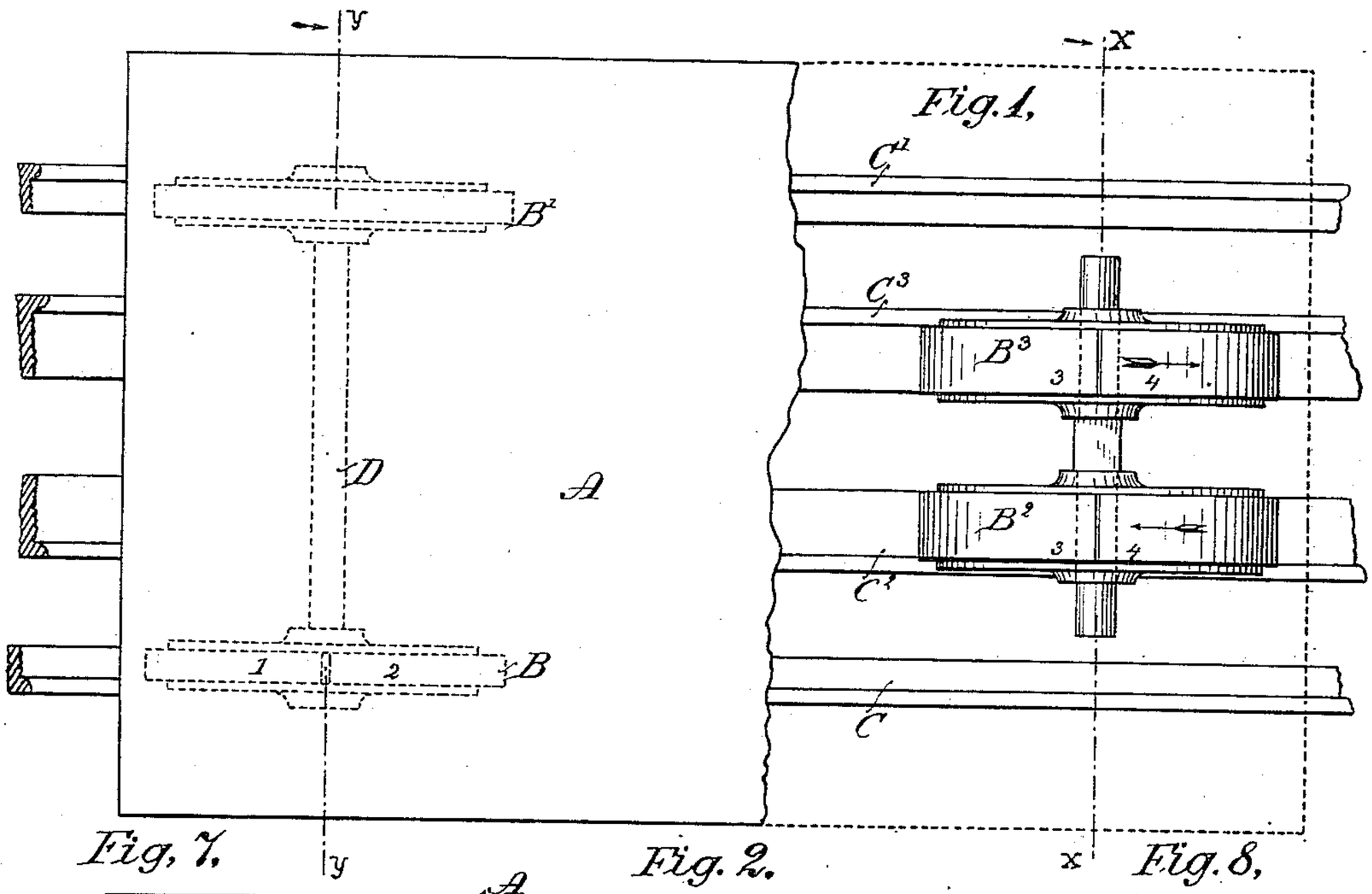
(No Model.)

2 Sheets—Sheet 1.

C. H. RUDD.

ELECTRIC RAILWAY.

No. 259,589. Patented June 13, 1882.



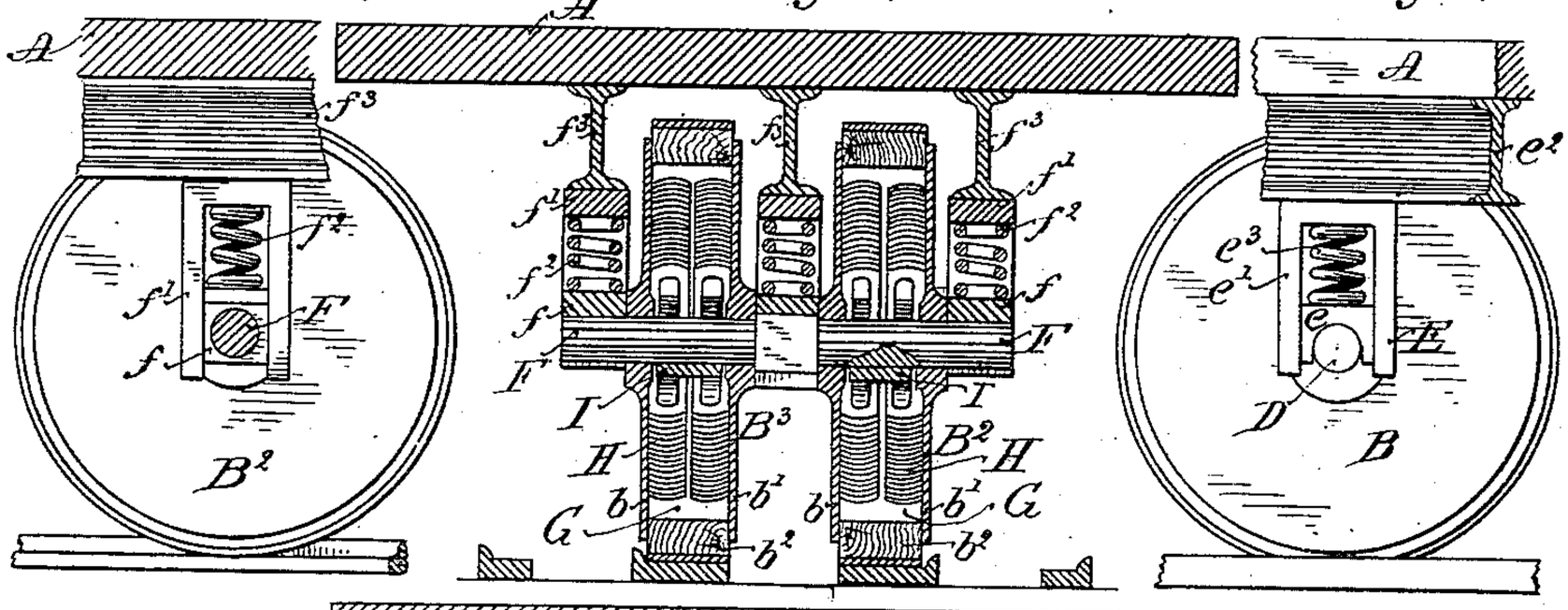
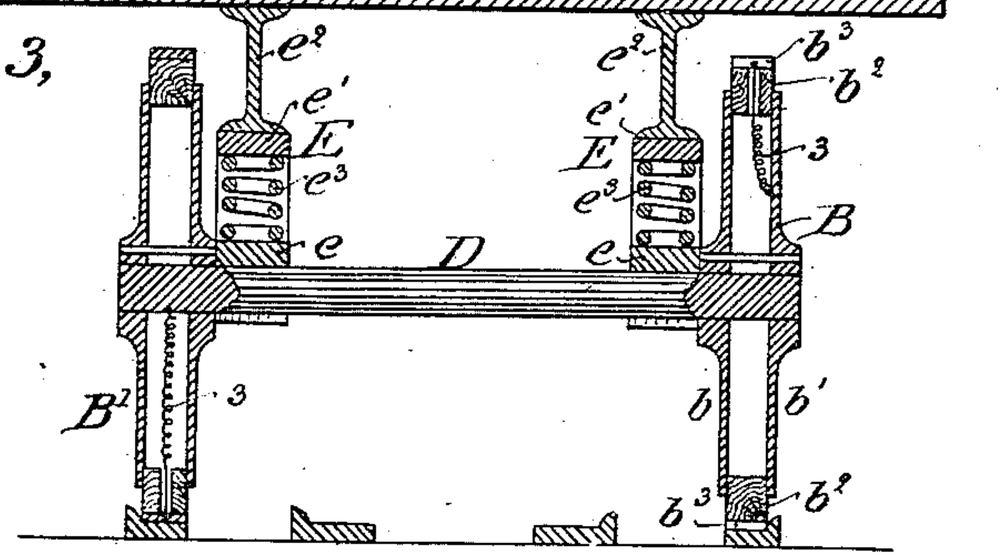


Fig. 3,



WITNESSES

Wm. A. Skinkle.

Ernest Abshagen.

INVENTOR

Chas. H. Rudd,

By his Attorneys

Baldwin, Hopkins & Peyton.

(No Model.) 2 Sheets—Sheet 2.

C. H. RUDD.

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Fig. 4.

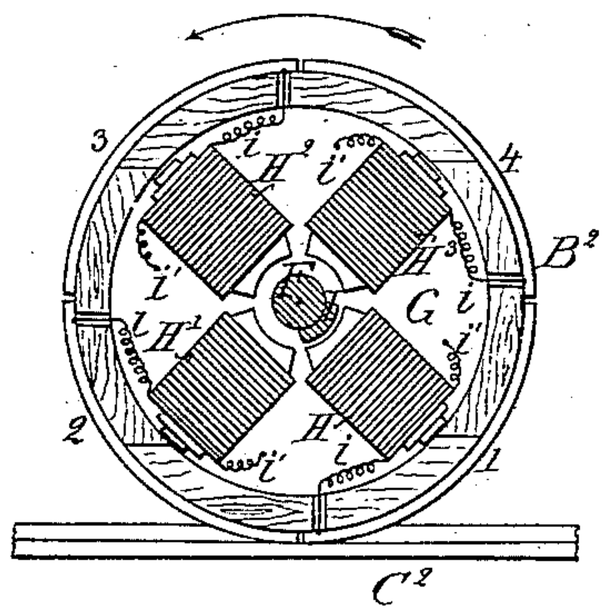


Fig. 5.

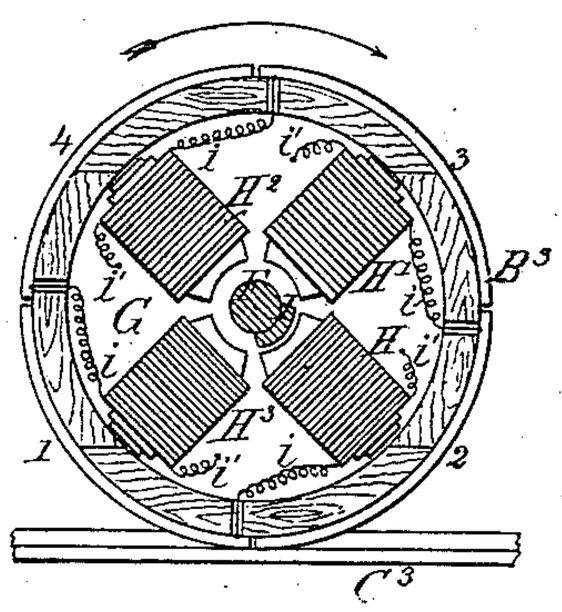


Fig. 6.

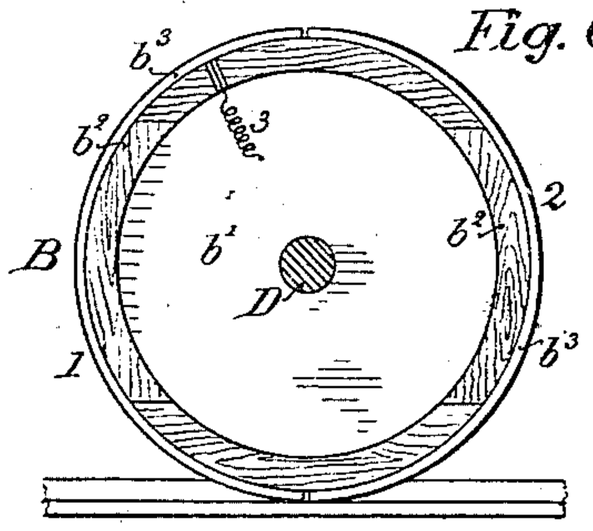


Fig. 9.

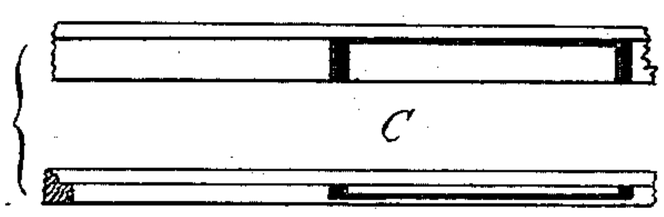


Fig. 10.

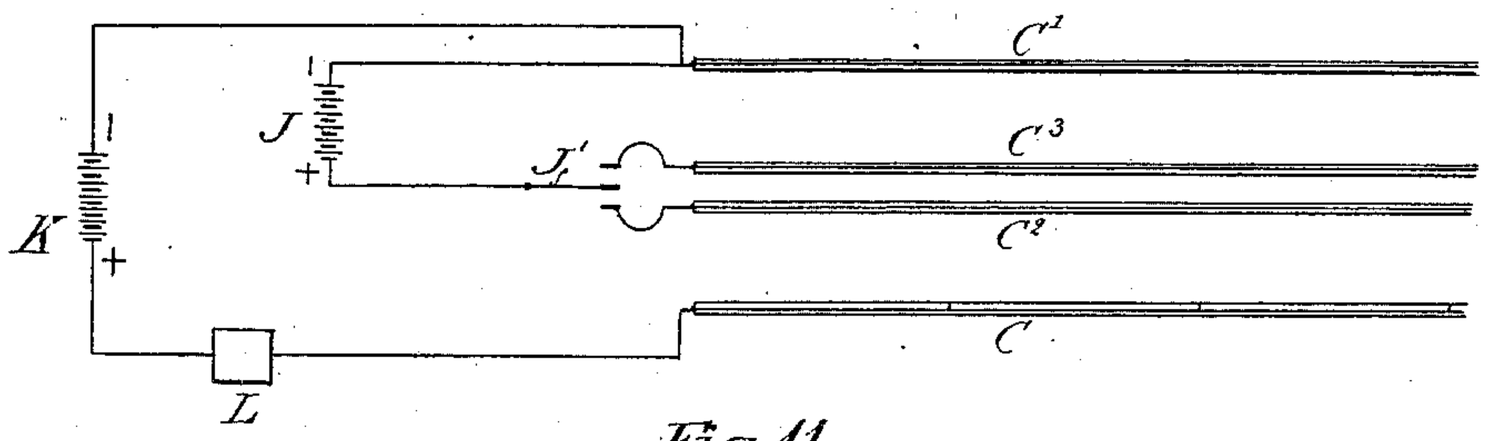
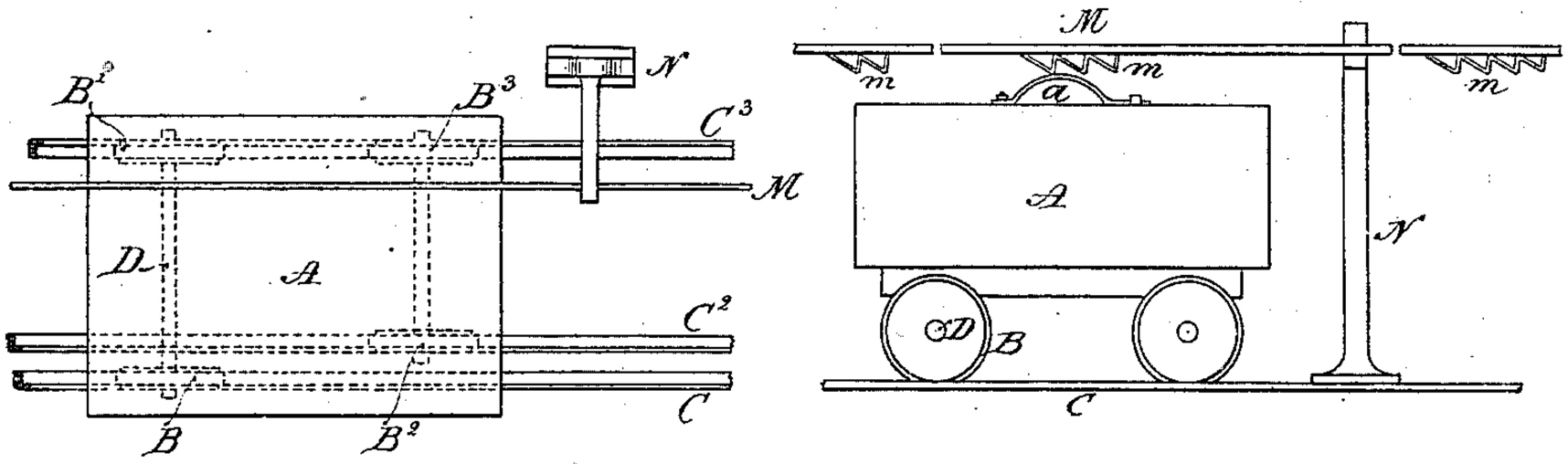


Fig. 11.



WITNESSES

Wm. A. Skinkle.
Ernest Abshagen.

INVENTOR

Chas. H. Rudd,

By his Attorneys

Baldwin, Hopkins & Peyton.

UNITED STATES PATENT OFFICE.

CHARLES H. RUDD, OF EVANSTON, ILLINOIS, ASSIGNOR TO JAMES W. WHITE, JAMES CLARENCE WHITE, AND H. M. LEWIS, TRUSTEES, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 259,559, dated June 13, 1882.

Application filed April 6, 1882. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. RUDD, of Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Railways, of which the following is a specification.

My invention relates to propelling cars, carriages, or vehicles upon railways by means of electro-magnetism; and its object more especially is to propel upon a railway light carriages or vehicles particularly useful in transporting light packages or articles rapidly, safely, and economically from one place to another. The object of my invention also is to improve electric railway propulsion generally; and it may be stated here at the outset that some of the improvements hereinafter described and claimed may be used without the others, and also in systems differing in some of their features from that herein particularly described.

The subject-matter claimed is distinctly pointed out at the close of the specification.

In the accompanying drawings, which show so much of my improved apparatus as is necessary to an understanding of my invention, my improvements being organized in the best way now known to me, Figure 1 is a plan or top view of the carriage or vehicle and the system of rails upon which it runs, a portion of the body of said vehicle being broken away to show the driving-wheels mounted upon the under side thereof. Fig. 2 is a transverse section through the apparatus on the line *x x* of Fig. 1, and Fig. 3 is a similar section on the line *y y* of said figure. Figs. 4 and 5 are side views of the interior of the respective driving-wheels for producing backward and forward movement of the carriage over the rails. Fig. 6 is a view of the interior of one of the supporting-wheels of the carriage, which is also particularly useful for signaling or reporting purposes, in order to indicate to the operator at a fixed station the speed of the carriage and its position upon the track. Fig. 7 is a view showing a spring or yielding bearing for the fixed shaft, around which the driving-wheels turn, and Fig. 8 is a similar view of a similar bearing for the revolving axle of the main supporting-wheels. Fig. 9 shows a plan and an edge view of one form of rail which may be used. Fig. 10 is a diagram of the system of rails and methods of running the circuits both to the driving and to the reporting or signaling wheels, and Fig. 11 comprises a plan view and a side elevation of a modified form of apparatus.

The body or frame A of the car, vehicle, or carriage may be of any suitable construction, and is mounted in this instance upon four wheels, B B′ B^2 B^3, each of which in the organization shown in Figs. 1, 2, and 3 runs upon its respective rail C C′ C^2 C^3, said rails constituting the track over which the carriage is propelled. The wheels B B′ are fixed upon an axle, D, so as to turn with said axle in bearings E E, suspended or connected to the under side of the carriage, car-body, or truck-frame, as clearly shown in Figs. 3 and 8. The bearings E E of said axle D are yielding bearings, and preferably consist each of a bearing-block, *e*, movable up and down in a bracket frame or box, *e′*, fixed to the car body or truck by a metallic girder or frame, e^2, a spiral or other suitable spring, e^3, being interposed between said block, which rests upon the axle D and said box so as to support the weight of the carriage or car-body, as clearly shown in Figs. 3 and 8.

The wheels B and B′ are what I term the "main" supporting-wheels of the carriage or car A. Said wheel B′ is preferably a plain metallic wheel; or it may be composed of metallic side plates with a felly clamped between them having a continuous metallic tire or band, as shown in Fig. 3, while the wheel B or its tire or tread is constructed preferably in sections electrically insulated one from the other. I prefer to construct said wheel B of two circular metallic side plates or disks, *b b′*, having suitable enlargements at their centers to afford proper strength in their connection with the axle D, with which they turn, said plates having securely clamped or fastened between them in any proper way, so as to project beyond their peripheries, a circular rim or felly, b^2—say of wood or some other suitable insulat-

ing material—which acts mechanically somewhat in the manner of an ordinary wagon-wheel felly. A metallic tire, b^3, nearly surrounds this rim or felly b^2, said tire being constructed, say, in two parts, 1 2, having their adjacent ends divided and insulated, as clearly shown in Figs. 1 and 6. One section—say part 1—of said tire b^3 is electrically connected with one of the metallic side plates or disks, b b', and through it to the axle D, as shown in Figs. 3 and 6—by means of a wire, 3, for instance—while the other part, 2, of said tire b^3 will be electrically disconnected from said axle D by reason of the interposed non-conducting rim or felly b^2, the object of which construction will presently appear.

The wheels B^2 B^3 are what I call the "driving-wheels," and they are preferably constructed somewhat similarly to the wheel B—that is to say, they preferably consist each of two circular metallic side plates or disks, b b', having clamped or otherwise securely fastened between them at their edges a circular rim or felly, b^2, of wood or some other suitable non-conducting material, said rim or felly extending out beyond the circumference of said side plates or disks, so as to electrically insulate said disks and the shaft F, upon and around which they turn, from the rails upon which said wheels run. The rims or fellies of the wheels B^2 B^3 are provided on their peripheries with sectional metallic tires, each tire preferably consisting of four sections, 1 2 3 4, the adjacent ends of which are separated and insulated from each other, as clearly shown in Figs. 1, 4, and 5. Said wheels B^2 B^3 are fitted by their side plates to turn independently upon a fixed or non-rotating shaft, F. Said shaft F rests in bearings or blocks f, which have up-and-down play in brackets or boxes f', spiral or other suitable springs, f^2, being interposed between the blocks f and said boxes f' in order to support the front end of the body or truck of the car or carriage and afford yielding bearings for the shaft of said wheels B^2 B^3 correspondently with those of the wheels B B'. The metallic frame or girders f^3 of the bearings of the shaft F are in electrical connection by contact or by connecting pieces or wires (not necessary to be shown) with the similar frame or girders, e^2, of the bearings of the axle D; or the respective girders e^2 may be formed in one piece with the respective outside girders, f^3, if desired, so that a continuous metallic or conducting frame is formed between the axles D F and the platform or body of the car.

The metallic side plates or disks, b b', of the driving-wheels B^2 B^3 should be sufficiently separated by their rim or felly b^2 as to form between said rim and the shaft F, around which said wheels turn, a circular chamber, G.

Within the chamber G of each of the wheels B^2 B^3, I preferably mount and secure equidistant from one another four electro-magnets, H H' H^2 H^3, as clearly shown in Figs. 2, 4, and 5, the poles of which face the fixed shaft F, which is provided at one point within each chamber G with an armature, I, the shaft itself, other than its armatures I I, being preferably constructed of non-magnetic metal. From each insulated section 1 2 3 4 of the metallic tire of each of the driving-wheels B^2 B^3 an insulated wire is run to one of the electro-magnets H H' H^2 H^3, the method of running the connections being clearly shown in Figs. 4 and 5. It will thus be understood that the electro-magnets are firmly fastened upon the interior of the wheels B^2 B^3, and that each section of the divided tire of each wheel B^2 B^3 is connected with its respective magnet. Said wheels B^2 B^3, as I have before stated, are the driving-wheels of the car or vehicle. Their construction and action are similar, save in so far as the electrical connections between the tire and magnets are concerned. These connections are run differently, as clearly shown in Figs. 4 and 5, the object of which is to rotate the wheel B^2 in one direction when its magnets are successively excited by a current of electricity traversing their coils, so as to propel the car or vehicle in one direction along the track, and to rotate the other driving-wheel, B^3, in the opposite direction when the coils of its magnets are successively excited, so as to propel the car or vehicle in the other direction along said track, the rotation of said wheels B^2 B^3 being due to the successive attractive action of the electro-magnets exerted upon their fixed armatures, each magnet of each wheel being excited in its turn as its section of the tire comes upon the track to act upon the armature and make the motion of the wheel constant about its shaft F by a current conveyed along the rails of the track, as will be fully explained.

The rails on which the carriage runs in the organization shown in Figs. 1, 2, 3, and 10 are four in number, and are preferably made in the form of the usual street-car rail, although it will be obvious other forms of rails may be used and the wheels of the car or carriage provided with the usual flanges. These rails are all insulated, so as to be good conductors of electricity, and are the medium through which the electric current is conveyed, which is converted into electro-magnetism at the vehicle to propel said vehicle.

The arrangement on circuit is clearly shown in Fig. 10. A generator or source of electricity, J, has its negative pole connected with the rail C', while the positive pole of said generator may be connected by a switch, J', with either of the rails C^2 C^3, accordingly as it is desired to propel the carriage in one direction or the other. A second generator or source of electricity, K, has its negative pole connected with the rail C', while its positive pole is connected with the rail C, it being thus understood that I prefer to utilize the rail C' as a common return-conductor for the currents of both the generators J and K, which are employed for different purposes, the generator J being utilized to propel the car or vehicle, while the

generator K is utilized for reporting purposes, so as to indicate by suitable apparatus, L, the speed of the car and its location upon the track.

The operation of the apparatus is as follows: Suppose the car or vehicle is at one end of the track, and it is desired to propel it forward to the other end or to any intermediate station. The engineer in control of the switch J′ will now turn said switch so as to make contact with the connection of the insulated rail C^3 and throw a powerful current along said rail. The insulated section of the tire of the driving-wheel B^3, resting upon the track, will conduct said current to its respective electro-magnet, which, being thereby excited, will exert its attractive action upon the armature I of the shaft F, and will pull said wheel around, turning it in a forward direction, as indicated by the arrow, Fig. 5. As soon as the section of the tire passes from the track the electrical connection between the rail and the magnet which has just been at work is broken, while the next magnet is simultaneously thrown into action to exert its action upon the armature and make the motion of the wheel constant, and so on. The circuit is completed from the rail C^3 successively through each working magnet of the wheel B^3 to the return conducting-rail C′ by means of the sectional tire, the connections *i i′*, the metallic side plate or disk of the wheel, the shaft F, the metallic bearings of said shaft, a metallic connection (or frame f^3 e^2) connecting said bearings with the metallic bearings E of axle D, said axle D, and the wheel B′. It will be understood, however, that the connections from the magnets of the driving wheel or wheels to the return-conductor may be organized in many different ways. When the movement of the carriage is to be reversed the switch J′ is shifted so as to withdraw the current of the generator from the rail C^3 and throw it upon the rail C^2 and through the magnets of the wheel B^2, the connections between the sectional tire of the wheel B^2 and its magnets being run so that the direction of rotation of the wheel B^2 will be the reverse of that of the wheel B^3. (See Figs. 4 and 5.)

From what has been said it will be seen that the operator or engineer may at will produce either forward or backward motion of the carriage from the station at which he is situated by throwing into action either one of two motors carried by the vehicle, and this control is very desirable.

In order to indicate the speed of the carriage along the track and to show its position to the operator, I have organized the wheel B, as hereinbefore described, to run upon the conducting-rail C. The current of the battery or generator K is thrown upon said rail C when the circuit is closed. At the times the section 1 of the tire of the wheel B is on the rail the circuit of the said generator K will be closed, a conducting-connection being formed by the tire section 1, its wire 3, the plate or disk *b′* of the wheel B, the axle D, and wheel B′ to the return-conductor C′, which, as before stated, is connected with the negative pole of the generator.

In the circuit of the generator K, I place a suitable apparatus, L, to denote the presence or absence of a current of electricity. Any suitable apparatus, of which there are many forms well known to electricians and in common use, may be employed for this purpose, and I have therefore not shown any particular one in detail. From what has been said as to the construction of the wheel B it will be obvious that during its rotation the circuit of the battery K will be made and broken, and this will cause electric impulses or waves to be thrown upon said circuit and indicated or recorded at L, the rapidity of which impulses or waves will be an index as to the speed of the vehicle.

In order to indicate the position of the carriage on the track, sections or portions of the surface of the rail C (see Fig. 9) for any desired lengths may be electrically insulated in well-known ways, so as to prevent the current of electricity of battery K from passing to the wheel B, but not preventing said current from being conducted to other sections of the track which permit the closing and breaking of the circuit through the wheel B, as before described. This construction causes the waves of electricity produced by the wheel B to cease at intervals, and by noting or recording these intervals the distance the carriage has traveled may be readily ascertained. Other ways of insulating particular sections or lengths of the track obviously may be employed.

In Fig. 11 I have shown a modified organization of apparatus, and these modifications or changes I will describe.

In the organization shown in Fig. 11 the wheel B′ is constructed so that it (or its periphery) is insulated entirely from its axle D in well-known ways, and said wheel runs upon the same rail, C^3, as the driving-wheel B^3, there being in this organization but three rails, as will be clearly seen on inspecting the drawing. The driving-wheel B^2 runs upon its rail C^2, as in the organization first described, while the supporting-wheel B is a plain metallic one in electrical connection with its axle D, and runs upon the rail C, which in this modified organization is the return-conductor for both the generators J and K. In lieu of the conducting-rail C of the organization first described, there is connected with the generator K a rod or wire or other conductor, M, suspended overhead from suitable posts or supports, N, along the line of the track, said conductor M having suitable contact points or places, *m*, along its length to make contact at determined intervals with a contact piece or spring, *a*, placed on the carriage or car A, said contact-spring *a* being electrically connected with the axle D, and through its wheel B with the return-conductor C. By knowing the number of electric waves or impulses to be produced by the con-

tact of the conductor M with the contact-spring *a* to the mile the position of the carriage on the track may be constantly known, together with its rate of speed, and these indications may be indicated or recorded by suitable apparatus, well known to electricians, as before stated.

From the foregoing description of my invention it will be understood that an operator stationed at a fixed point may operate and control one or more cars or carriages upon an electric railway, while as the carriage moves along the track it reports itself to the operator, and the operator is therefore constantly informed as to the speed and position of the carriage.

I wish it understood that I do not limit myself to the details of construction which I have described and shown.

I do not claim herein any of the improvements shown and described by me relating to the apparatus and organizations for recording the speed and position of the car or train upon the track, as these improvements will constitute the subject-matter of a separate application.

What I claim as my invention is—

1. The combination, substantially as hereinbefore set forth, of a carriage with one or more of its supporting-wheels divided at its periphery into electrically-insulated sections.

2. The combination, substantially as hereinbefore set forth, of a wheel divided into electrically-insulated sections with electro-magnets carried by said wheel and electrically connected with said sections.

3. The combination, substantially as hereinbefore set forth, of a wheel divided into electrically-insulated sections, a non-rotating shaft around which said wheel turns, electro-magnets carried by said wheel and electrically connected with its insulated sections, an armature fixed upon the said non-rotating shaft, and circuit-connections, including a source of electricity, to convey current to excite said electro-magnets and cause them to act upon said armature.

4. A wheel composed of a body portion, a rim or felly of non-conducting material to insulate said body portion from a rail upon which the wheel runs, and a sectional conducting-tire, one or more of whose sections are in electrical connection with said body portion, and through it with the axle or shaft of said wheel.

5. The combination, substantially as hereinbefore set forth, of a non-rotating shaft, a hollow wheel fitted to turn around said shaft, electro-magnets carried by and inclosed within said wheel, and an armature fixed upon said shaft within said wheel, so as to be acted upon by said electro-magnets when excited.

6. The combination, substantially as hereinbefore set forth, of a carriage, a track upon which said carriage runs, two electromotors forming part of said carriage, one to move said carriage in a forward direction and the other to move said carriage in a backward direction, a generator of electricity, circuit-connections, and switch mechanism forming part of said connections to throw either one of said motors into action.

7. The combination, substantially as hereinbefore set forth, of a railway-carriage having two electromotors, separate insulated rails for the driving-wheels of said carriage, an electric generator to throw current upon either of said rails to propel said carriage, and a separate return or third conductor for the current traversing either one of said insulated rails.

8. The combination, substantially as hereinbefore set forth, of a vehicle, a shaft of said vehicle, an electromotor-wheel revolving around said shaft to propel the vehicle, and a rail between the main rails of the track upon which said motor-wheel travels.

9. The combination, substantially as hereinbefore set forth, of a vehicle, electro-magnetic mechanism mounted on said vehicle so as to propel it, a generator at a fixed station supplying electricity to said mechanism, and a switch device by which said propelling mechanism is controlled, so as to enable the operator at a fixed station to produce either forward or backward motion of the vehicle at will.

In testimony whereof I have hereunto subscribed my name this 22d day of March, A. D. 1882.

CHARLES H. RUDD.

Witnesses:

GEORGE WALKER,

CARL FOCKE.