J. M. GOODWIN.

Electric Railway-Signals.

No. 150,150. Patented April 28, 1874.

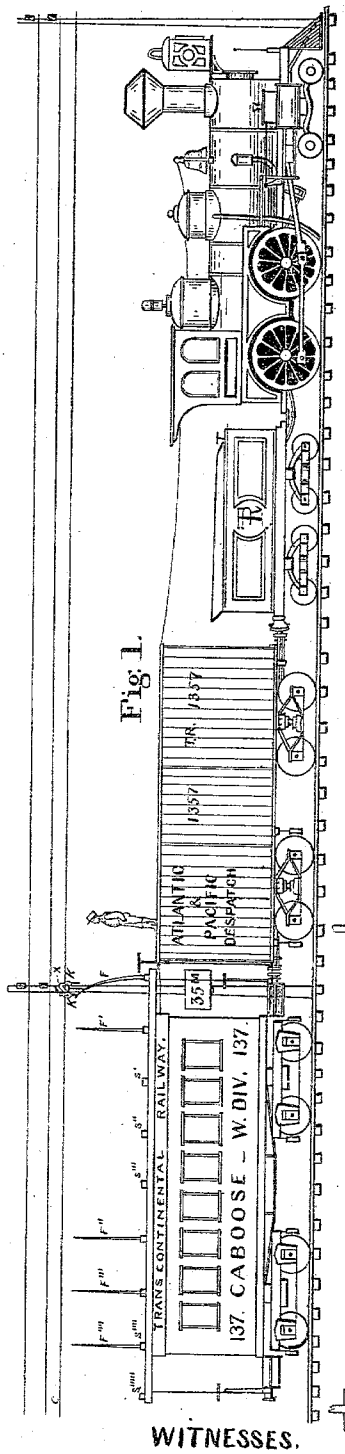

Fig. 1.

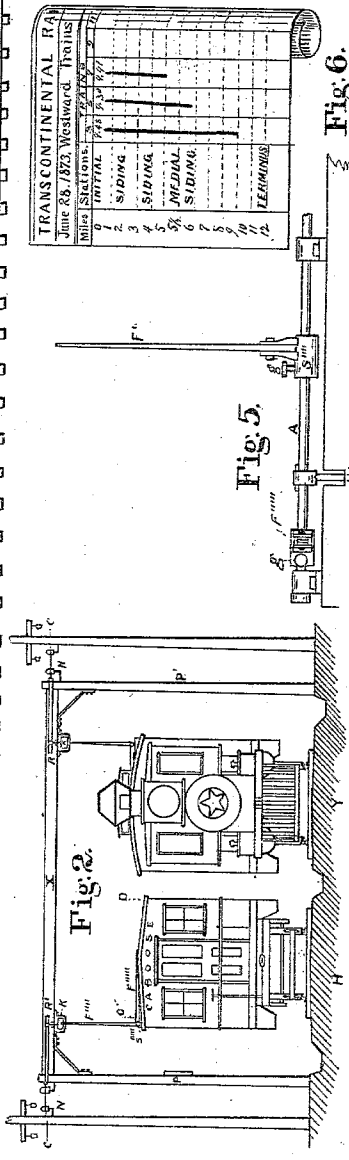

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

WITNESSES.

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IMPROVEMENT IN ELECTRIC RAILWAY-SIGNALS.

Specification forming part of Letters Patent No. **150,150**, dated April 28, 1874; application filed July 14, 1873.

To all whom it may concern:

Be it known that I, JOHN M. GOODWIN, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful System of Signals for use upon Railroads and other lines of Traffic and Travel, for which I desire to secure Letters Patent of the United States.

The object of my invention is to provide means whereby engines, cars, or trains, or other vehicles moving upon railroads or other lines of traffic and travel, shall, (at any points on such roads at which those managing the same may see fit to fix the necessary apparatus, herein described,) through the automatic operation of suitable mechanical and other contrivances, cause the transmission to an office, or simultaneously to several offices, on or near the line of such roads, of signals, which shall indicate to the "train-dispatchers," or to the operators attending such offices, the moment of the passage of any one of said engines, cars, or trains under or by any one of said points, and at the same time indicate, by suitable combinations of such signals, and by the intervals between such signals, the "number" or other distinguishing symbol by which each such passing engine, car, or train is designated and known on the road to which it belongs; and, furthermore, at the same time indicate the direction in which such engine, car, or train is moving, and, approximately, the speed at which it is moving, whereby very desirable results, as regarding safety and economy of operation, may be secured.

In the following description of my said invention reference is had to the drawing accompanying and forming part of this specification.

In said drawing, Figure I represents a locomotive-engine, a freight-car, and a "caboose" upon a railroad, connected and forming a train, the finger F of the apparatus on the top of the caboose being shown as engaging the fixed apparatus at a signal-point. Fig. II represents, in cross-section, a double-tracked railroad, with a view of the rear of a caboose (on a reduced scale) on the left-hand track H, and the head of a locomotive and forward end of a passenger-car on the right-hand track Y; also, the bridge or girder X over the railroad, sustaining the fixed signal apparatas of a signal-point. Fig. III presents (on an enlarged scale) a side view of one end of the bridge or girder shown in Fig. II, with the fixed signal apparatus, viz., the metal strip R′, the key (composed of the parts u' and K′) mounted on its pivot $p\,p'$, and the key-guard M; also, the insulator N and the telegraph-wire C, whereby said signal apparatus is connected with certain instruments in the offices aforesaid. Fig. IV presents a section on the line $x\,x$ of the bridge or girder shown in Fig. III, with a side view of the key u' K′, (shown in Fig. III;) also, a side view of the corresponding key u K, attached to the girder X on the side reverse to that shown in Fig. III; also, a section of the metal strip R′, and of the corresponding strip R, and a section of the key-guard M. In Fig. IV the finger F of Fig. I is shown as about to engage the lower part K′ of the key u' K′. Fig. V represents (on an enlarged scale) a portion of the roof the caboose, carrying a corresponding portion of the rocker-shaft or finger-rod A, and two of the fingers used to operate the fixed apparatus aforesaid, one of the fingers, F″″, being shown erect, and one, F‴″, depressed. Fig. VI represents a form for a schedule for the record of movements of trains, as hereinafter described. Fig. VII represents (on an enlarged scale) a portion of the rear end of a caboose, with an end view of the rocker-shaft or finger-rod A. The finger F″″ is shown erect, as in Fig. V, and the finger F‴″ depressed. The set-screw g clamps the socket s'''' (see Fig. V) of the finger F″″ upon the finger-rod A.

The mode of construction and operation of the several devices comprehended by and comprised in my said invention I describe as follows; and in this description I have in view the application of my said system of signals to a double-tracked railroad, on which a line of electro-magnetic telegraph is assumed to be in operation, although, as hereinafter explained, it may equally well be used on railroads having but a single track:

It having been decided to establish a signal-post at each mile along the line of the railroad, I measure from the selected initial point, and at the proper site for each such signal set up two stout poles, $p\,p'$, Fig. II, opposite each other, one on each side of the way, and at such distance from the rails as will insure the clear-

ance of all engines and cars passing thereon, each pair of poles supporting a bridge or girder, X, Fig. II, crossing the two tracks at a height above the rails sufficient to clear the heads of men standing erect on top of the highest car. Upon each face of each end of this bridge or girder I plant a strip of copper or other metal, R′, Fig. III. On one end of each metal strip a hook is formed. The hooked ends project outward from the railway, slightly beyond the respective ends of the girder. The strips extend inwardly far enough to bring their ends inside of the outer rails of the tracks. Upon the poles of the existing line of telegraph independent lines of wire—one for the right-hand and one for the left-hand track—are put in place. From the telegraph-poles standing nearest the said signal-poles the independent or signal wires are led to the insulators, one of which is shown at N′, Fig. III, on the signal-posts, and thence to a connection with the metal strips aforesaid. Upon the bridges or girders aforesaid, and in such position as to be very nearly perpendicularly over the outer sides or walls of cabooses or other cars passing along the respective tracks, keys, of brass or other suitable metal, *u′* K′, Fig. III, and *u* K, *u′* K′, Fig. IV,) are placed. These keys are made with springs coiled around the pivots *p p′*, Figs. III and IV, on which they turn, so that their upper extremities (*u′*, Fig. III, and *u u′*, Fig. IV) are held firmly against the metal strips aforesaid. Metal bolts, as at *b*, Fig. IV, passing through the girders, connect the opposite keys of each pair or set. A proper battery (it may be the one used for working the existing line of telegraph on the road, or an independent battery) being put in operation, and attached to each signal-wire, and the proper ground-connections being made to perfect the circuits, and the keys upon the girders of the several signal-stations being, as aforesaid, pressed against the metal strips, it is obvious that an electric current will flow uninterruptedly through the circuits formed by the lines of signal-wire, the metal strips, the metal keys, and the bolts connecting the keys. Now, for the purpose of producing the signals that shall indicate the moment when an engine, car, or train passes one of these signal-posts just described, I attach to such engine or car, or one of the cars in such train, certain fingers or laths, (F F′ F″ F‴ F⁗, Fig. I, and F and F⁗, Fig. II,) of steel or other suitable material, of such length, and so arranged, and preferably fixed upon a rocker-shaft or finger-rod, laid in suitable bearings along the edge of the roof of such car, or the roof of the cab of such engine, that when the engine or car to which they are attached passes the girder at the signal-station, the free ends of the said fingers or laths will be brought against the lower part (K′, Fig. III, and K′, Fig. IV) of the key opposing their passage. The fingers, as they, one after the other, strike the said lower part of the key, will cause the upper part of the same (*u′*, Fig. III, and *u′*, Fig. IV) to recede from the metal strip R′, Figs. III and IV, whereby the circuit on the line of wire to which the affected key is attached will be broken; and instruments, such as are used on ordinary telegraph-lines for indicating, by sounds, the breaking and closing of such circuits, being attached to the signal-wires at the office or offices aforesaid, the moment of the passage of each finger by the signal-key will be indicated at such office. As the removal from the strip of metal, against which it has been, by the coiled spring aforesaid, pressed, of either key of any pair of keys will sufficiently break the circuit, the simultaneous disturbance of both keys of any pair is undesirable, and, therefore, a guard, M, Figs. III and IV, is placed between the keys of each pair in such a way that the finger, after striking and throwing forward the lower part of any key, strikes the guard, and is by the same so far deflected backward that the opposite key escapes any blow from the finger. Each finger that may be in proper position for so doing, in turn strikes the key opposing it, and at each stroke a signal is sent into the offices; and in order to distinguish each train from others, each train carries its fingers arranged in a manner peculiar to it. Thus, as railroad trains are usually designated numerically, I would usually so arrange the fingers as to produce signals in such number and sequence as should indicate, according to an established code, certain numbers. For example, if it be assumed that the train shown in Fig. I is known as No. 23, it would be well to set up at the forward end of the rocker-shaft or finger-rod two fingers separated by a certain space, and, after leaving an interval equal to four spaces or more, set up near the rear end of the rod three fingers separated by intervals equal, each, to one space. The signals would then arrive at the offices in the order — — — — —, thereby naturally indicating the number 23, and so on. The fingers are flexible, and are, preferably, at their lower ends fastened into stout metal sockets by means of bolts and nuts, as shown in Fig. V, so that in case of breakage renewals may readily be made. The sockets *s⁗*, Fig. V, fit loosely on the finger-rod A, Fig. V, and are held in any desired position by means of set-screws *g*, Fig. V and VII. When not in use the fingers may, by loosening the set-screws, be turned down upon the roof of the car, as shown in Fig. VII, and when in that position, the set-screws being loosened as aforesaid, the rod, if rotated, will turn freely in the temporarily-disused sockets. After a train has passed a signal-post placed at or near a station on a railroad, and has, through the operation of the apparatus herein described, indicated to the train-dispatcher or the attendants at the offices its said passage, and afterward, in the "switching" or "drilling" of the train at the station, it be necessary

to move the caboose, or other car carrying the fingers, backward and forward past the signal-post, it will be desirable to prevent the transmission of unnecessary signals; and in order that the fingers may be so placed as to avoid contact with the keys during such moving backward and forward, a lever, L, Fig. V, and L L′ in dotted lines in Fig. VII, extending into, and operating from, the interior of the car, is attached to the rocker-shaft or finger-rod, whereby, on occasion, the shaft or rod may be partially rotated, and the fingers at the time set on the said shaft be thrown downward and into a position where they will not engage the keys.

In Fig. VII the dotted lines at L and L′, respectively, show the positions of the said lever when the finger F′′′′ is erect, and when the same is depressed or thrown out of the position necessary for engagement with the keys. After the switching is finished, and the train resumes the progress along the road, the fingers, properly set and arranged, should be raised into the erect position.

In case the train while running breaks in two, and, through reason of gravitation, or, as sometimes happens, through the action of the wind, the caboose or car carrying the fingers runs backward along the line, and while so running backward passes a signal-post, signals will be sent in to the offices in an order the reverse of that established for that train; for example, in the case of the train shown in Fig. I, which I have designated as No. 23, the signals would reach the offices in the order ———— ——, instead of, as before described, in the order —— ————; thus train No. 32 would be signaled. Now, if, as is customary on American railroads, trains moving, say, westward are designated by odd numbers, and opposing trains, or those moving eastward, are designated by even numbers, and if, on the wire devoted to trains with odd numbers, as No. 23, an even number, as No. 32, comes in, as I have explained that it would in the event just supposed, then the train-dispatcher is made aware that for some reason the whole or a part of train No. 23 is running backward, and is warned to take such steps for the prevention of accident as experience and the rules of the road shall dictate. The speed at which the train might be running backward would also be clearly indicated, as will be shown below.

The signal-keys may, in case of need, be used for sending messages in the ordinary alphabet; and as, (when the signal-posts are placed at each mile,) in case of a break-down, a means of communication with offices will never be more than half a mile from the train, I anticipate that very valuable results will be derived from such use of the signal-line from time to time.

The fingers will, preferably, be placed about four feet apart on the rocker-shaft or finger-rod. A train moving at the rate of twelve miles per hour runs seventeen and one-half feet per second; at fifteen miles per hour, twenty-two feet per second; and at thirty miles per hour, forty-four feet per second. Thus, with train moving at rate of twelve miles per hour, the interval between the signals produced by the strokes of two of the fingers set four feet apart would be not quite one-fourth of a second; at fifteen miles per hour, about one-fifth of a second; and at thirty miles per hour, one-eleventh of a second.

The signals, as received at the offices, will be by the attendant recorded upon schedules provided for the purpose, and, preferably, prepared on the plan shown in Fig. VI, on which the position of each and every train may at any moment be noted from an observation of the several lines drawn in the appropriate columns, starting at the points representing the commencement of the runs of the trains, respectively, and continued up or down the page as the trains progress.

If, as will sometimes be the case, two or more trains moving in one and the same direction happen to pass signal-posts simultaneously, the signals sent in will be of such a character as to indicate the fact; and the trains that have thus simultaneously signaled, and the points from which they have thus, at the same moment, signaled, may be readily determined, for, the rate of progress, so many minutes to the mile, of each train, up to the moment of the joint or mixed signal, having been exactly indicated, the attendants may, through the exercise of no more than ordinary intelligence, decide correctly in the premises. Thus, if train No. 3 signal from post No. 6 at ten o'clock, her rate of speed being thirty miles per hour, or a mile in two minutes, and train No. 7 signal from post No. 4 at ten o'clock and one minute, her rate of speed being twelve miles per hour, or a mile in five minutes, and at ten o'clock six minutes a mixed signal comes in, the rapidity of the delivery of part of the signal and the slower delivery of the other part will indicate that one of the trains is an express and the other a freight train; and because No. 3 ought to reach post No. 9 and train No. 7 ought to reach post No. 5 at about the same moment—that is to say, at about ten o'clock and six minutes—an observation of the time-piece will show the trains by which, and the post from which, the signals are sent. Train No. 3 will make her three signal-strokes in two-elevenths of a second, while the seven strokes of No. 7 will occupy one and one-third second, so that unless one of the fingers of train No. 7 strikes the key at post No. 5 at precisely the instant when one of the fingers of No. 3 train strikes the key at post No. 9, (a synchronism that may never occur,) the two signals will come, to the practiced ear of the operator, as distinct from each other as though they were in every way separate. Judging from the results of experiments, I think that resort to the ordinary working line of telegraph for the purpose of determining questions arising from the occasional mixture of signals will rarely be neces-

sary; but, in case the attendants on the signal-line are in doubt from any cause, any train, on its arrival at the station next succeeding the break, may be properly placed on the schedule by the use of the regular road-wire.

In railway economy, the regulation and equalization of the speed of trains is a matter of much importance; and, under the conditions heretofore existing, the persistent efforts of railway superintendents to control the men in charge of freight-trains, and, in cases of infringement of rules in regard to running, to place the blame where it ought to be placed, have been only partially successful, principally because it has been impracticable to maintain a sufficient surveillance of the trains when between stations. My invention supplies a means for that constant supervision of the speed and movements of all trains that is so much needed.

When using this system of signals, and the mechanical devices appurtenant thereto, upon a single-track railroad, it will be necessary to place the two sets of signal-keys upon each bridge or girder in the same position, respectively, in regard to the two rails of the single track, that they are herein shown (in Fig. II) to occupy in regard to the outer rails of the tracks of the double-track road. It will also be advisable to so construct the rocker-shaft or finger-rod and its attachments that they may be readily transferred from one side of the engine, car, or caboose to the other; as, for example, from the side G of the caboose, as shown in Fig. II, going from the observer, to the side D of the same caboose on its return trip, coming toward the observer, in order that the fingers may be, according to the direction of motion of the train to which they are attached, in position to engage the keys of the line of wire devoted to the signaling of that train; or, two rocker-shafts and two sets of fingers may be provided—one for use on each set of keys; or, cars or cabooses may be turned at each end of the road, so as to bring the apparatus into proper position for use, as indicated. If considered a more convenient mode of applying and using the system of signals herein described, or if, for any reason, (as, for instance because of peculiarities of form of existing permanent structures, as bridges, tunnels, or buildings,) it be deemed expedient to place the metal strips and the signal-keys and key-guards on the posts P P', Fig. II, alongside the road or way, or on brackets or arms attached to and projecting from such posts, instead of on the bridge or girder aforesaid, and over the road or way, and to correspondingly modify the arrangement of the rocker-shaft or finger-rod and the laths or fingers, making said fingers project, when set, diagonally or horizontally from the roof, or from the side of the engine, car, or caboose, instead of vertically, as hereinbefore described, or if circumstances render it expedient to attach the rocker-shaft or finger-rod, and the fingers or laths, to the lower part of the side of the car or engine, or to the under side of the floor or frame of any car or engine, and to place the insulators, metal strips, signal-keys, and key-guards, or their equivalents, on the ground beside or on the ties or substructure supporting the road or way, or the tracks thereof, then these said modifications of the arrangement of the said several devices may be made, and the circuits for the transmission of the signals made by the operation of the signal-keys under these or any such modifications may be formed as hereinbefore specified, or by including therein any convenient substitute for the independent wire before described. Furthermore, the fingers aforesaid may be made to operate keys fixed, as specified in the case of the said signal-keys, above, alongside, or upon the road or way, that shall, by means of suitable devices, mechanically produce either visible or audible signals, or both.

What I claim is—

1. The signal-keys or circuit-breakers and the key-guards, or their respective equivalents, constructed and operating substantially as and for the purposes described.

2. The rocker-shaft or finger-rod, and the adjustable fingers or laths, or their respective equivalents, attached to or carried by an engine, car, caboose, or other vehicle of any kind, constructed and operating substantially as and for the purposes set forth.

JOHN M. GOODWIN.

Witnesses:

MAITLAND PORTER,

JAMES M. HALL.