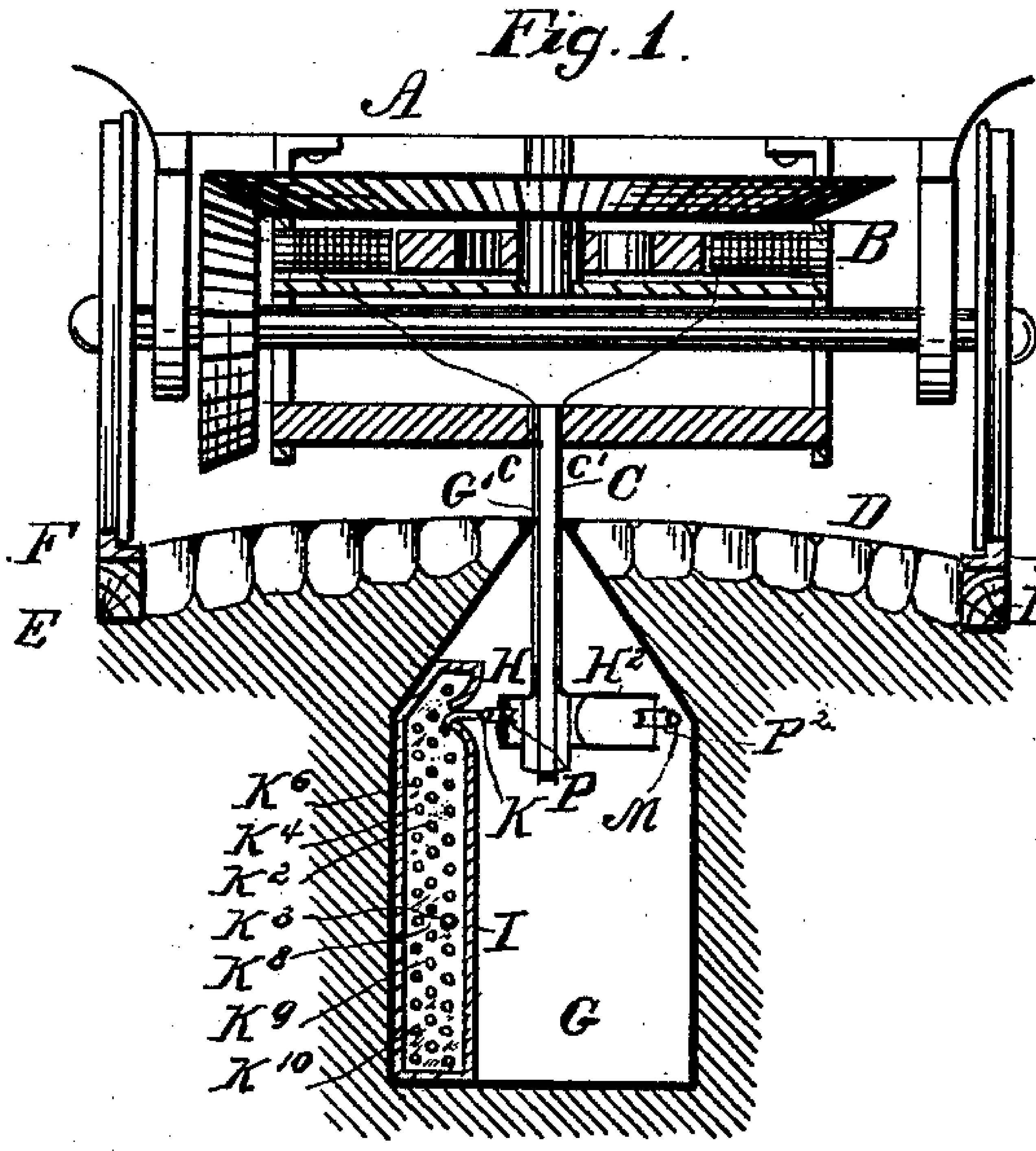
(No Model.)

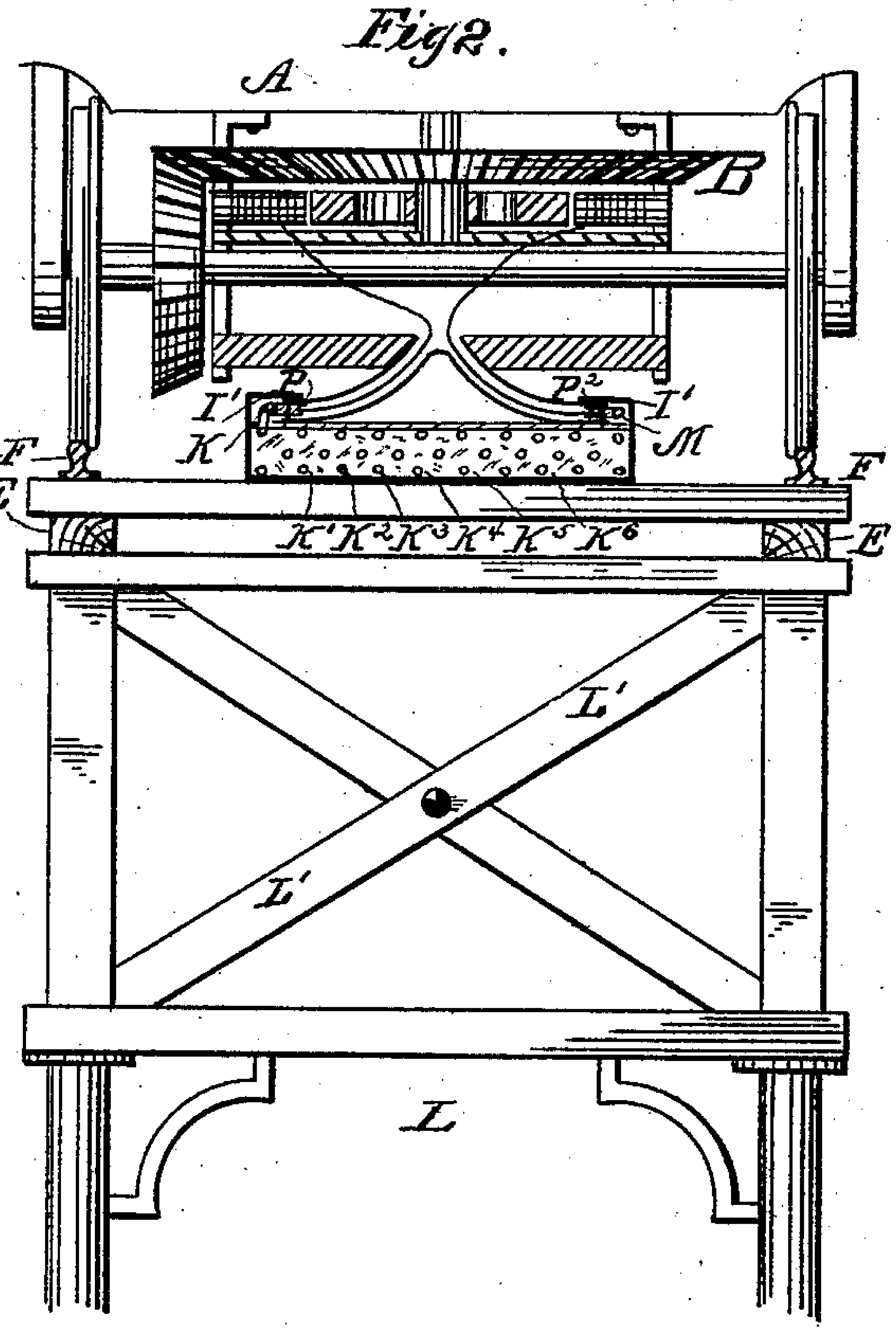
2 Sheets—Sheet 1.

I. W. HEYSINGER.

ELECTRIC RAILWAY.

No. 359,607. Patented Mar. 22, 1887.





Witnesses:
John Nolan
Joshua Pusey

Inventor:
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N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

I. W. HEYSINGER.

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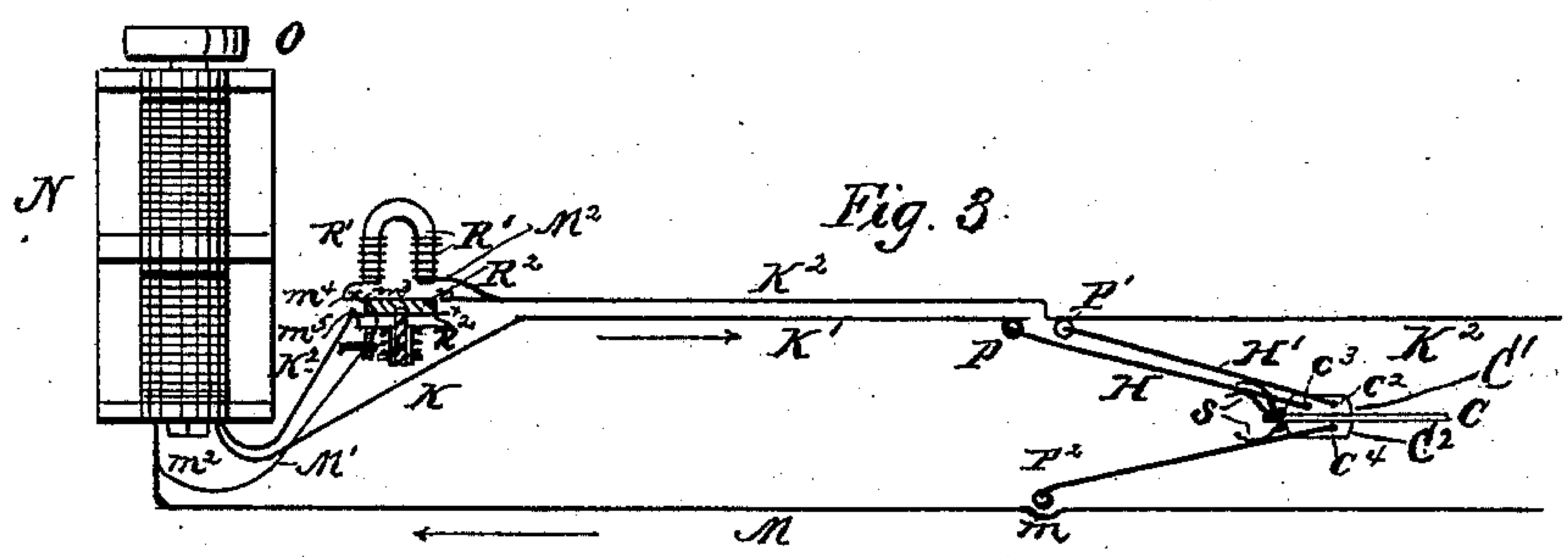

Fig. 3.

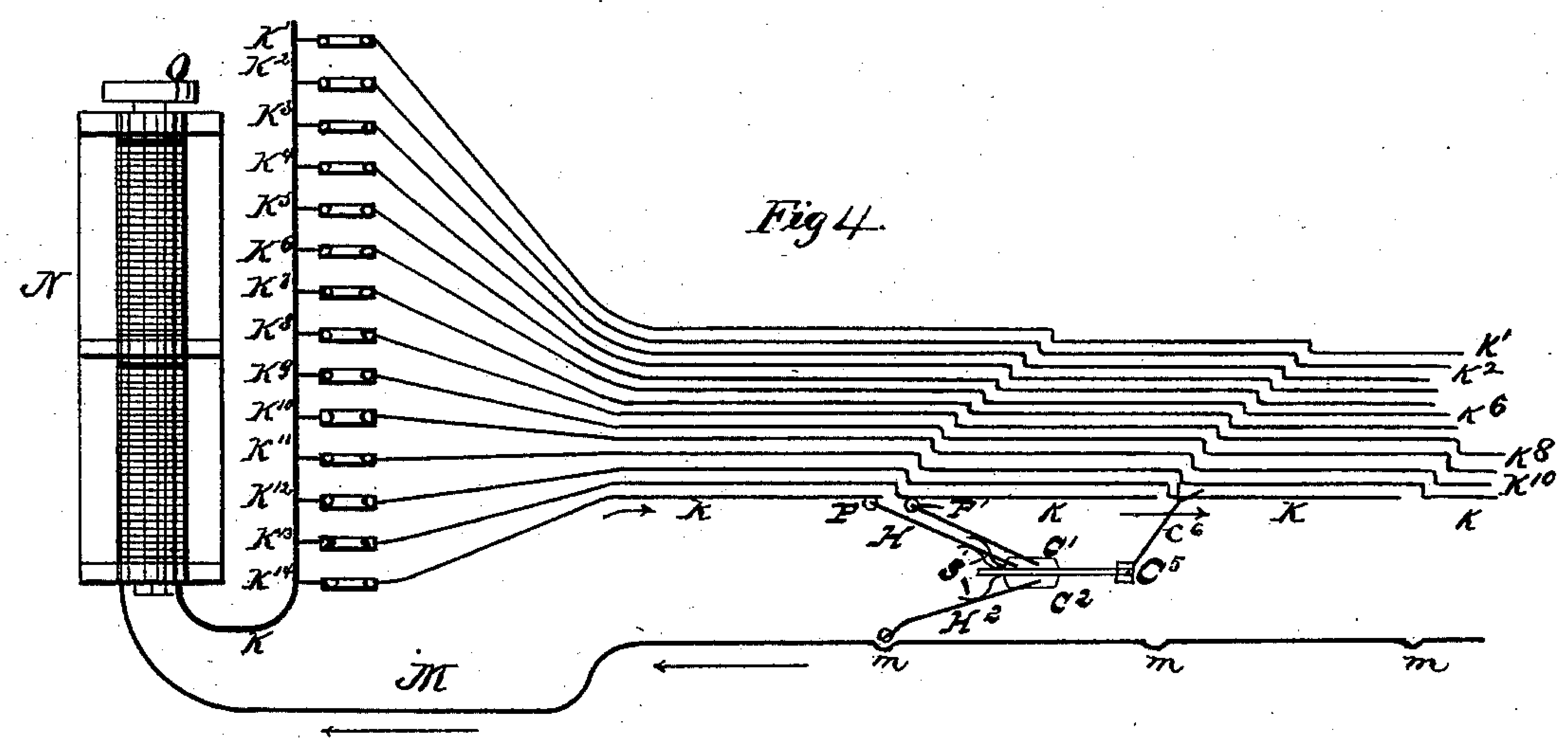

Fig 4.

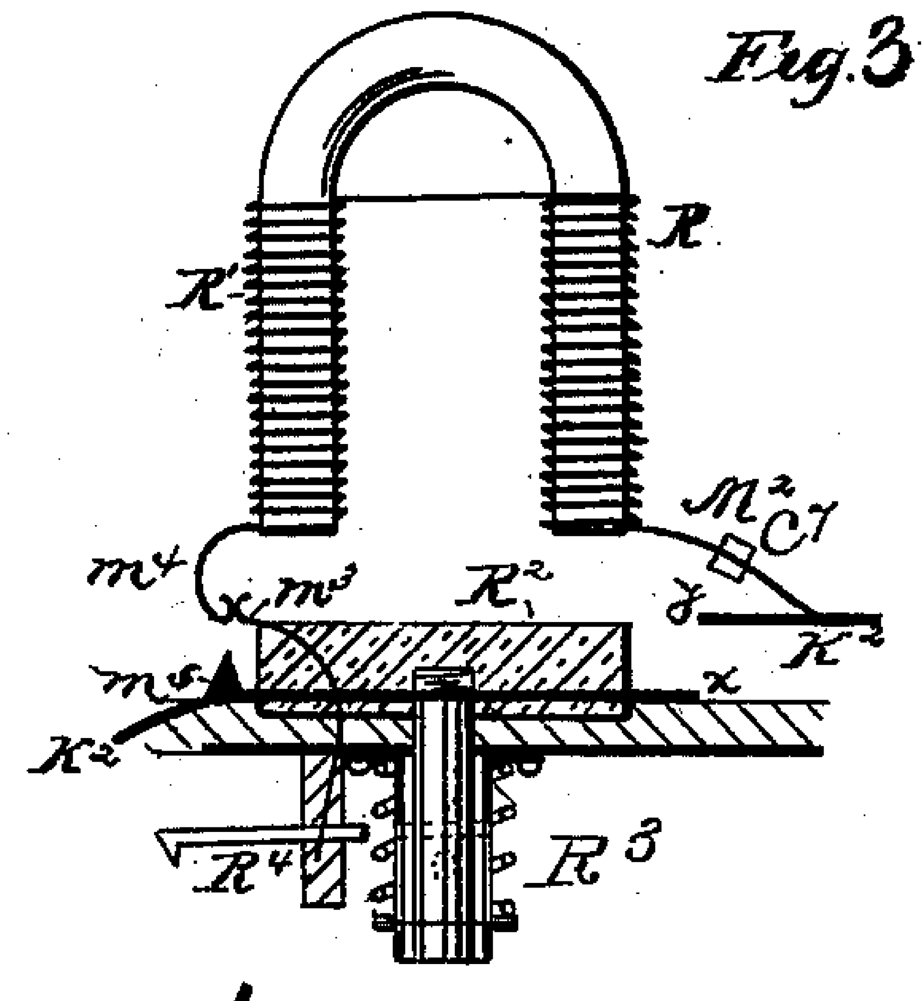

Fig. 3a.

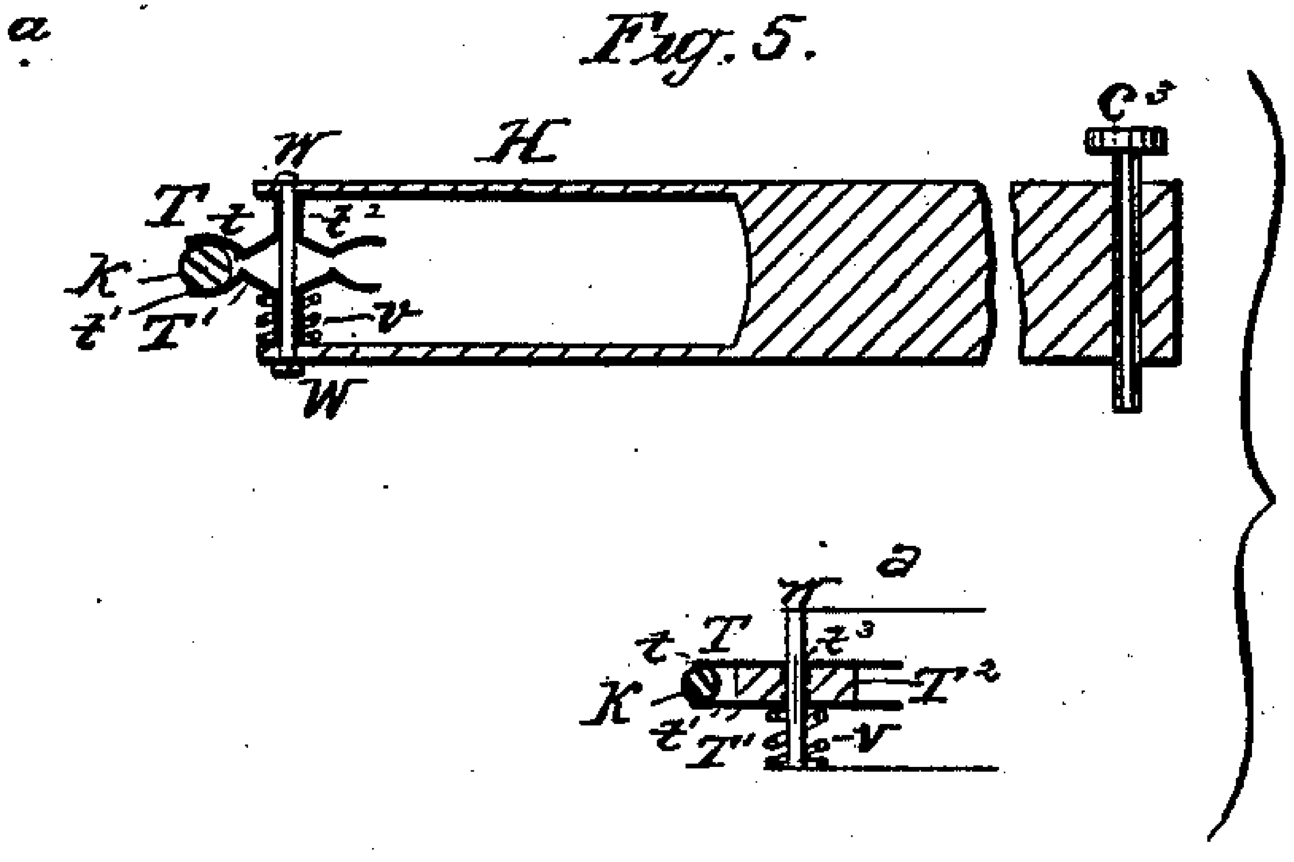

Fig. 5.

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UNITED STATES PATENT OFFICE.

ISAAC W. HEYSINGER, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 359,607, dated March 22, 1887.

Application filed February 9, 1886. Serial No. 191,295. (No model.)

To all whom it may concern:

Be it known that I, ISAAC W. HEYSINGER, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Improvement in Electric Railways, of which the following is a full, clear, and exact description, reference being had to the drawings accompanying and forming a part of this specification, in which—

Figure 1 is a transverse vertical section of an electrical railway embodying my invention as applied to a street-railway provided with a subterranean conduit, showing the electric wires or conductors, the railway-car, the electric motor or dynamo attached thereto, and the means for conducting electricity from the electric wires of the subway to the motor upon the car. Fig. 2 is a view, similar to Fig. 1, of an elevated or other electric railway in which no subterranean conduit is employed. Fig. 3 is a plan view showing the means whereby I automatically shift the current from one block or section of my electric cable or conducting-wire to a succeeding block or section when it is not deemed desirable to maintain all the blocks in a charged condition at the same time. Fig. 3ᵃ is an enlarged view of the electro-magnet and its coacting parts, as shown in Fig. 3. Fig. 4 is a plan view of a part of the station containing the dynamos which supply the line with electric energy for propulsion of the cars, showing a number of such shifting-magnets as are shown in Fig. 3ᵃ arranged in series, so that the current may be shifted from the cable controlled by one of these magnets to the next as the car travels along the line, and so on continuously, and which, by the position of the armatures of the various magnets, will show which blocks or sections upon the line are occupied by cars or trains of cars and which are not, and which also provide means, by preventing contact of the armature with its magnet, for arresting the motion of any car or train of cars at the end of any block or section of cable upon which the said car or train may at any time be. Fig. 5 is a vertical sectional view of the electro-conducting rollers which I prefer to use, for communicating electricity from the fixed cable through the swinging arms shown in the figure to the electro-motor or dynamo upon the car, which by suitable gearing propels the same. Fig. 5ᵃ is a view of the roller shown in Fig. 5 somewhat modified in form.

The lettering in all the figures is uniform.

The first part of my invention relates to the construction of an electric railway provided with a fixed electric cable and a trackway along the same, and having cars adapted to traverse the said railway from end to end, propelled by the electric energy communicated from the said electric cable or conductor, in which the electric cable is divided into a series of blocks or sections arranged longitudinally along the line and detached from each other where their adjacent ends approach each other, these blocks or sections being of such length, proportionately to the amount of travel upon the line, that not more than a single car or train of cars may be upon any one block at the same time, and in which the independent electric cable of each block or section is independently supplied with electric energy from a separate wire or conductor carried along out of contact with any other sectional cable or conductor. For ordinary street-railways these blocks might be from a quarter to a half mile in length, varying with the traffic, while on a line from Philadelphia to New York, for instance, the blocks might have a length of from five to ten miles, more or less.

The second part of my invention relates to the construction of the electric connections used by me for transmitting the electric energy of the sectional cables to the motor-dynamo of the car and thence back to the common source of supply, so that no loss of energy or break in the current may be encountered as the car travels across the break between the two adjacent ends of the blocks or sections of the fixed cables, which, independently supplied, lie end to end along the whole line. For this purpose I provide the car with a fixed bar descending from its under side, to which are attached two swinging arms on the side occupied by the block-cables and one only on the side occupied by the return cable or conductor. To the ends of these swinging arms are attached groove or other rollers, which roll along the cables and communicate the electric energy through the rollers, the swinging arms, the descending bar, and the dynamo carried by the car, all these being made of electro-conducting material properly insulated. The swinging arms are held outwardly by springs or like means, and upon the side occupied by the sectional cable the two swinging arms lie one behind the other, one pulley or roller following the other upon the same cable at such distance apart that when the end of one block is reached, before the rear roller shall have cleared the cable of the block behind, the roller in front will have passed onto the cable of the next block. The electric conductors of these two arms are joined together as they ascend to the car above, so as to make a common conductor. I sometimes use brushes instead of rollers, but usually prefer the rollers herein shown and described.

The third part of my invention consists in the use of the longitudinal chamber or supplemental conduit I, extending along the trackway and carrying within it the supply-wires K^2 K^3 K^4 K^5, as shown in Figs. 1 and 2, insulated from each other and drawn successively from the said insulated chamber to form connection with and supply electricity to the main conductor at various points into which the same may be sectionally divided along the line. When I use a conduit, G, as shown in Fig. 1, I usually carry this supplemental supply-conduit I within the conduit G; but I sometimes also carry the same along outside the conduit G, and where no such conduit G is used I carry the insulated box I and its contained wires along the trackway, as shown in Fig. 2, or in any other manner which will secure the advantages herein shown, described, and claimed.

The fourth part of my invention relates to the construction of an automatic current-shifter or series of current-shifters to be applied to the line-wires of the various blocks of cable in the main station, whereby, when it is not desirable to maintain all the blocks in a continuously-charged state, the passage of a car from a block which is charged to a succeeding one which is not charged will shift the current automatically into that block, at the same time throwing the block just passed out of connection with the charging-dynamo in the station, and whereby also I am enabled at a glance, by a suitable index attached to the armatures of the electro-magnets used by me, or by mere observation of the armatures themselves, to determine the position of every car or train of cars upon the line at any moment within the limit of length of a block of my cable or conductor, and also whereby I am enabled, by preventing the closure of the armature of any electro-magnet in the series, by a suitable bolt or lever, to prevent the transmission of the current to any block desired, and so stop any or all trains from the main station at will.

The last part of my invention relates to the construction of the conducting-rollers through which I transmit electric energy from the cable to the car, whereby the cable is held in contact with the roller over a much larger surface than that of merely rolling contact.

Referring to the drawings, Fig. 1 is a transverse view, in section, of a street-railway in which my invention is used.

A is the car traveling upon the rails F F, which are supported by the stringers E E in the street D.

B is an electromotor-dynamo attached to the car, and may be of any form or construction required.

C is a draft-bar extending down into the conduit G, through the longitudinal slot G′, and the bar C is provided with conducting-wires *c c′*, which extend outward along the arms and rollers to make connection with the fixed cables K and M and transmit the electricity to and from the motor B.

To the sides of the draft bar C, within the conduit G, are attached lugs C′ C^2, on opposite sides, to which are pivoted, so as to move in a horizontal plane, the swinging arms H and H′, upon the side occupied by the sectional cable K, and H^2 upon the side occupied by the return cable M. These swinging arms are held outwardly by the springs S S S, which may be of any desired form.

Upon the extremities of the arms H H′ H^2 are mounted rollers, preferably grooved upon the periphery, P P′ P^2, which revolve in a horizontal plane and rest against the sectional cable K K′ upon one side and the return cable M upon the other.

The rollers, arms, and bar are all provided with insulated electric conductors, and the rollers are composed of some conducting material, such as copper. As shown in Fig. 5, I prefer to make these rollers of loosely-attached sheets or disks of copper, with or without a wooden or metal disk between, and the sheets or disks are held together with a light spring, so that the top and bottom sides of the electric cables K and M shall be embraced by the inner surfaces of the copper disks where they extend out beyond the interposed wooden plate, where such is used, or where the disks are flanged at the edges for the purpose. The spring holding the disks together will produce a slight pressure and a continuous contact over a large surface, and at the same time will, by the rotation of the disks, sweep away dirt and polish the contact-surfaces of the conductors. The position of the arrows in the figures serves to show the direction of the electric currents.

At I, Fig. 1, is shown a box, or rather a continuous insulated casing or chamber, placed in the conduit G at one side thereof, and which extends along the whole length of the conduit. In this box I are contained a number of electric conducting-wires, K^6 K^4 K^2 K^3 K^8 K^9 K^{10}, &c., which extend longitudinally side by side and are all insulated from each other by a suitable packing. To avoid induction I use any of the means in general use; but usually a large return-conductor, M, will be sufficient. When I use my current-shifting devices, as the current will be but upon a few of these wires K^2 K^{10} K^6, &c., the induction will be inconsiderable in any case, so far as practical annoyance is concerned, while in Fig. 1 I show these wires K^6 K^4, &c., in a box or casing within the conduit G; yet I do not always so inclose them, but sometimes carry them along the street in a separate conduit, or overhead, or carry them into the conduit G from independent stations along the line, instead of from a common station, as shown in Fig. 4.

In Fig. 2 I show an elevated railway in cross-section, in which the wires K^2 K^3, &c., are contained in a horizontal box between the rails, the cables K M extending along above the same, no subterranean conduit being employed, and I protect the cables K and M in this construction by springing the hoods I′ I′ over them from the sides of the box I, having an open inner side, through which the bar C and the arms H H′ H^2, with their rollers, communicate with the said cables.

While other forms of conduit may be employed, the one I prefer to use is that secured to me by Letters Patent No. 325,173, dated August 25, 1885, in which I point out in general terms the adaptability of the said conduit to an electric railway, such as I now show, describe, and claim in this application.

The wires K^4 K^6 K^9, &c., are connected with the motor-dynamos in the main station, as shown in Fig. 4, or with various sub-stations along the line, which supply electricity for moving the cars; but in Fig. 4 I show a single dynamo of great power, which thus will supply all the wires K′ K^2 K^3 K^6 K^9 K^{14}, &c., and consequently all the blocks of cable along the line, either all at once or successively.

Referring to Fig. 4, it will be seen that the blocks K K are supplied by the wires K^2 K^3, which all extend along the line together in the box I, Figs. 1 and 2, the cable or main conductor lying farther within this line and in contact with the rollers P P′. At a certain point the main cable will terminate, this being the end of one of the blocks or sections above described. The next wire in the rear, K^2, will now come to the front a short distance in advance of the end of the first block, and will be bent into line with the former cable, or will form connections with a new length of cable, as may be preferred. This new block will extend a definite distance and then, in like manner, terminate, and a new conductor take its place as a cable, and so on for the whole length of the trackway, all these blocks or sections of cable being totally disconnected from each other. At the interval between the ends of any two blocks of cable a car supplied by a single roller, P, might be out of connection, and the current would be necessarily broken in a single roller passing over this vacant space. To avoid this I use the double set of rollers P P′, one traveling behind the other at such distance apart (see Fig. 2) that before the rear roller, P, has left the last block the front roller, P′, will have passed over the vacant space and commenced receiving the current from the succeeding block. As the conducting-wires of the rollers P and P′ unite before passing into the motor B, it is immaterial whether the current is carried by one or the other arm H or H′. The wires K′ K^2 K^3 K^4 K^5, &c., thus pass to the front successively, (see Fig. 4,) each supplying a new block or section of cable with electric energy. A single return-cable, M, is used, extending along the whole line, which receives the return electricity from all the blocks, and should be of sufficient cross-section and conducting-power to freely return all the currents to the generating-station.

A ground-connection may be used for the return current; but I prefer a direct return-cable for many reasons.

While a large added expense of construction might be imagined for a block system like mine, from the multiple-supply wires K′ K^2 K^{10} K^{14}, extending along the line, yet this is only apparent, as since but one car or train of cars runs upon one block at any one time, (though in case of emergency two or more might be run,) the current required for each block and the corresponding weight of side wire and cable would be smaller in the same proportion, the only increase being the allowance for accidental variation and the resistance of the wires K^2 K^6, &c.

In Fig. 3 I show in more detail the means I use to shift the current from one block of cable to another when it is not desired to charge all the blocks simultaneously. For instance, in street-car lines at morning or evening or on special occasions the cars will run much closer together and the whole line may be maintained in a charged state, while at other hours of the day the cars may run much less frequently, and then only a single dynamo, or one of smaller power, may be used, and the current shifted automatically from one block of cable to another as the car travels along the line and passes from one block to another when moving either forward or backward.

The dynamo which generates the electric energy is shown at N, the driving-pulley at O, and the return cable or conductor at M.

K′ is the wire which supplies the first block of cable K, and in Fig. 3 is shown as constantly charged with electricity to avoid complication in the drawings, the shifting mechanism being shown in this figure as applied to K^2 only. When the car reaches the position on the line shown in Fig. 3, the current is on the first block K, but not on the succeeding block supplied by the wire K^2. The moment the front roller, P′, passes over the end of the first block K and beyond it comes in contact with and begins to travel upon the cable of the succeeding block supplied by K^2, the rearmost roller, P, still traveling upon the cable of the first block. Immediately opposite, on the return-cable M, is a deflection, m, intended to throw the roller P^2 out of contact at the same instant that the rollers P P′ are in the position shown. This deflection m may be any sort of insulated space, as I merely show a deflection to illustrate it more clearly in the figure.

R is an electro-magnet in the supply-station near the dynamo N, and the wire K^2, which controls the second block of the cable K, is broken at the points x y, (see Fig. 3^a,) the one portion of the wire K^2 being attached to the armature R^2 of the electro-magnet R, so that when the armature is drawn up to the magnet contact will be made between the ends of the wire x and y, but not otherwise. When x and y are in contact, the current from the dynamo N will pass along the wire K^2 into the second block of cable K.

M^2 is a branch wire extending from the wire K^2 beyond the break x y to the coils of the electro-magnet, and this branch wire, after forming the coils of the magnet, is extended down at M′ to form a connection with the return-cable M at the point m^2.

A powerful retracting-spring, R^3, holds the armature R^2 from contact with the magnet R, and a bolt, R^4, is provided, by means of which the armature R^2 may be permanently kept out of contact with the magnet R, so that no current can pass over the wire K^2 to the block of cable supplied thereby. When the rollers P P′ P^2 are in the positions shown in Fig. 3 contact of the arm H^2 will be broken with the return-cable M, so that no current can pass. A new circuit will be formed in which the current will pass from K′ through the arm H and backward down the arm H′ into the block of cable controlled by the wire K^2, thence back along the wire K^2 through the branch M^2 and the electro-magnet, and thence down the wire M′ to the return-cable M. The electro-magnet R, set into action by the return current, will draw up the armature R^2, thus forming contact with the end y through the end x of the wire K^2. The branch wire M′, after leaving the electro-magnet R, is also broken, so that motion of the armature R^2, which places x and y in contact, breaks contact between m^3 and m^4. At the same time m^5, a point upon the wire K^2, forms contact with the point m^4 of the branch M′, and the current instantly reverses, passing from the dynamo N out the wire K^2 to the block of cable and a portion of the current through the electro-magnet R, to hold the armature R^2 in place. The car advancing, the arm H^2 is again connected with the return-cable M, and the current passes up either H or H′, or both, to the motor B and down through the return-cable M. This operation is repeated at the end of every block of cable and with each succeeding car or train of cars. When the car has passed entirely off the block of cable and connection is broken with the return-cable, the spring R^3 will withdraw the armature from the magnet, and the corresponding block will remain uncharged until another car passes.

Where danger of accident is so common from exposed electric wires it is important to afford the fullest protection, and by using these features of my invention it is only along the individual block occupied at any time by a car that danger can be incurred under any circumstances, either of personal injury or from fire, while the dissipation of energy from imperfect insulation, atmospheric conduction, &c., is, in a great measure, prevented. Of course, when a car is backing the process will be inverted, the arrows in Fig. 3 being reversed.

In Fig. 4 I show (without special detail) the arrangement of electro-magnets for a line of fourteen blocks, in which a single dynamo, N, supplies a main conducting-rod, from which branches K′ K^2 K^3 K^4 K^5, &c., extend to the corresponding wires, which may be either in or out of contact, as the cars are upon one block of the line or another, contact being made or broken by the electro-magnets R R R, as above described, and which are shown in Fig. 4. By means of a simple indicator applied to these magnets, or by the position of the armatures themselves, the position of each car or train upon the whole line may be known at a glance, so far as each block is considered, and the motion of each car or train may be arrested at will from the central station without interfering with the motion of any other car on the line at the end of any block upon which such car or train may be running. For instance, if a telegram reach the main office that a bridge is unsafe or a cut filled by a wash—say on block 14—the engineer at the station has merely to push in the locking-bolt R^4 upon the magnet marked K^{14}, and the car or train will come to a stop as soon as it leaves block 13. As the advance of each succeeding train is known at the station by the indicator, no train following the train thus arrested can collide with it if the bolt on K^{13} be also pushed in; or if the indicator shows that a train for New York does not leave its block at any point on time, it will be known at once at the station that something has gone wrong, and a turn of the bolt upon the magnet controlling the preceding block will effectually guard that train from injury. As soon as the train passes off its block, the embargo is raised behind, and the trains follow each other at the intervals announced at the station upon the indicator in the office. The blocks out of connection also serve for telegraphic purposes. To make connection with the wire K^2 while the car or train is upon the block supplied by K′, a swinging finger, C^6, upon the locomotive, in advance of the arms H H′, is placed in contact with the cable of one block, while the car is stopped just at the end of the next block in rear. Through this independent connection, by means of the telegraphic apparatus C^5 C^7, Figs. 5 and 4^a, messages may be sent to and fro while they remain uncharged, and messages pass to and fro at all times.

While I show a special construction in Figs. 3 and 4, yet I do not limit myself to this specific means or the arrangement of armatures, bolts, springs, branch wires, &c., as shown, my object in the drawings being to clearly bring out the points and advantages involved; but I use any of the various equivalents in common use in electrical practice, such as would be readily understood and supplied by those familiar with the arts to which my invention pertains.

In Figs. 5 and 5ª I show a roller which I prefer to use, as by my construction I do not merely secure a rolling contact of the periphery of a conducting-roller with a cable, but a sliding contact as well with the upper and lower surfaces of the cable over a considerable area instead of at a single point. It consists of two disks of metal, preferably copper, with either an interposed plate of wood or other material or else having the opposite metallic disks flanged at their edges, upward and downward, so as to present a grooved periphery, in which the cable may lie, and having its upper and under sides embraced and overlapped by the outer surfaces of the metallic disks. These disks T T′ are perforated in the middle, as is shown at t^2 t^3; and I prefer to flange the sides of these perforations outwardly to form hubs to insure steady running, as is shown in the figure. Through the perforations t^2 t^3, I pass a vertical bolt, W, connected with the arm H, and upon this bolt W, I place a light spring, V, to hold the disks T T′ together under a slight tension and insure perfect contact with the upper and lower surfaces of the cable K. It will now be seen that as the roller travels along the cable the flanges *t t′* will embrace the same, rotating with more or less slip, but at all times having a broad surface of contact and sweeping aside any dirt or rust which may form upon either the cable or the disks. As the latter are merely struck up or spun from a sheet of copper or other suitable metal the cost of replacement, when worn out, is inconsiderable, while the lightness of tension against the sides of the cable K will not perceptibly wear the same for a long time.

The disk T^2, Fig. 5ª, may be of wood or metal, and forms the body of the roller which travels along the cable under rolling contact only. When T^2 is not used I flange out the plates or disks T T′, as shown in the first part of Fig. 5. I do not always use this form of roller in the use of my invention as a whole, but prefer the rollers described, unless, for special reasons, other forms of roller, brushes, wires, &c., may be preferred.

While in Figs. 3 and 4 I show a single supply-dynamo, I do not in using my invention confine myself to a single generating-dynamo at the supply-station of the whole line or at each sub-station along the line, but use either a single dynamo with a divided current or a number of generating-dynamos at each station, each of which supplies such number of the supply-wires K′ K^2 K^4 K^8, &c., as may be desirable or necessary, and I vary the relative sizes of these dynamos to suit the special requirements of the case, and I otherwise modify the practical details of construction in accordance with the advances of electrical science without departing from the principles of my invention. I also apply those parts of my invention—as, for instance, the supplemental conduit I, containing the insulated supply-wires, the appliances for telegraphing or telephoning back from the locomotive over the uncharged wires of the system, the current-gathering rollers T and their attachments, and such parts of my invention as are not necessarily dependent on my current-shifting devices—to other systems of electric railways for which they may be adapted without departing from my invention, as herein shown, described, and claimed.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an electric railway, in combination with the trackway F and sectional cable K, the closed conduit I, extending along the said trackway and containing the insulated wires K′ K^2 K^3 K^4 K^5, said conduit I being perforated at various points along the line thereof, through which perforations the said insulated wires K′ K^2, &c., are electrically connected with the different blocks or sections K K K of the said cable, substantially as described.

2. In combination with the block-cable K K K, the different sections of which are supplied by the independent wires K′ K^2 K^3, the connecting or draft bar C, attached to the motor-car A, adapted to actuate the same and having the duplicate rollers P P′, traveling one behind the other, electrically connected with the motor B of the car above, and so constructed as to bridge over the insulated spaces between the adjacent ends of the blocks into which the said cable K is divided, substantially as and for the purposes herein set forth.

3. In an electric railway, in combination with a cable, K, divided into longitudinal blocks or sections independently supplied with electro-motive energy from outside sources, and a return-cable, M, the car A, having motor B and electric connecting-bar C, together with the duplicate arms H H′, provided with rollers or brushes P P′, traveling behind each other and in contact with the cable K, and the single opposite arm H^2, provided with roller or brush P^2, traveling in contact with the return-cable M, substantially as described.

4. In combination with the bar or support C, attached to the car A, having motor B, the pivoted connecting-bars H′ H^2, swinging to the rear from the said support C in a horizontal plane, having springs S S and rollers or brushes P′ P^2 at their outer ends, which are held in contact with the electric cables K and M by the outward pressure of the springs S S, substantially as described.

5. In an electric railway having a series of independent insulated conducting-wires arranged longitudinally to form a block or sectional cable, each section of said cable being independently supplied with electro-motive energy from the dynamo N through the separate wires K′ K^2 K^3, in combination with the

said sectional cable K K K and one or more supply-wires, K^2, the electro-magnet R, supplied through the branch M^2, and having the circuit-breaker m^3 m^4, the armature R^2, the open or closed contact ends x and y upon the wire K^2, and wire $K^2 x$, thrown in or out of contact by the movement to and fro of the armature R^2, the whole operating substantially as and for the purposes herein set forth.

6. In an electric railway having the supply-cable divided into longitudinal independent blocks or sections supplied through the insulated wires K' K^2 K^3, the current-shifting devices constructed to shift the current from one block of cable to a succeeding one as the car A passes from one block to another, the said shifting devices consisting of the bridge-connection H H', to span the adjacent extremities of two blocks or sections, the return-cable M, having the opposite insulated space, m, the electro-magnet R, the armature R^2, brought up to the magnet by the passage of the current through the wire K^2 and branch M^2, and the circuit completed from the dynamo N to the car A through the said wire K^2 by contact of the ends x and y, produced by the closure of the armature of the electro-magnet, substantially as described.

7. In combination with the trackway F, car A, motor B, connecting-wires K' K^2 K^3, sectional cable K K K, electro-magnet R, and circuit-closing armature R^2, the bolt R^4, adapted to prevent motion of the armature R^2 and thus prevent connection between the dynamo N and the car A through the wire K^2 and arrest the motion of said car A at the entrance to such block or section of cable as may be supplied through the wire K^2, substantially as described.

8. In an electric railway, the cars or trains of cars A, moving each along a single insulated block or section of supply-cable, K, receiving its electro-motive energy through one of the series of supply-wires K' K^2 K^3 K^4, &c., the said series of supply-wires deriving their electric energy from an electric generator at the supply-station, and having interposed upon the said wires the said series of shifting-magnets R R R R, operating, substantially as described, to cause the current of electricity to be shifted automatically as each car or train advances from one block or section of cable to the next succeeding one, and so on continuously, substantially as herein shown and described.

9. In a block-cable electric railway having a series of supply-wires for the different insulated blocks or sections of which the cable is composed and a series of current-shifting devices, constructed and operating substantially as herein described, the electric indicators R^2 R^2 R^2, or their equivalents, at the supply-station, adapted by their movement to show what blocks of the sectional cable K are occupied by cars or trains of cars and what are not so occupied, and to indicate the moment at which each car or train of cars enters upon or leaves any block or section upon the said line, substantially as described.

10. In an electric railway having the block or sectional cable K, consisting of the insulated longitudinal sections K K K, each of which blocks or sections is adapted to transport one car or train of cars, and a series of supply-wires, K' K^2 K^3, each of which supplies one of said insulated sections, the combination of the car A and electrically-charged block or section of cable supplying the same, with the series of uncharged blocks or sections upon which no car is placed, the different blocks being successively supplied with electric energy as the car advances, and devices at the supply-station to throw the supply-wires out of circuit as the car leaves each block or section, substantially as described.

11. In an electric railway, in combination with one or more supply-wires, K', a sectional cable, K, and motor-car in contact therewith, supplied with electricity from said wires, contact devices on said car to shift the current from one supply-wire to another as the car advances, the intermittently-uncharged supply-wires K^6 K^{10} K^{14}, &c., adapted to serve as telegraph or telephone wires from the car A to the station while thus uncharged, and the instruments C^5 and C^7, placed on the car or train in a position to be thrown into circuit with an uncharged wire, substantially as described.

12. In combination with the cable supported in the conduit, the conducting-roller P, carried by an arm connected with the car, consisting of the opposite disks, T T', perforated at the center and loosely journaled upon the shaft or pivot W, and the spring V, adapted to hold the disks together and grasp the cable on the upper and lower sides between the inner sides of said disks T T', substantially as described.

13. A current-collector for electric railways, consisting of two flat disks of copper or other conducting material, perforated at their center, and the central disk, T^2 of wood or other material, smaller in diameter than the disks T T', the whole journaled upon the pivot W and forming a grooved roller of a width of groove suitable to embrace the upper and lower sides of the electric cable K, between the disks T T', and take up electric energy therefrom, substantially as described.

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Witnesses:

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