No. 825,245. PATENTED JULY 3, 1906.

R. C. SAYER.

ELECTRIC TRANSMISSION.

APPLICATION FILED JAN. 27, 1904.

5 SHEETS—SHEET 1.

Fig. 1.

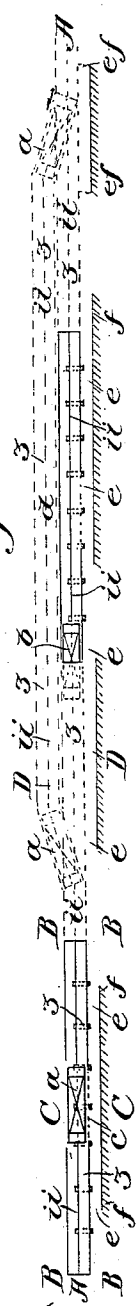


Fig. 2.

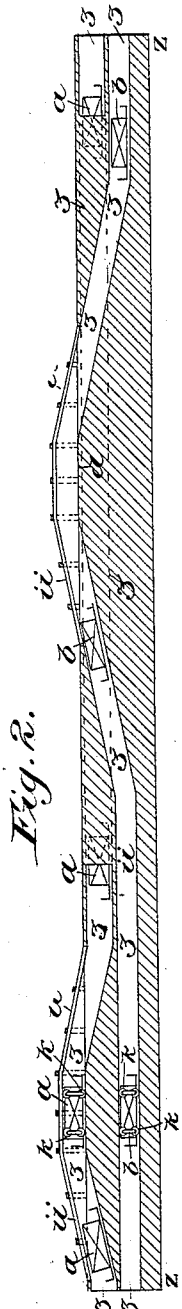


Fig. 11.

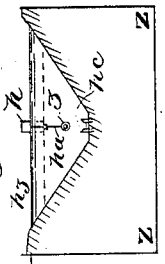


Fig. 9.

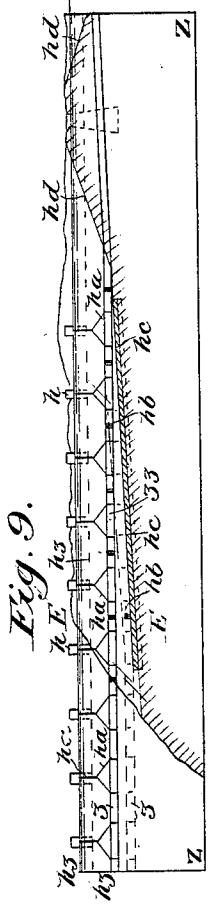
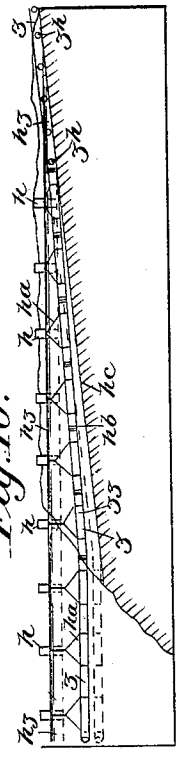


Fig. 10.



Witnesses:
Albert Jones
Samuel Percival

Inventor:
Robert Cooke Sayer
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Fig. 3.

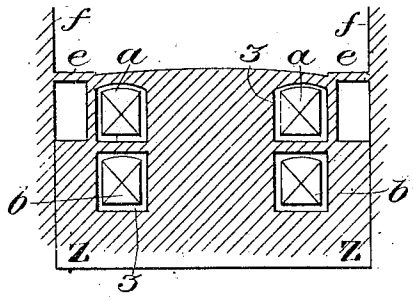


Fig. 4.

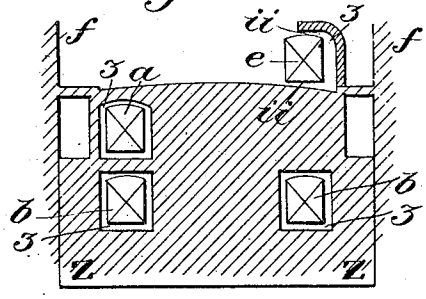


Fig. 5.

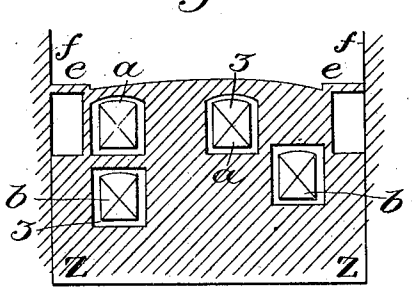


Fig. 17.

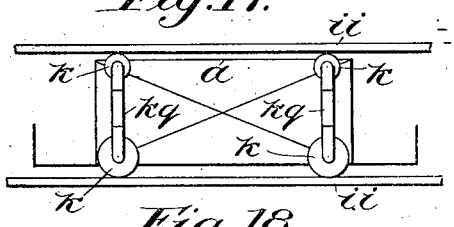


Fig. 18.

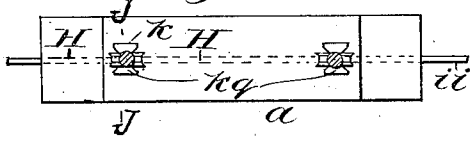


Fig. 6.

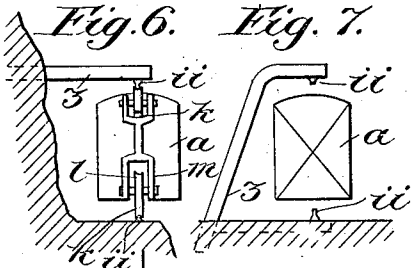
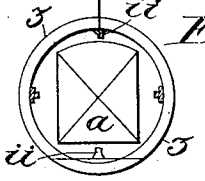


Fig. 7.

Fig. 8.



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5 SHEETS—SHEET 3.

Fig. 16.

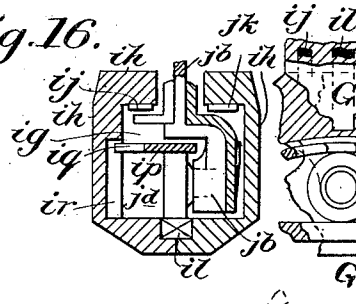


Fig. 15.

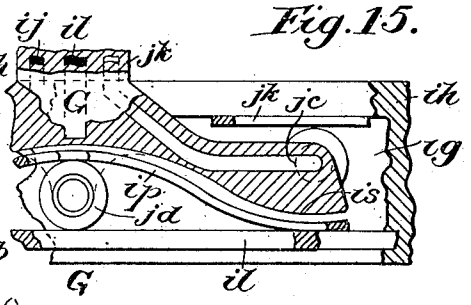


Fig. 14.

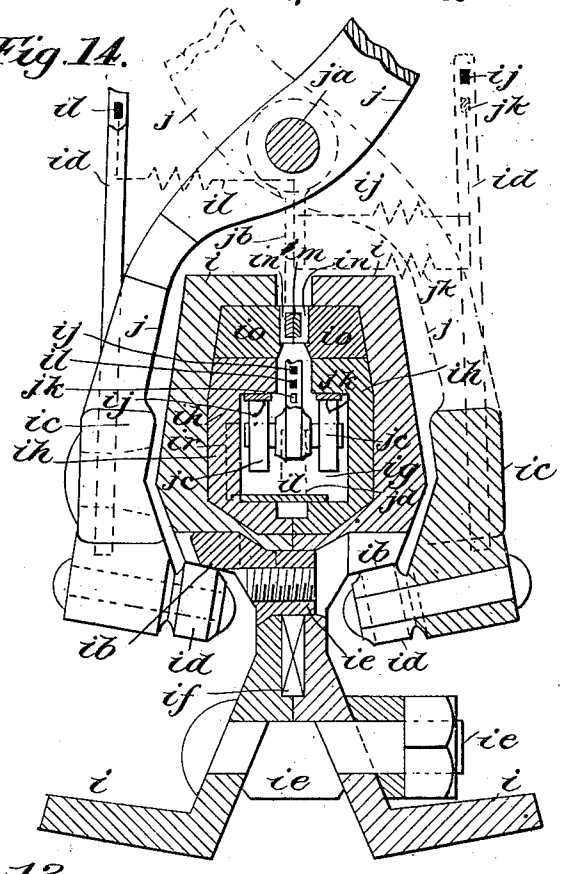


Fig. 12.

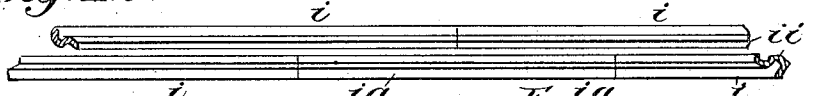
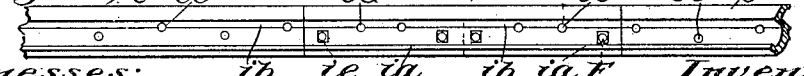


Fig. 13.



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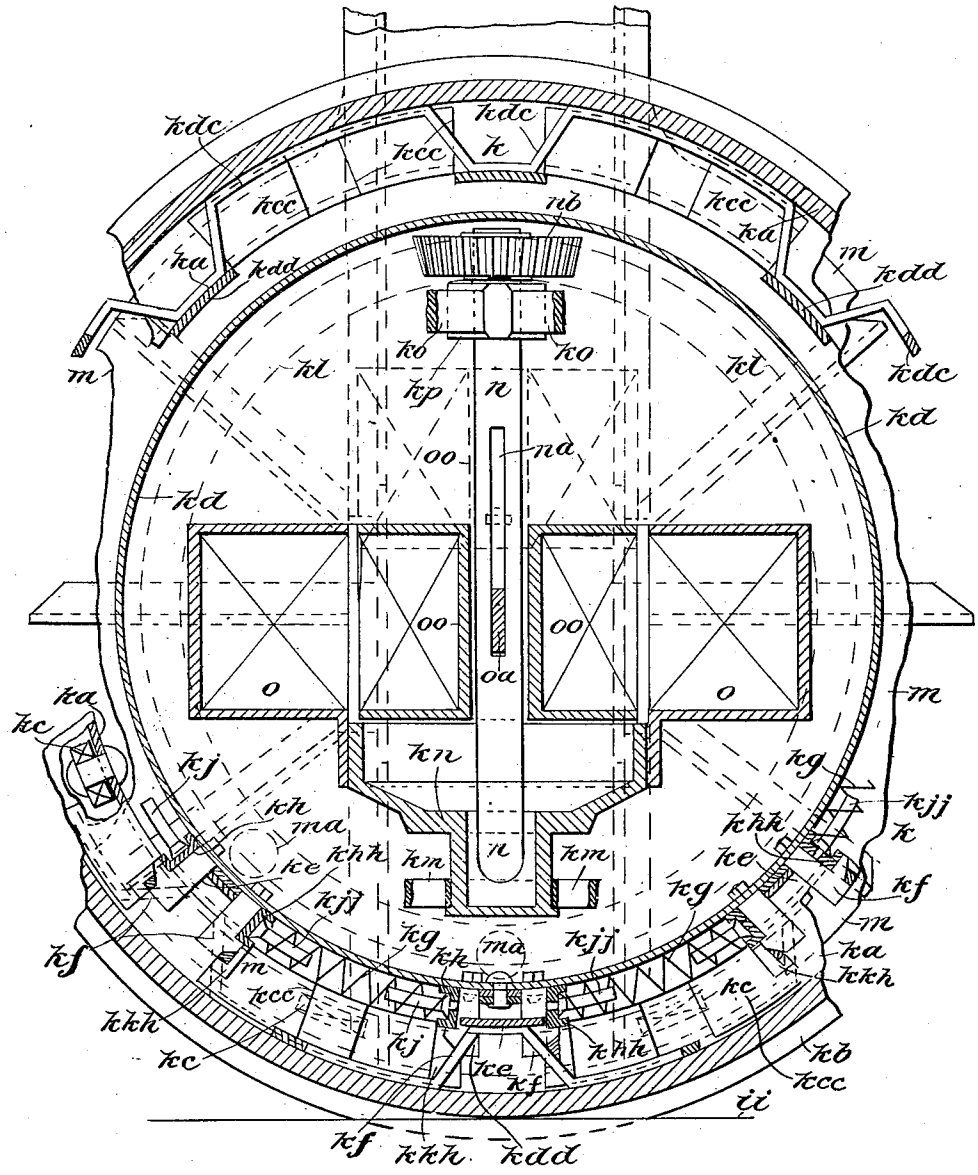
5 SHEETS—SHEET 4.

Fig. 19.



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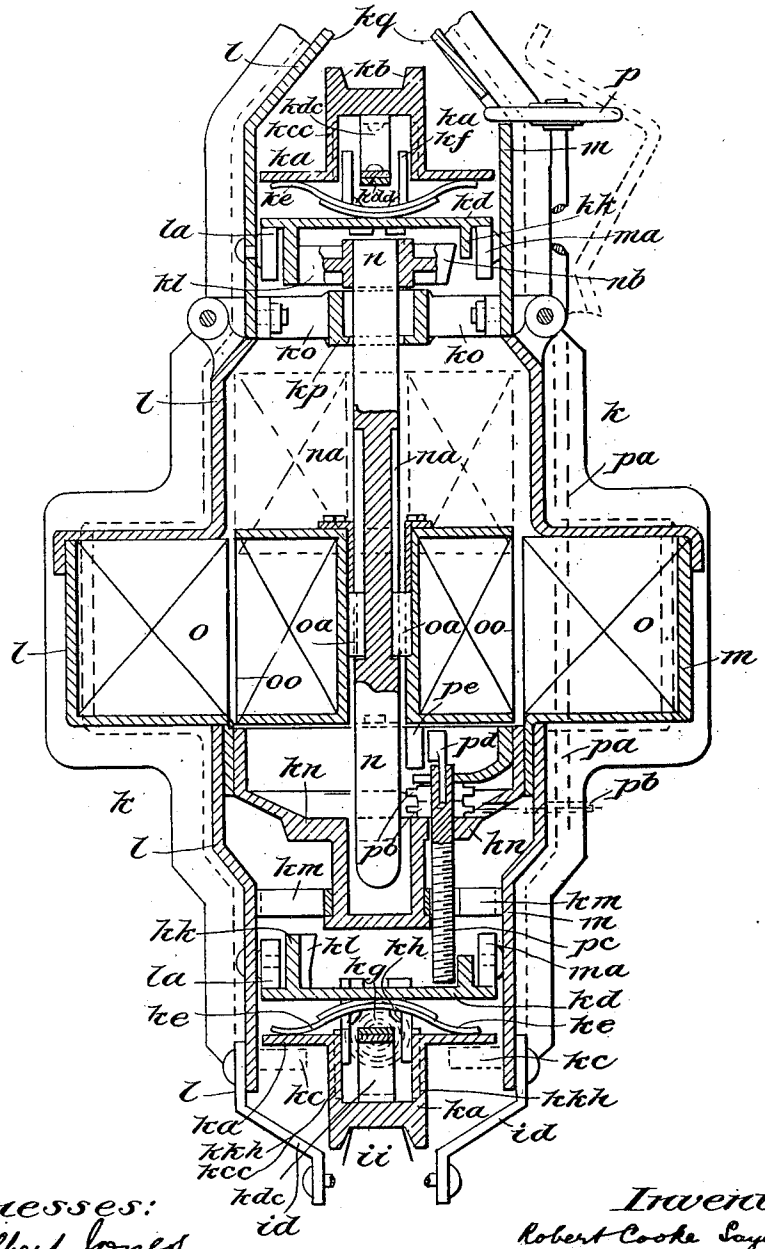
APPLICATION FILED JAN. 27, 1904.

5 SHEETS—SHEET 5.

Fig. 20.



Witnesses:
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Samuel Percival

Inventor:
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UNITED STATES PATENT OFFICE.

ROBERT COOKE SAYER, OF BRISTOL, ENGLAND.

ELECTRIC TRANSMISSION.

No. 825,245. Specification of Letters Patent. Patented July 3, 1906.

Application filed January 27, 1904. Serial No. 190,897.

To all whom it may concern:

Be it known that I, ROBERT COOKE SAYER, a subject of the King of Great Britain and Ireland, residing at 11 Clyde road, Redland, Bristol, England, have invented certain new and useful Improvements in Electric Transmission; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object is an electric railway with vehicles to travel over it so constructed as to secure "rapid" short-distance and "express" long-distance transmission for passengers and goods able to be loaded and unloaded at the level and directly from the pavements of densely-populated urban streets without danger to other or its own traffic while being transmitted through and from urban districts and open country and across water to connect similar populations in other lands, and essentially it consists of—

First. Two or more rails carried on opposite sides of a tube, frame, or support. One or all such rails are formed with a head without projecting bolts, fish-plates, or other projecting parts, a closed tube in the head, an electric conductor in the tube insulated on top by a ribbon able to rise and fall, parts of the rail-head made concentric to the fulcrum of levers that are carried on the surface of the rail by wheels or suspended from a car and retained in place by other wheels that run against the concentric parts and are carried on the levers each side of the rail by parts able to more or less grip its head when the levers and the wheels are actuated laterally. The levers carry an arm pointed at each end able to push aside, but keep closed, the parts closing the tube, so that conductors in the arm having wheel-contacts to run against the conductors in the tube and raise and thrust down the insulating-ribbon always connect to and from the motors; a car or body carried between the said rails by two connected wheels, each end having double flanges to guide them and able to swivel upon it and run upon or against the rails, so that the axis of the car produced will cut a line between and connecting the centers of gravity of a pair of the rails. One, or all the wheels, has a motor within it regulated by drawing its rotor more or less from or to its stator, and cushioned from vibration by the periphery of the wheel being separate from its center driving part that acts against springs between them and carrying the wheel more or less by the said wheels acting against the said concentric parts of the rail should either of the motor-wheels fail, and thus enables the parts to fulfil the necessary conditions.

Second. Constructing the tube, frame, or support for the above said rails suspended above urban streets or in shallow subways below them close to their pavement and bringing them to the surface level of the pavement at fixed stopping-places, so that air may enter there and circulate through the subways.

Third. Constructing the tube, frame, or support suspended from floats in water by hollow jointed tubes able to supply the tube with air, jointing the rail-carrying tube by known means, so as to make it flexible in all directions.

The object is attained as set forth by the following specification and drawings, where—

Figure 1 shows in parts a plan of the tube or frame arranged for one side of urban streets; Figs. 2, 3, 4, 5, sections at A A, B B, C C, D D, on Fig. 1, having a datum Z Z; Figs. 6, 7, 8, cross-sections in open country; Figs. 9, 10, sectional elevations of the tube for tidal waters; Fig. 11, a section at E E, Fig. 9; Figs. 12, 13, a plan and elevation of the rail; Fig. 14, a section at F F, Fig. 13. Fig. 15, a detail for insulating and picking up the current; Fig. 16, a section at G G, Fig. 15; Figs. 17, 18, a section and plan of the car: Figs. 19, 20, sections at H H, J J, Fig. 18, of the wheel.

The rapid-service cars *a* in open areas, Figs. 6 to 11, run in the same tube or frame *z* and on the same rail *ii* as the express-cars *b*, the speeds being similar. As the population increases, *a* and *b* run in separate tubes or frames *z* and pass one another in either direction, above, below, or laterally. For urban streets the frame *z* is suspended, Fig. 8, above or at the back of them or below them, Figs. 1 to 5, but in all cases come to surface stopping-places *c* for *a* and *d* for *b* at either side of the pavement *e* and buildings *f* that pedestrians may step direct from *e* to *a* or *b* without danger from other traffic. For the cars *b* to pass *a* and rise to the surface to *d* the frame *z* is diverted laterally, Figs. 1, 2, and 5, and brought into line again

adjacent to the pavement *e*. The cars *a* and *b* are carried over water areas *hz*, Figs. 9, 10, 11 by the tube *z* being suspended from floats *h*, connected by hollow jointed tubes *ha* to provide air, and at the land approaches and elsewhere when required for curvature the tube *z* is formed in lengths *zz*, connected by flexible joints *hb* of known form for *zz* to successively rest upon or be raised from walls or the bottom *hc* by the floats *h* as the tides fluctuate, (shown by dotted lines,) and the tube *z* is fixed by the bank *hd*, except where steep gradients are admissible, Fig. 10. It is then carried by wheels *zh*. The areas *hz* are connected to urban districts by the tubes or frames *z*, carrying the cars *ab* in hilly or flat parts, as shown by Figs. 6, 7 and over obstructions by Fig. 8.

In all cases the cars *ab* are supported between the rails *ii*, which are formed in cross-section, of two duplicate parts *ii* and fish-plate parts *ia* without projections externally at the head, a longitudinal key *if*, and parts *ib* concentric to the center *ja*, on which levers *j* of known form and working are able to be moved laterally, and these parts are held together by bolts *ie*. Thus a longitudinal hollow or tube *ig* is formed and closed by soft longitudinal parts *im* and hard parts *in*, thrust together laterally by springs *io* to inclose an insulating-lining *ih* and electric conductors *ij jk il*.

The levers *j* carry an arm *jb*, Figs. 12 to 16, 20, upon their fulcrum-bolts *ja*. It has electric conductors *ij il jk*, connecting with wheels *jc jd jc*, that run upon the conductors *ij il jk* in the tube *ig* and with links *id* and the stator *o* of the motor, and the part of the arm *jb*, passing between the closing parts *im in* of the tube *ig*, is pointed each end to fit their curvature and keep *ig* opened as the arm *jb* passes on until closed again by the springs *io*. The levers *j* have parts *ic* to fit the rail *ii* on each side and carry wheels *id* to run longitudinally against the two concentric parts *ib* of the rail *ii* and hold the levers *j* to it, and the wheels *id* traverse the parts *ib* laterally when the levers *j* are moved to grip or be loosened from the rail *ii*. The conductors *ij il* carry positive currents, but of different pressure, and when required *il* is covered by an insulating-ribbon *ip*, having lugs *iq*, that enter slots *ir* of suitable length in the insulator *ih*, so that as the wheel *jd* passes along upon *il* it raises the ribbon *ip* and the lugs *iq* in *ir*, and the ribbon *ip* is thrust down again by the following part *is* of the arm *jb*. The conductor *jk* carries the negative currents to the wheel *jc*.

The cars *a b*, Figs. 1, 6 to 8, and 17 to 20, are carried by the wheels *k* and their two flanges *kb* upon and against the rails *ii*. The cars swivel upon the wheels *k* at *kq*, as "bogie" cars, by known means.

The wheels *k* are formed of a peripheral part *ka*, having two flanges *kb*, lateral wheels *kc* to run against fixed sides *lm*, explained below, recesses *kcc*, and stops *kdd*, carried on the strap *kdc*. The wheel *k* has an inner concentric part *kd* with lugs *kf*, cross-springs *ke* between two pairs of *kf*, and springs *kg*, carried in saucers *kh*, having arms *kkh*, projecting into recesses *kcc*. The springs *kg* have guiding-horns *kj*, secured to the saucers *kh*, and *kh* normally rest against the lugs *kf* and the stops *kdd*, with their arms *kkh* against the ends of the recesses *kcc*. These act in the left direction. Duplicate saucers *khh* and attached parts act similarly against duplicate stops and the springs *kg* to rotate the periphery *ka* in the opposite (right) direction. The inner part *kd* also has flanges *kk* and teeth *kl*. The wheel *k* also has fixed sides *lm*, retained in place upon the part *kd* by wheels *la ma* and the wheels *kc* on the periphery *ka* and are connected by struts *km* to a bearing *kn* and *ko* with a collar *kp* to support the axle *n* of the rotor *oo*, having keyways *na* and the pinion *nb* to gear with the teeth *kl*. The sides *lm* carry the stator *o* of the motor.

The motor is formed of any number of stator and rotor elements, one pair being shown, according to the power required. The rotor *oo* has keys *oa* in the ways *na* to drive the axle *n* when raised to the dotted position or returned within *o* by turning the handle *p*, rod *pa*, pinions *pb*, and screw-bolts *pc* to raise the parts *pd* and their wheels *pe*, on which the rotor *oo* rests.

Working: The electric pressure is supplied to the rail-conductors *ij il* by known means and passes to the wheel-contacts *jc* or *jd*, arm *jb*, Fig. 16, the spindle *ja* of the levers *j*, Fig. 14, the links *id*, and the stator *o* of the motor, Fig. 20, and the negative *jk* is returned similarly by *id j ja jb* to the wheel *jc* and the conductor *jk*, Figs. 14, 15, causing its rotor *oo* by the keys *oa* to actuate the axle *n* and pinion *nb* to drive the teeth *kl* and parts *kd kk kf ke*, so that the lower part *kd* of the wheel *k* is driven, say, to the left for the car to traverse the rail *ii* to the right, and the lugs *kf* rotate to the left and slide the springs *ke* with them upon *ka* and the saucers *kh*, horns *kj*, and *kkh* against the pressure of the springs *kg* and resistance of the periphery *ka* until *kkh* meet the ends of the recesses *kcc*. Then the periphery *ka* necessarily rotates with *kd*, if not before; but the saucers *khh* are left behind, thrust against their stops *kdd* and arms *kkh* against the ends of their recesses *kcc* by the compression of the springs *kg*. The springs *ke* cushion the vertical and longitudinal motions, and the wheels *kc* rotate against the fixed sides *l* and *m* to give them lateral motion. The wheels *k* swivel to act as bogies and are thrust by known means against the rails *ii* for traction purposes and carry the cars within the tube, frame, or sup-

port *z* from, say, a station *c* or *d*, Figs. 1, 2, at the pavement of a street to descend rapidly to below the street within *z*, but close to the pavement *e*, Figs. 3 to 5, to give room for drains (or to ascend and be suspended above the streets) and to rise (or fall) to other stations *c* or *d* and descend (or rise) again and reach open country, Figs. 6 to 8, and cross water, Fig. 9, by descending through the bank *hd* to the suspended tube *zz* and *z* and rise similarly, Fig. 10, to other lands. The rotor *oo* of the motor is given more or less power by drawing it to or from its stator, and the car is stopped and firmly held independently of the wheels *k* by the brake-jaws *ic*, Fig. 14, being made to grip the head of the rail *ii* more or less by drawing the upper parts of the levers *j* together laterally by known means and drag by the links *id* on the sides *lm*. The car is normally carried each end on one wheel *k*. Should it fail, the wheels *id*, Fig. 14, traversing the concentric surfaces *ib* of the upper rail *ii*, support it.

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

1. Two or more rails, carried on opposite sides of a tube, frame, or support; one or all such rails are formed with a head without projecting bolts, fish-plates or other projecting parts, a closed tube in the head, an electric conductor in the tube insulated on top by a ribbon able to rise and fall, parts of the rail-head made concentric to the fulcrum of levers that are carried on the surface of the rail by wheels, or suspended from a car, and retained in place by other wheels that run against the concentric parts and are carried on the levers each side of the rail by parts able to more or less grip its head when the levers and the wheels are actuated laterally; the levers carry an arm pointed at each end able to push aside, but keep closed, the parts closing the tube, so that conductors in the arm having wheel-contacts to run against the conductors in the tube, and raise and thrust down the insulating-ribbon always connect to and from the motors; a car or body carried between the said rails by two connected wheels each end having double flanges to guide them, and able to swivel upon it and run upon or against the rails, so that the axis of the car produced will cut a line connecting and between the centers of gravity of a pair of the rails; one, or all the wheels, has a motor within it regulated by drawing its rotor more or less from or to its stator, and cushioned from vibration by the periphery of the wheel being separate from its center driving part that acts against springs between them, and carrying the car more or less by the said wheels acting against the said concentric parts of the rail should either of the motor-wheels fail, substantially as described.

2. Two or more rails, carried on opposite sides of a tube, frame or support; one or all such rails are formed with a head without projecting bolts, fish-plates or other projectin parts, a closed tube in the head, an electric conductor in the tube insulated on top by a ribbon able to rise and fall, parts of the rail-head made concentric to the fulcrum of levers that are carried on the surface of the rail by wheels, or suspended from a car, and retained in place by other wheels that run against the concentric parts and are carried on the levers each side of the rail by parts able to more or less grip its head when the levers and the wheels are actuated laterally; the levers carry an arm pointed each end able to push aside, but keep closed, the parts closing the tube, so that conductors in the arm having wheel-contacts to run against the conductors in the tube, and raise and thrust down the insulating-ribbon always connect to and from the motors; a car or body carried between the said rails by two connected wheels each end having double flanges to guide them, and able to swivel upon it and run upon or against the rails, so that the axis of the car produced will cut a line connecting and between the centers of gravity of a pair of the rails; one, or all the wheels, has a motor within it regulated by drawing its rotor more or less from or to its stator, and cushioned from vibration by the periphery of the wheel being separate from its center driving part that acts against springs between them, and carrying the car more or less by the said wheels acting against the said concentric parts of the rail should either of the motor-wheels fail, constructing the tube frame or support for the above said rails, suspended above urban streets, or in shallow subways below them close to their pavement, and bringing them to the surface-level of the pavement at fixed stopping-places, so that air may enter there and circulate through the subways, substantially as described.

3. A rail, a head to the rail without external projections, levers of known form having their center of movement above the rail, parts on the levers able to grip the rail-head, wheels on the gripping parts able to run against parts of the rail made concentric to their center and hold the levers in position, substantially as described.

4. A rail formed with a head without projecting bolts, fish-plates or other projecting parts, a closed tube in the head, an electric conductor in the tube insulated on top by a ribbon able to rise and full, parts of the rail-head made concentric to the fulcrum of levers that are carried on the surface of the rail by wheels, or suspended from a car, and retained in place by other wheels that run against the concentric parts and are carried on the levers each side of the rail by parts able to more or less grip its head when the levers and the wheels are actuated laterally; the levers carry an arm pointed at each end able

to push aside, but keep closed, the parts closing the tube, so that conductors in the arm having wheel-contacts to run against the conductors in the tube, and raise and thrust down the insulating-ribbon always connect to and from the motors, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

ROBERT COOKE SAYER.

Witnesses:
LORIN A. LATHROP,
GEO. E. COLES.