

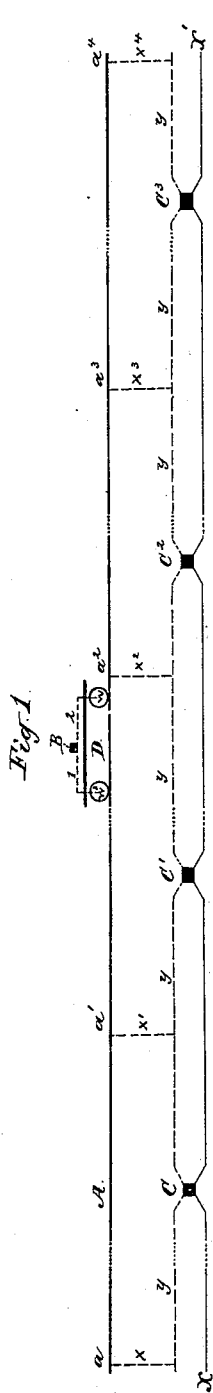
(No Model.)

2 Sheets—Sheet 1.

C. W. WILLIAMS.
RAILWAY TELEGRAPH.

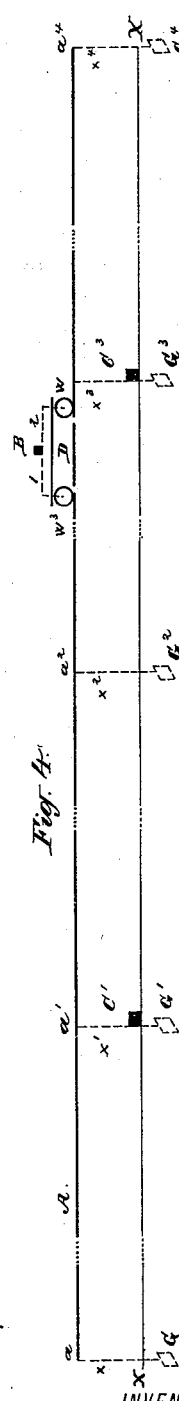
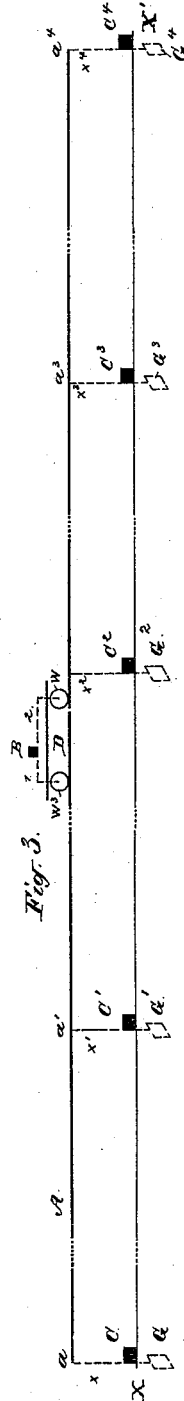
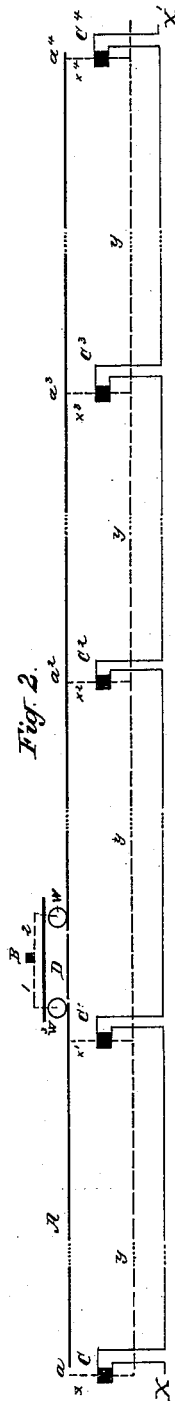
No. 343,095.

Patented June 1, 1886.



WITNESSES

A. J. N. Vermeilys
A. S. Fitch



INVENTOR,

Charles W. Williams

By his Attorney

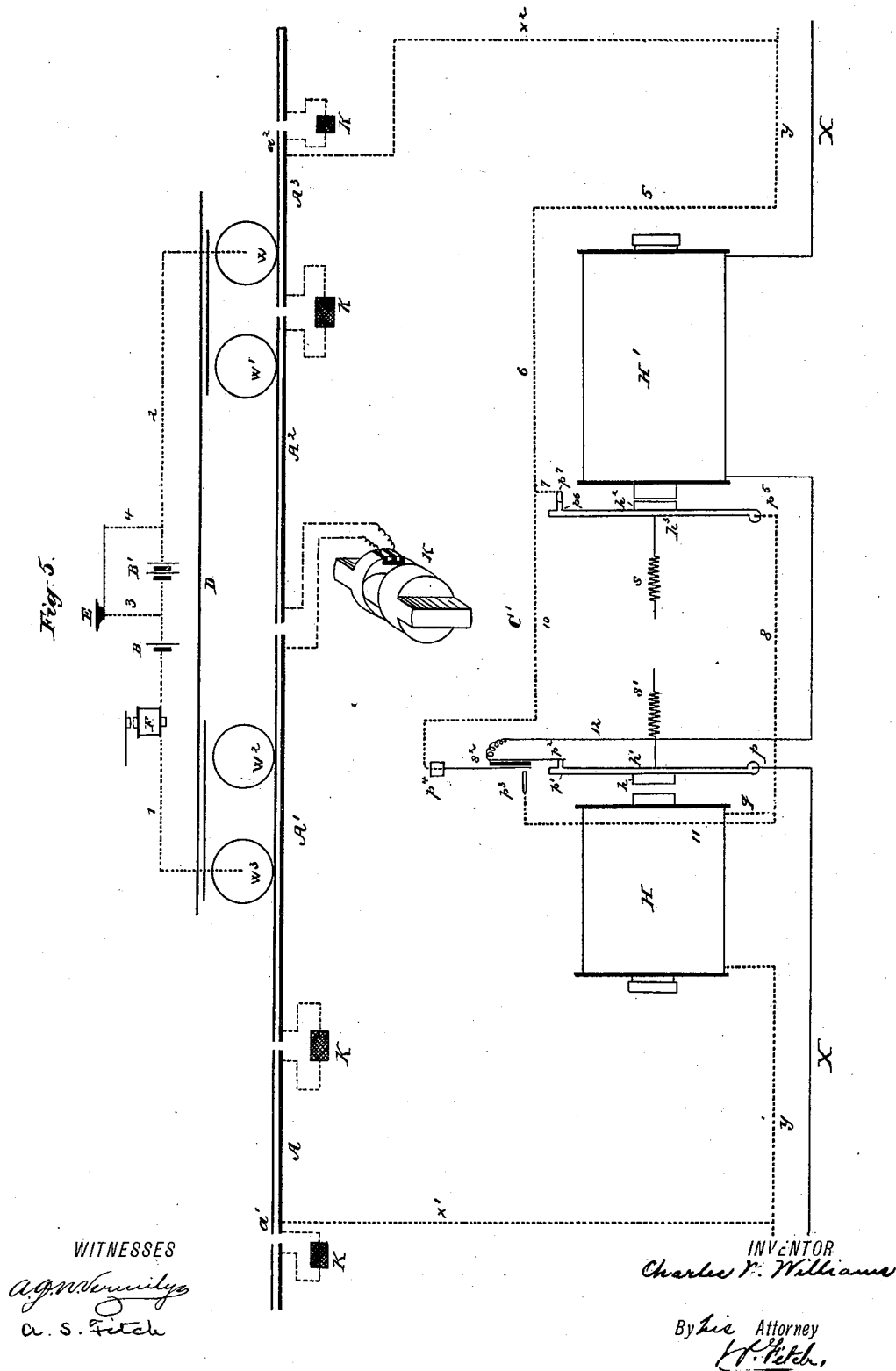
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Fig. 5.



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UNITED STATES PATENT OFFICE.

CHARLES W. WILLIAMS, OF CAVE CITY, KENTUCKY.

RAILWAY-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 343,095, dated June 1, 1886.

Application filed November 12, 1885. Serial No. 182,512. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. WILLIAMS, of Cave City, Barren county, Kentucky, and a citizen of the United States of America, have invented certain Improvements in Railway-Telegraphs, of which the following is a specification, reference being had to the accompanying drawings, forming part of the same, in which—

Figure 1 represents several sections of a railroad-track, one of them having upon it a telegraph-car, a series of train-circuits, a main circuit, and a series of repeaters, through each of which passes the main circuit, and also one of the train-circuits. Fig. 2 represents a similar system, so arranged that each train-circuit passes through two repeaters. Fig. 3 represents a system similar to that shown in Fig. 2, but in which the earth forms part of the train-circuit. Fig. 4 represents a system similar to that shown in Fig. 1, except that in this, also, the earth forms part of the train-circuit; and Fig. 5 represents in detail a form of repeater and its connections, the train-circuit, the car, and its equipments, with an indication merely of a key-block which may be employed.

The object of this invention is to maintain an unbroken electrical circuit or circuits from a telegraph-station on the ground to an electrical apparatus on a car upon a railway, or from one such car to another, whereby electrical signals may be communicated from one to the other, and to do this in a way that will obviate many of the objections which present themselves in other systems of apparatus for a like purpose now in use; and it consists, essentially, in combining with the main-circuit conductor a series of short consecutive circuits which are successively in circuit with the car, or a circuit which communicates with the car, and a series of repeaters, by which impulses in one, either the train or main circuit, are repeated in the other of said circuits. By this means I am enabled to have a practical working railway-telegraph of indefinite length, to obviate the difficulties that arise from imperfect insulation in long circuits when the train-circuit is also a part of the main circuit, and to establish such a system without interfering with the working of the main circuit, risking the grounding thereof, or deranging it in case a train or trains at their

immediate circuit-connections fail to work, and to confine the effect of any such derangement to the immediate train or train-circuits so deranged.

Fig. 1 represents four sections or train-circuits of my system. By "train-circuits" I mean those intermediate the telegraph-car and the main circuit.

X X' is the main line-circuit conductor, which is distinct from the train-circuits, and may be supported upon poles in the usual manner, thus securing perfect insulation, or arranged in any other suitable way. It may be an ordinary telegraph-line, such as is in general use, being grounded at either end, and connected with way-stations, and used as such lines commonly are; but at proper distances it passes through repeaters C, &c., to be presently described, each one of which is also in a train-circuit. From the rails A, &c., short wires $x x' x'' x''' x^{iv}$ extend to a wire, y , passing through the said repeaters, being connected thereto at such points that the wire y between any wires, $x x'$, &c., passes through a repeater.

D is the car. It carries a battery, B, a telegraph-key, E, and a sounder, F, the wires 1 and 2 extending from the respective poles of the battery to the front and rear trucks of the car, and being put in electrical connection with the rails of the road by means of the wheels, as shown in Figs. 6 and 10 of Letters Patent No. 313,462, issued to Messrs. Ives, Barnum, and myself, though this is not absolutely necessary, as electrical connection between the car instruments and the circuit upon the ground may be secured by any other suitable means—such, for instance, as are employed in Letters Patent No. 309,274, heretofore granted to said Messrs. Ives, Barnum, and myself.

When employing the devices shown, in order that the circuit of the car-battery should include the repeater and not short-circuit along the track from one car-wheel to the other, it is necessary that a break should at all times exist between the rails upon which, respectively, the wheel connected with wire 1 and that connected with wire 2 stand. To secure this, the rails at intervals shorter than the distance between said wheels are insulated one from the other, and provided with a key-block which is operated by the first truck of

the telegraph-car passing over it to break an electric connection from one rail to the next, and again by the last truck to close such a connection. If it is not convenient to employ rails shorter than the car, then the battery-wires must be extended over more than one car, which may easily be done. Any form of key-block that will accomplish the described breaking and closing of a circuit from one rail to another may be used. Such a one is described and shown in Letters Patent No. 309,274, heretofore referred to, and is indicated at K, Fig. 5, herein. The repeater, Fig. 5, by means of which impulses in the train-circuit cause corresponding impulses in the main-line circuit, and vice versa, consists of a coil or relay, H, of low resistance, in the train-circuit, and another, H', in the main-line circuit. The former is provided with an armature, *h*, secured to a swinging lever, *h'*, forming part of the main-line circuit, and the latter with one, *h²*, secured to a swinging lever, *h³*, which forms a part of the normal train-circuit. *h³* is hinged at *p⁵* and provided with a contact-point, *p⁶*, at or near its other extremity, which when the armature is drawn toward its magnet makes contact with a contact-post, *p⁷*, connected with the train-circuit wire 6 by wire 7. It also has a spring, *s*, which draws it away from its magnet and breaks the contact at *p⁶* whenever the circuit through magnet H' is broken. *h'* is hinged at *p*, and provided near the other extremity with a contact-point, *p'*, which makes contact with contact-piece *p²*, which is in the main-line circuit, and a spring, *s'*, which acts counter to the force of magnet H. Another contact-post, *p³*, is provided connected with the train-circuit by wire 11; also a spring, *s²*, secured to a post, *p⁴*, and at its free end to contact-piece *p²*, from which it is insulated. It has a wire, 10, running from it to train circuit wire 6. These springs, posts, points, &c., are so located, supported, and arranged that when the armature *h* is drawn toward its magnet, carrying lever *h'* and its point *p'* away from *p²*, and thus breaking the main-line circuit and interrupting the current through H', which would permit spring *s* to draw back *h³* and break the train-circuit at *p⁶*, the spring *s²* will, before this break is accomplished, make contact with *p³*, thus establishing another complete circuit through H. The instrument on the car is so arranged that it may at the will of the operator employ a strong or a weak battery, and this result is here accomplished by providing two batteries—one, B, connected as usual, and the other, B', also in the train-circuit, but having short wires running from its respective poles or polar connections, one, 3, to one contact-point of the key E, and the other, 4, to the other contact-point of said key. The sounder on the car is at all times in circuit.

The operation of these devices is as follows:
65 The car having entered the system and, we will say, reached that section of it between *a'* and *a²*, the connections through the key-blocks

from *A'* to *A²* and from *A²* to *A³* have been broken and the circuit of battery B is, key E being closed, battery B, wire 1 through sounder F to wheel W³, rail A', key-block K, rail A, wire *x'*, wire *y* through repeater C', by magnet H, wires 9 and 8, lever *h³*, point *p⁶*, post *p⁷*, wires 7 6 5 to *y* and thence by wire *x²*, rail A³, wheel W, wire 2 and to the other pole of the battery, the main-line circuit through the repeater at the same time being wire X, lever *h'*, point *p'*, piece *p²*, wire 12, magnet H', wire X. Now, if a break is made by a way-station operator in the main-line circuit, the current through H' will cease. It will not attract armature *h²*, and spring *s* will draw back *h³* and break the train-circuit at *p⁶*, thereby producing the usual action in sounder F. The main circuit being closed, the train-circuit, as is obvious, will also be closed, and thus an operator by making and breaking the main-line circuit produces corresponding changes in the train-circuit, and may thus communicate with the operator on the car. The current of battery B is not strong enough to so charge H as to overcome the force of spring *s'*; but when the operator on the train wishes to transmit a message he opens the key E. This brings into action the stronger battery B', which has previously been short-circuited through the key by wires 2 3 4 2. The current through electro-magnet H is now strong enough to overcome spring *s'*, and attracts armature *h*, swinging lever *h'* on its pivot, and drawing *p'* away from *p²*, thus breaking the main-line circuit and causing the station-sounder to respond. When the key on the car is again closed, battery B' is again short-circuited, spring *s'* overcomes the remaining force of H, and draws back lever *h'*, thereby closing the main-line circuit with the usual result. It will thus be seen that impulses in the one circuit are duplicated in the other, and thus messages may be transmitted from the car to any station on the line or any car similarly equipped in any other section of the system, and vice versa. But it will also be seen that when the main circuit is broken at *p'* the current through H' will cease, and spring *s* will draw back *h³*, and break the train-circuit at *p⁶*, and this would cause the failure of the repeater to work by cutting off the car-battery current from magnet H, which is necessary to enable it to hold the main-line circuit broken, and to bridge this difficulty is the purpose of the subsidiary train-circuit through 11, *p³*, *s²*, and 10, as heretofore described. By their means the train-circuit is established from wire 9 through them to wire 6 before it is broken at *p⁶*, as the stress and flexibility of spring *s²* is such that *p²* will remain in contact with *p'* until after *s²* makes contact with *p³*, thus obviating this seeming difficulty. As may be seen in Fig. 1, there is a series of these train-circuits, such as *a x y C y x' a' A* and *a' x' y C' y x² a² A³*, &c., each independent of the other, except wires *x*, &c., which are common to two adjacent circuits,

but may be independent, if preferred, and it is obvious that in case any telegraph-car should be out of order that would in no way affect the action of any other car that a defect in any train-circuit or repeater would not affect any other train circuit or repeater, and that defects in all the train-circuits would not prevent the using of the main line from one stationary office to another, which is the result aimed at in my present invention. I have said the wires running from the rail (wires x) might in each circuit be independent of similar wires in the other circuits, and while this is true I prefer to arrange them as shown, as this is a simple way of preventing any momentary break when the car passes from one section to another, for, as will be readily seen, at no time can the car be so placed that there will not exist a circuit through a repeater from the rail upon which one circuit-wheel stands to the rail upon which the other circuit-wheel stands.

The modifications embraced in Figs. 2, 3, and 4 are so manifest as to need no further explanation than that given in the description of those figures.

I do not intend to limit myself to the exact devices shown, as many modifications will readily suggest themselves to any electrician which would still be entirely within the spirit of my invention, which contemplates a main-line circuit-wire, and a series of independent consecutive circuits intermediate the main-line wire and the car-instruments, howsoever arranged, with means for reproducing in one signals or impulses made in the other. It will also be noticed that I have described my apparatus as employing normally-closed circuits. Provision for this must be made or the fact regarded in making and receiving the signals; but no explanation is necessary, as any electrician readily understands how this may be done.

The devices which I employ upon the car to produce the impulses, as described, I regard as novel when arranged and combined as shown; but I reserve the invention therein disclosed for future application.

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

1. In a railway-telegraph system, the combination, with a main-line conductor, of a repeater having a circuit adapted to be closed or broken, as described, by the closing or breaking of the main-line circuit, a car provided with a partial circuit and electrical instruments included therein, contact devices making contact between the ends of said partial circuit and said repeater-circuit, divisions in said repeater-circuit located at distances from each other less than the distance between said contact devices, and circuit-breakers, substantially as described, whereby said repeater-circuit is continuously held open between said

contact devices and the current is thereby shunted through the car-circuit, thus permitting impulses produced by instruments in the car and main circuits to cause similar impulses in the other of said circuits, all as and for the purpose specified.

2. In a railway-telegraph system, the combination, with a main-line circuit, of a series of consecutive train-circuits, one of the connecting-wires of which is common to two adjacent train-circuits, and means, as described, for producing in said main or either of said train-circuits electrical impulses similar to impulses which have been produced in said train or main circuits, as and for the purpose described.

3. In a railway-telegraph system, a main-line circuit, a series of train-circuits on the ground, a car carrying a partial circuit, and means for breaking the train-circuits and shunting them through said partial circuit, and the described means for producing electrical impulses in said train-circuit thus completed or in said main-line circuit and for enabling the said impulses in either of said circuits to produce similar impulses in the other of said circuits, all constructed and combined as and for the purpose specified.

4. A repeater consisting of electro-magnets H H' , provided with armatures h h' , secured to swinging levers h' h'' , which are connected to springs s s' , acting counter to said magnets, wires y , adapted to form part of a train-circuit, as described, wires 8 and 9, leading from magnet H to lever h' , wire 11, post p' , wires X , adapted to form part of a main-line circuit, as described, one leading to lever h' and the other from magnet H' , wire 12, piece p' , point p' , spring s' , point p' , post p' , wires 7, 6, 5, and 10, all constructed, arranged, and combined substantially as and for the purposes specified.

5. In a railway-telegraph system, the combination, with a line-conductor, of a car provided with a partial circuit and electrical instruments included therein, contact devices making contact between the ends of said partial circuit and said line-conductor, divisions in said line-circuit conductor located at distances from each other less than the distance between said contact devices and circuit-breakers, substantially as described, whereby said line-circuit is continuously held open between said contact devices and the current is thereby shunted through the car-circuit, thus permitting impulses produced by instruments in the car or main circuits to be reproduced by instruments in the other of said circuits, all as and for the purpose specified.

CHARLES W. WILLIAMS.

Witnesses:

W. T. WILLIAMS,
J. W. PAYNE.