KENYON.

ELECTRIC SIGNALING APPARATUS.

No. 492,497. Patented Feb. 28, 1893.



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ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 492,497, dated February 28, 1893.

Application filed June 3, 1892. Serial No. 435,363. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. KENYON, a citizen of the United States, and a resident of the city of New York, in the county and State of New York, have invented a certain new and useful Improvement in Electric Signaling Apparatus, which improvement is fully set forth in the following specification and the accompanying drawings, which form part hereof.

This invention relates to automatic electric block signaling apparatus for railroads, and consists in an improvement upon the broad invention of Adoniram J. Wilson, (assignor to the Hall Signal Company) as shown and claimed by said Wilson in his patent (No. 479,928 granted August 2, 1892) on a permissive block signal system.

The Wilson invention just named permits a definite number—determined by the particular installation—of trains to enter upon any one block, and occupy the same at one time, and to depart therefrom without any one or more—short of the entire pre-determined number—of said trains clearing the signal at the beginning of the block,—but insuring that the last one of the specified number of trains shall clear the signal as it leaves the block.

The object of my improvement is to overcome the objection found in the above system that there is nothing to prevent more than the pre-determined or "permitted" number of trains from entering the block, and nothing to establish any safeguard against the signal being cleared as the last of the "permitted" number of trains leaves the block, but while one or more extra trains may still remain upon it. It is manifest that the error would be perpetuated if trains were continuously entering the block. Not until the block was entirely clear of trains would the said Wilson system start right again, and it would only continue to work efficiently so long as the "permitted" number of trains was never exceeded on the block.

To insure that the permitted number of trains shall never be exceeded upon any one block installed with a signaling apparatus such as referred to,—I provide a second or absolute signal and color it—say red, while I use the signal of the Wilson system as precautionary and color it—say green, both signals being preferably placed in the same case one above the other. The arrangement is such that while the operation of the green signal is precisely the same as in the Wilson system alluded to, the red signal acts to a certain extent independently thereof and is at clear until the full permitted number of trains have entered the block (or are upon the block and the overlap, if there is an overlap) when, on the last of the number entering the block, it goes to danger, and so remains until one of the trains leaves the block when it goes again to clear. When a fresh train comes on and again makes up the full permitted number, the red signal returns to danger, and so on. I preferably effect the above result by providing a separate or supplementary battery and circuit for the red signal,—such circuit being, preferably, normally closed,—and a spring contact or circuit breaker or maker in said circuit adapted to be operated by the last of the permitted trains on its entering the block, and to be restored by the first of the permitted trains to leave the block on its leaving the block. This spring contact or circuit breaker or maker may be conveniently made a part of the multiple circuit instrument which is reversed by the train already mentioned as last entering the block, and which is restored by the first train leaving the block. The result will be that the circuit of the red signal will be broken or made directly the block is occupied by the full complement of trains provided for by the particular installation of multiple circuit instruments and branch circuits employed at that particular part of the line; and when one of the trains leaves the block the circuit of the red signal will be restored to its normal condition and the red signal will clear as before mentioned. In its preferred form the electrical installation is arranged so that the red signal is cleared by a current and sent to danger by the absence of a current,—but it is apparent that if the signal operates on the reverse principle, the circuit would be normally broken, and be adapted to be temporarily made while the proper complement of trains is on the block.

The accompanying drawing represents my improvement as embodied in simple form in an overlapping block system similar to that de-

scribed in the Wilson application Serial No. 411,292 before mentioned, and where no more than three trains at any one time are to be permitted upon the one block indicated in the diagram.

T is a track instrument at the entrance to the block, and T^2 a similar instrument at the entrance to the next block, while instruments T′ and T^3 are placed respectively at the end of the overlap in the two blocks, only such parts being shown at each of these track instruments as are operated by the train to affect the signal circuit of the block shown in the drawing.

G is the green precautionary signal which is operated by the system of circuits shown, and as described in Wilson's said application, or in any desired way. It is placed at or near the entrance of the block, and the red absolute signal R is preferably placed in the same case, although it can be arranged in any other suitable manner in the neighborhood of the green signal.

The precautionary signaling circuit which, in the form of apparatus shown in the drawing, is normally closed, may be traced as follows:—battery Z, battery line wire 15, track instrument T, contact piece 10, magnet 9, armature of relay 7, armature of relay 8, coil or relay 8 to battery. So long as this circuit remains closed throughout, the magnet 9 holds the signal G at clear.

The system shown in the drawing can best be described by its successive operations under the successive action of trains in moving over the track.

First operation—on first train striking track instrument T.—This momentarily breaks contact of that track instrument with contact pieces 10 and makes contact of the instrument with contact piece 11. The break at 10 is a break of the main signaling circuit of the precautionary signal G and it demagnetizes 8 and 9. The demagnetizing of 9 causes the signal G to fall to danger and the demagnetizing of 8 causes its armature to fall, which introduces a second (and this a permanent) break in the main signaling circuit of the precautionary signal. This circuit manifestly cannot be remade at this point (to wit, at the armature of relay 8) until that relay is again magnetized by being included in some other circuit, and so the break indirectly caused by the train at armature of relay 8 is permanent in comparison with that of the direct break occasioned at 10, and the signal G is thus kept permanently at danger. The function of the relay 8 and its armature is thus to transform any temporary break in the main signaling circuit of the precautionary signal G into a permanent break, subject to being remade only by including the coil of this relay 8 in some other circuit and thereby magnetizing it, and it may therefore be called the precautionary signaling relay. The temporary contact made by track instrument T with contact piece 11 completes a branch circuit as follows: battery, line 15, track instrument T, contact piece 11, contact springs *c* of multiple circuit instrument 2, lower or reversing magnet of multiple circuit instrument 1, coil of relay 7 and battery. This temporary magnetizing of the relay 7 makes a temporary break at its armature in the main circuit of the precautionary signal, which break sets or resets the signal G at danger, if by any mischance this has not been already done. The relay 7 thus insures the setting or resetting of the signal at danger and may be called the resetting relay. The magnetizing of the lower or reversing magnet of the multiple circuit instrument 1, reverses and locks that instrument, reversing the contacts of its contact springs *a*, *b*, *c*, from their normal positions, which normal positions are those shown in the drawing. (This reversal of the points of multiple circuit instrument 1 it will be important to bear in mind in following the successive operations.)

Second operation—on the first train striking track instrument T′.—This makes a contact at 12 and completes the following branch circuit: battery, line, T′, 12, *b* of 1, *d* of multiple circuit instrument 3, lower or reversing magnet of 2, resetting magnet 7 and battery. This locks the multiple circuit instrument 2 and reverses its points *a*, *b*, *c*, from their normal positions shown in the drawing.

Third operation—on second train striking track instrument T, with first train still on the block.—This breaks contact at 10 as before (thus insuring the setting of signal G at danger) and it also makes contact at 11. The latter, in the now reversed positions of the points of multiple circuit instruments 1 and 2 from their normal positions, completes the following circuit: line, T, 11, *b* of 2, *e* of 4, lower or reversing magnet of 3, resetting magnet and battery. This locks the multiple circuit instrument 3 and reverses its points *a*, *b*, *c*, *d*, *e*, from their normal positions shown in the drawing.

Fourth operation—on second train striking track instrument T′.—This in the reversed positions of the points of multiple circuit instruments 1, 2 and 3, completes the following branch circuit: line, T′, 12, *b* of 3, *d* of 5, lower or reversing magnet of 4, resetting magnet and battery. This locks multiple circuit instrument 4 and reverses its points *a*, *b*, *c*, *d*, *e*, from their normal positions shown in the drawing.

Fifth operation—on third train striking track instrument T, with the first two trains still on the block.—This in the reversed positions of the points of the multiple circuit instruments 1, 2, 3 and 4, completes the following branch circuit: line, T, 11, *b* of 4, *d* of 6, lower or reversing magnet of 5, resetting magnet and battery. This locks the multiple circuit instrument 5 and reverses its points *a*, *b*, *c*, *d* and *e* from their normal positions shown in the drawing. The operation also as before breaks the main signaling circuit of the precautionary green signal at 10, thus insur-

ing the setting of the signal G at danger. The reversing of point *e* of 5 breaks the signaling circuit D, C, M, of the red or absolute signal R, and thereby sets that signal R at danger.

Sixth operation—on third train striking track instrument T′.—This in the reversed positions of the points of the multiple circuit instruments 1, 2, 3, 4 and 5, completes the following branch circuit: line, T′, 12, *b* of 5, lower or reversing magnet of 6, resetting magnet and battery. This locks the multiple circuit instrument 6 and reverses its points *a*, *b*, *c*, *d* and *e* from their normal positions shown in the drawing. The reversing of point *e* of 6 introduces a second break in the signaling circuit D, C, M, of the absolute signal R and thereby insures the setting or continuing of that signal R at danger.

Seventh operation—on first train striking track instrument T².—This in the reversed positions of the points of all the multiple circuit instruments, completes the following circuit: line, T², 13, *a* of 5, upper or unlocking magnet of 5, resetting magnet and battery. This unlocks multiple circuit instrument 5, restoring its points to their normal positions. This remakes one of the breaks (at *e* of 5) in the signaling circuit of the signal R.

Eighth operation—on first train striking track instrument T³.—This in the reversed positions of the points of multiplte circuit instruments 1, 2, 3, 4 and 6, completes the following branch circuit: line, T³, 14, *a* of 6, upper or unlocking magnet of 6; resetting magnet, and battery. This unlocks multiple circuit instrument 6, thus restoring its points to their normal positions. The restoring of *e* of 6 remakes the final break in the signaling circuit D of the absolute signal R and sets that signal at clear.

Ninth operation—on second train striking track instrument T².—This in the reversed position of the points of multiple circuit instruments 1, 2, 3 and 4 completes the following branch circuit: line, T², 13, *c* of 5, *b* of 6, *a* of 3, upper or unlocking magnet of 3, resetting magnet and battery. This unlocks the multiple circuit instrument 3, restoring its points to their normal position.

Tenth operation—on second train striking track instrument T³.—This in the reversed positions of the points of multiple circuit instruments 1, 2 and 4 completes the following branch circuit:—line, T³, 14, *c* of 6, *e* of 3, *a* of 4, upper or unlocking magnet of 4, resetting magnet and battery. This unlocks the multiple circuit instrument 4, restoring its points to their normal position.

Eleventh operation—on third train striking track instrument T².—This, in the reversed positions of the points of multiple circuit instruments 1 and 2, completes the following branch circuit: line, T², 13, *c* of 5, *b* of 6, *c* of 3, *d* of 4, *a* of 1, upper or unlocking magnet of 1, resetting magnet and battery. This unlocks multiple circuit instrument 1, restoring its points to their normal positions.

Twelfth operation—on third train striking track instrument T³.—This in the reversed positions of the points of multiple circuit instrument 2, completes the following branch circuit: line, T³, 14, *c* of 6, *e* of 3, *c* of 4, *c* of 1, *a* of 2, upper or unlocking magnet of 2, main signaling magnet 8 and battery. This unlocks multiple circuit instrument 2, restoring its points to their normal positions and by magnetizing the main signaling magnet 8 of the precautionary signal it draws up the armature of that magnet, thereby completing that main signaling circuit which had been permanently broken at that point by the first operation above described. That main signaling circuit being thus restored throughout, the current of the battery Z flows through it as at first, magnetizing the magnet 9, and setting the signal G at clear. The system is then in every part restored to its original and normal position, ready to pass again through the several operations above described.

If there is but one train at a time upon the block, the successive operations of that train on track instruments T, T′, T² and T³ will be those numbered 1, 2, 11 and 12 respectively in the above enumeration. If there are but two trains at a time upon the block, their successive operations upon the successive track instruments will be respectively those numbered 1, 2, 3, 4, 9, 10, 11 and 12 in the above enumeration. If after one of the three trains on the block has passed off the block, (operating the system according to the seventh and eighth operations enumerated above) a fourth train enters upon the block, the operations of that fourth train upon the track instruments T and T′ will be those numbered 5 and 6 in the above enumeration, and the first of the three trains then on the block to leave the block will repeat upon the track instruments T² and T³ the operations numbered 7 and 8 above, and so on. It will thus be seen that in the arrangement of circuits shown in the drawing any number of trains may be upon the block at one and the same time up to three trains, that is to say, there may at times be one train upon the block, at times two trains, at times three trains, at times no trains &c. and the system will automatically manipulate the signals G and R in such a way as to keep both at danger so long as there is the full permitted number of trains upon a block and its overlap, and to keep the precautionary signal G at danger so long as there is any train at all upon the block or its overlap, and to keep both signals at clear so long as there are no trains upon the block or its overlap.

It will be evident that the track instruments T′ and T³ may, if desired, be dispensed with, it being necessary in that case to have only half the number of multiple circuit instruments. It will also be evident from the above description that in order to accommodate or provide for a greater number of trains upon a block at once than three, it will only be necessary to proportionately increase the num-

ber of multiple circuit instruments, with their proper connecting branch circuits to be manipulated through them by the successive trains acting upon the successive track instruments.

It will also be evident that the invention is not limited to the automatical manipulation of visual signals, as the place of those signals in the system may be taken by audible signals, as bells, or by locking devices in an interlocking system, &c. Again the visible or audible signals or locks may be operated by some other power (as steam, compressed air, dynamos, storage batteries, &c.) and the currents of the batteries be employed merely to control or direct that other power.

It will also be evident that the invention is not limited to any particular kind of track instrument T, T′, T^2, T^3, as any form of track instrument might be employed that would do the work above described in the system without departing from the invention. And the place of the track instruments (or some of them) in the system might be taken by rail circuits suitably arranged to be operated by the passing trains and to in turn suitably operate the circuits and branch circuits.

It is also evident that many modifications might be made in the specific construction of the multiple circuit instruments and in the specific arrangements of the branch and local circuits, without departing from the invention.

It will be observed that in the overlap system shown in the drawing, I have embodied a supplementary circuit D, extending from the multiple circuit instruments 5 and 6 to my extra or absolute red signal R,—and including two spring contacts or circuit breakers, *e* of 5, and *e* of 6, a local or supplementary battery C, and a magnet M for the red signal. These spring contacts will be normally closed, for a standard Hall disk signal, so as to hold the red disk R clear normally,—and the reversing of the instrument 5, or of the instrument 6, will break the circuit and set the red signal R at danger, and the restoration of both instruments 5 and 6 to a normal condition will remake the brakes, close the supplementary circuit and clear the absolute signal R. The same end could be reached without the use of the local battery C, by putting both signals G and R in the one main signaling circuit normally,—but by means of suitable branch circuits adapting the signal G to be cut off from the current in the same manner as described in the Wilson application,—and the signal R to be kept in closed circuit until the last of the permitted trains has entered the block, and to be restored to closed circuit when the first train leaves the block. This arrangement would not involve a departure from the essential principle of my invention. It could be attained for instance by leading the wires of circuit D (which run to the poles of battery C) to the poles of battery Z instead, thus putting the magnet of signal R in parallel circuit with the magnet of signal G. Any suitable means could be employed to balance the resistance of the parallel branches, if that is desired.

In the drawing I have shown the supplementary circuit D as having two circuit breakers, namely, *e* of 5, and *e* of 6, but this is merely an adaptation of the idea to an overlap system. If no overlap be used then one circuit breaker is sufficient—to be broken by the last of the permitted trains on entering the block and to be restored by the first to leave the block.

In the practical use of my improvement, an engine driver approaching a signal post and finding both signals clear would know that the block was entirely clear for him to go ahead fast;—finding green at danger and red clear he would know that one or more trains were ahead of him on the block, but not the full permitted number, and would proceed on to the block but keeping a sharp look out ahead;—finding both signals G and R at danger he would come to an absolute stop, knowing that the full permitted number of trains were already on the block;—when the red signal cleared he would go ahead cautioned by the green signal that there were trains ahead of him on the block.

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

1. In a permissive block signal system, the combination with a signaling circuit operating or controlling the operation of a precautionary signal guarding a block or given section of track, and with a series of branch circuits and a corresponding series of multiple circuit instruments controlling such branch circuits,—arranged to be operated in succession in one direction by trains successively entering the block, and to be operated in reverse succession and direction by said trains on their subsequently successively leaving the block, so that the last train of a permitted number shall clear said precautionary signal previously set to danger by the preceding trains,—of a supplementary or local circuit controlled by one of said multiple circuit instruments, and an extra or absolute signal operated by or through said local circuit in such manner that the absolute signal will always be at danger when the permitted number of trains are on the block or guarded section, but will clear directly such permitted number is reduced by one train leaving the section,—substantially as and for the purposes set forth.

2. In a permissive block signal system applied to overlapping blocks, the combination with a signaling circuit operating or controlling the operation of a precautionary signal guarding a given section of track consisting of one block and an overlap on the next succeeding block,—and with a series of double sets of branch circuits and a series of double sets of multiple circuit instruments control-

ling said branch circuits,—arranged to be operated in succession in one direction by trains entering the overlap and leaving the overlap in succession, and to be operated in reverse succession and direction by said trains on their subsequently and one after another entering the overlap of the next succeeding block, and on their leaving the same,—of a supplementary or local circuit controlled by one set of said double sets of multiple circuit instruments, and an extra or absolute signal operated by or through said supplementary or local circuit, in such manner that the absolute signal will always be at danger when the permitted number of trains are on the block and overlap, but will clear directly such permitted number is reduced by one train leaving the overlap or guarded section, substantially as and for the purposes set forth.

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