(No Model.) 3 Sheets—Sheet 1.

C. E. EMERY.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 536,275. Patented Mar. 26, 1895.

Fig. 22.

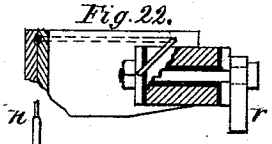


Fig. 23.

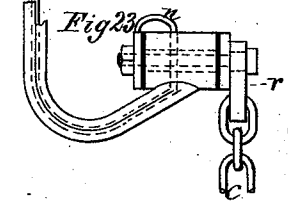


Fig. 24.

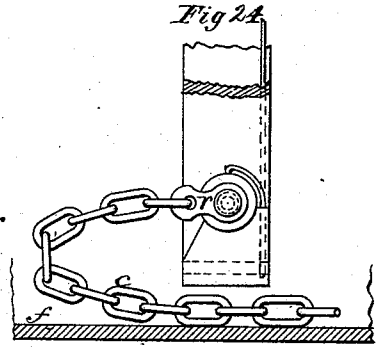


Fig. 17.

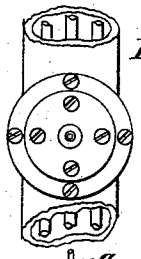


Fig. 18.

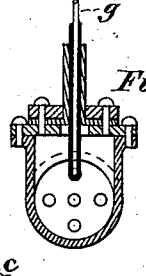


Fig. 21.

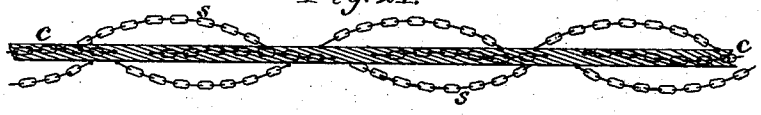


Fig. 3.

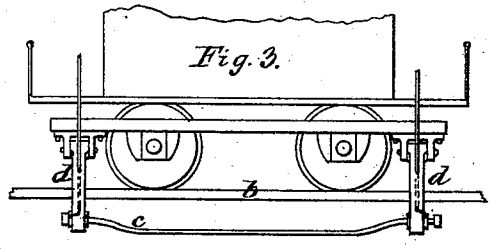


Fig. 19.

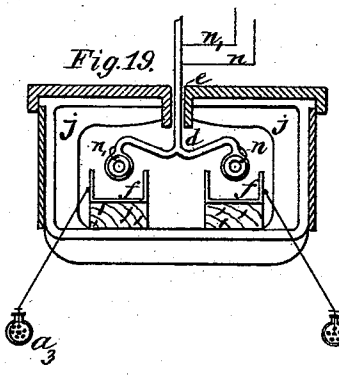


Fig. 20.

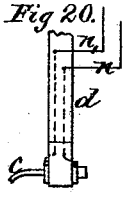


Fig. 2.

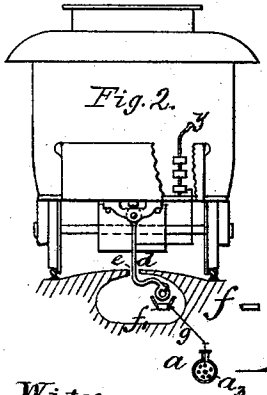
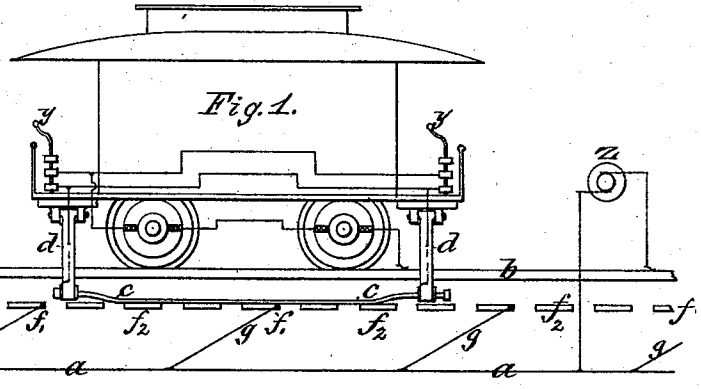


Fig. 1.



Witnesses,

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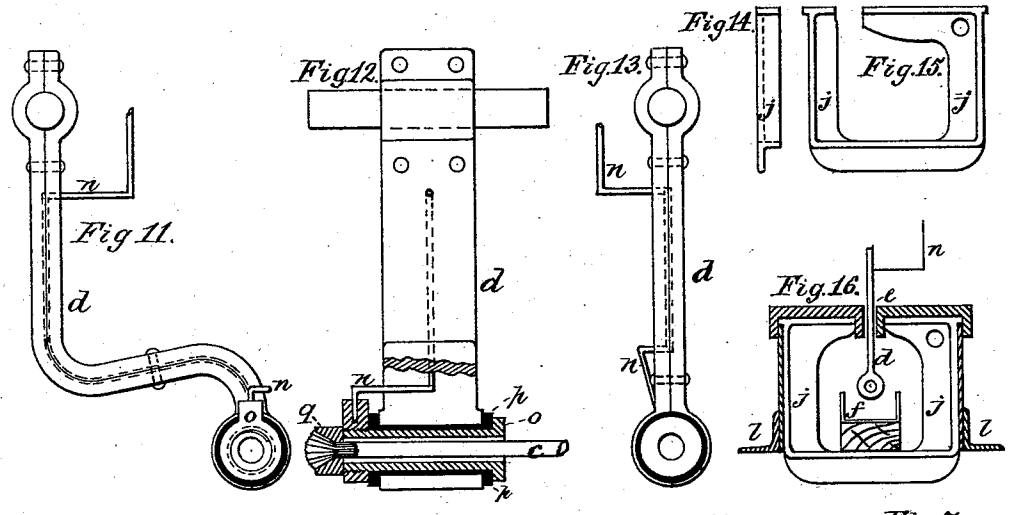
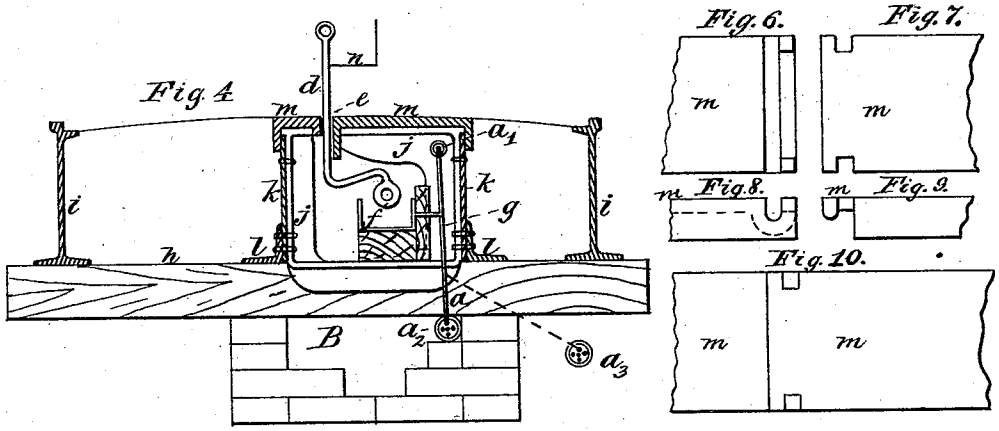
(No Model.) 3 Sheets—Sheet 2.

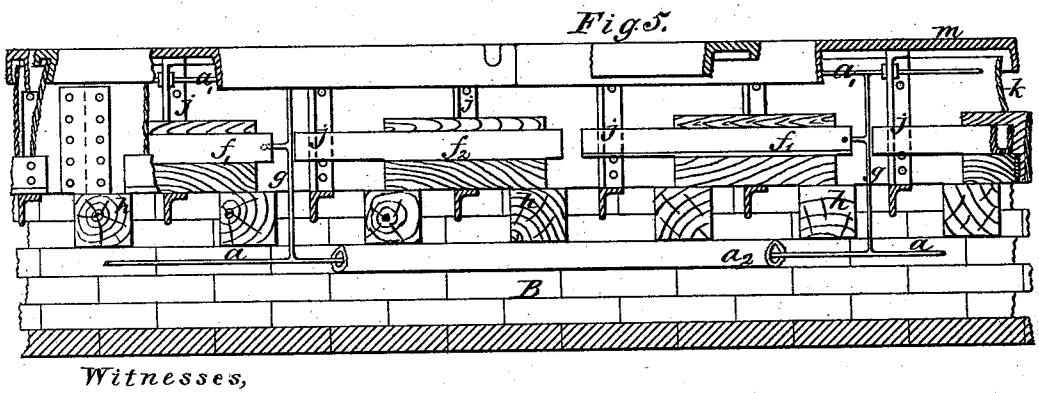
C. E. EMERY.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 536,275. Patented Mar. 26, 1895.







Witnesses,

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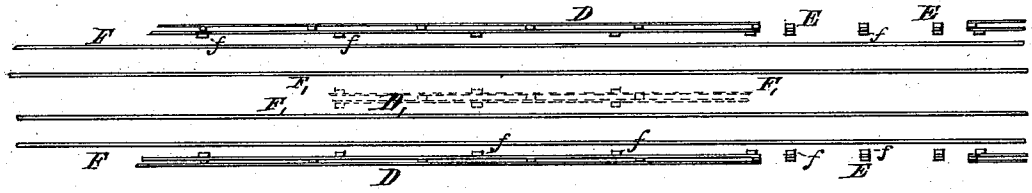
(No Model.) 3 Sheets—Sheet 3.

C. E. EMERY.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 536,275. Patented Mar. 26, 1895.

Fig. 28.



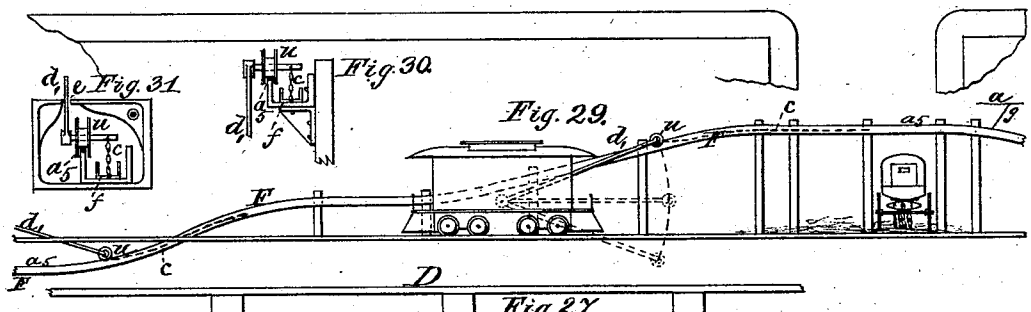


Fig. 31.

Fig. 30.

Fig. 29.

Fig. 27.

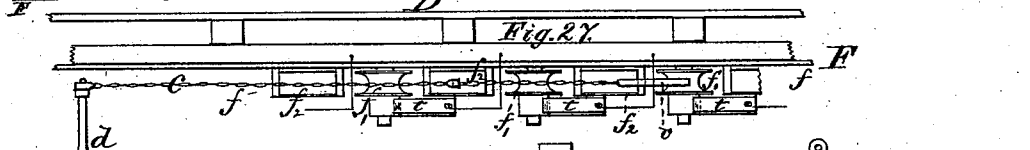


Fig. 32.

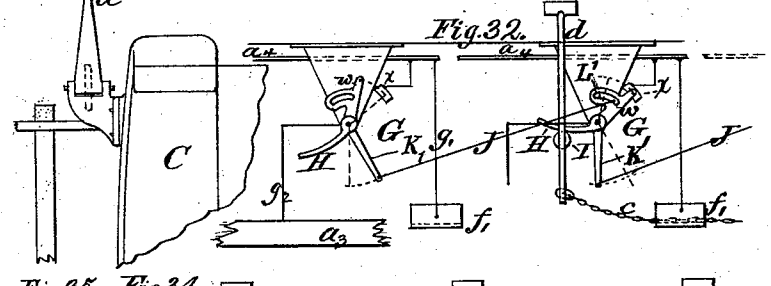


Fig. 33.

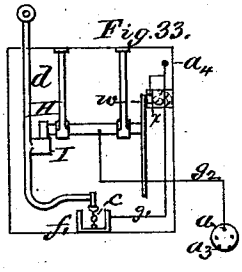


Fig. 35.

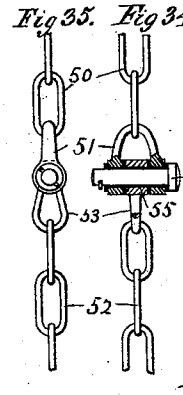


Fig. 34.

Fig. 26.

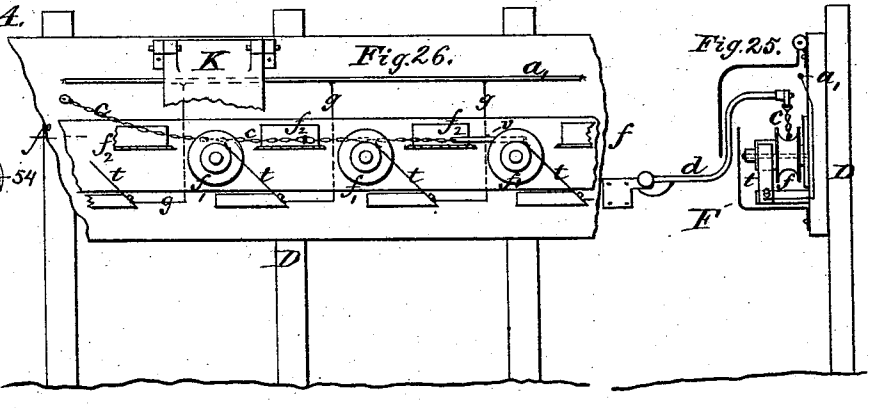


Fig. 25.

Witnesses,

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Livingston Emery

Inventor,

Chas. E. Emery

UNITED STATES PATENT OFFICE.

CHARLES E. EMERY, OF BROOKLYN, NEW YORK.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 536,275, dated March 26, 1895.

Application filed March 15, 1894. Serial No. 503,673. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. EMERY, of Brooklyn, Kings county, New York, (office New York city,) have invented a new and Improved Conduit System for Electric Railways; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making part of this specification.

The invention relates principally to a system in which electric communication between stationary electric conductors and a movable car is established by an electric conducting rope or chain which is dragged through fixed troughs or grooved rollers, some of which are energized with electric current. The return current is either taken through the rail as is customary or brought back through another conducting rope or chain, dragged through a duplicate set of guide troughs or rollers connected to the return main of the electric system.

In one method of carrying out my invention the conducting rope or chain is connected to the lower end of a pendent arm passing through a slot in the surface of the street communicating with a small subway containing preferably at one side, not directly under the slot, a series of supports in the form of grooved rollers or short troughs separated and insulated from each other, of which a number severally situated at definite pre-arranged intervals are connected either permanently or as the car passes with the main electric conductor from the station. The pendent bar running in the slot carrying the insulated conductor will be called a "drag arm" instead of a trolley arm, as its office is to drag the electric conducting chain or rope which in either form will in general be called the "drag rope." The rollers or troughs used to support the rope will, independent of the particular kind of each, be called supports and designated in general *f*. Such of these supports as are connected electrically to the main line and insulated from the return will be called herein live supports and designated *f'*. The other supports which are to be insulated from both the main and return conductors, and are therefore neutral except when connected to a live support by the drag rope, will be designated f^2. The general system, comprising a drag rope used in connection with live and neutral supports, is well adapted for erection on a fence or line of poles contiguous to the track with or without sections of subway.

The invention consists in the method of and means adopted for connecting a movable car with stationary electric conductors, which consists of a flexible conducting chain or rope operating in connection with suitable supports, and further consists in various combinations and details necessary to carry the invention into effect as more specifically set forth hereinafter.

In the drawings, Figures 1 and 2 represent respectively side and end elevations, partly in section and largely in diagrammatic style, of an electric railway car, railroad tracks and an electric conduit and details illustrating the general features of my invention. Fig. 3 is a modification of Fig. 1 with drag arms carried by the truck. Figs. 4 and 5 are respectively cross and longitudinal sections of an electric conduit embodying many features of the invention. The remaining figures refer to various modifications and details which can be most satisfactorily explained in detail in the body of the specification. In general, however, it may be stated that Figs. 6 to 10 inclusive show a covering for the conduit and Figs. 14 and 15 represent details of the conduit as particularly described hereinafter. Figs. 11 to 13 inclusive and Figs. 22 to 24 inclusive show details of the drag arm in two forms as particularly described hereinafter. Figs. 16 and 19 represent modified forms of conduit as particularly described hereinafter. Figs. 17 and 18 represent underground wire conduits as particularly described hereinafter, and Figs. 21, 34 and 35 represent modified forms of drag rope as particularly described hereinafter. Figs. 25, 26, 27 and 28 represent the construction and arrangement of a conduit on a fence as particularly described hereinafter. Fig. 29 represents an undulating conduit above and below ground, and Figs. 30 and 31 details of the same. Figs. 32 and 33 represent electric section cut-outs applicable to the system.

Figs. 1 and 2 represent respectively elevations of the side and end of an electric rail-

road car and of a conduit system, showing the principles of my invention, the illustration being largely diagrammatic, with enough detail to convey to the mind a proper conception of the names and in general the relative position of the various parts.

Z represents diagrammatically the generator at the power station, from which one main conductor connects with an electric main, a, or a system of overhead or underground feeders, there being shown in connection with Fig. 2 an underground pipe, a^3, containing a number of such feeders, a. The return conductor from the generator Z is connected with a return conductor b, in this case represented as the rails upon which the car runs. The car is shown at each end provided with a pendent drag arm d, which for this particular construction is to extend downward through a slot in the roadbed, be curved to one side and the end connected to a flexible chain or wire rope or combination of wire and chain, designated c, which drags along the surface of a number of trough or roller supports f shown in Fig. 1, to avoid confusion on the small scale, by small rectangles. The drag rope c is in one form provided with a head at each end, adjusted so that the rope when dragged from one end will have sufficient slack to fall down upon and come in contact with the bottoms of the groove or channel-way in the supports f. All of the supports shown in the various views will be distinguished in general as supports f. At substantially regular intervals, each less than the distance between the two drag arms d for the particular construction shown, the supports f' are made of electric conducting material and severally connected by branches with the main electric feeder a to make so-called "live supports," through which current is imparted to the drag rope. The effect is that as the car moves along, the conducting drag rope c is always in contact with one or more of the live supports f' and current therefrom passes through the drag rope c and an insulated conductor supported by drag arm d to the regulators on the car represented diagrammatically on each platform, and by operating the handle y of either of such regulators, the current is admitted to motors under the car, represented diagrammatically by circles on the main axles and shaded brushes. For illustration simply the current is represented as passing in series to two motors and then to the rail or return circuit b. It will be understood that any customary arrangement of regulators and motors may be applied to the car.

In Fig. 1 the drag arms d are represented as attached by means of pivots running parallel with the track underneath the platforms of the car. This arrangement will only answer where the height of the subway can be made great enough to allow for the vertical movements of the car.

Ordinarily an arrangement substantially similar to that shown in Fig. 3 is preferable, in which the drag arms d are pivoted to pins attached to the frame of a truck which carries the wheel boxes with little or no vertical play and therefore supports the drag arms and drag rope at a definite elevation in relation to the rails. In either case the pivots at the top of the drag arms permit lateral motion of such arms to follow the slot on curves or where the same is necessarily diverted from exact parallelism with the rails. It is understood that these drag arms would in this respect follow the construction of the grip arms used on cable railways, which are permitted either to swing on pins or to slide on guides laterally for the purpose stated.

Fig. 4 shows a cross-section of a track and conduit for a street railway containing many of the chief distinguishing features of the invention, Fig. 5 showing a corresponding longitudinal section and for part of the distance a side view of some of the various features. The drag arm is designated d, as before, and passes through a slot e in the top of the conduit at the surface of the street and within the conduit bends laterally so that an eye in the end is located over and preferably partly within the groove or channel of a support f in this case of the trough form. By reference to Fig. 5 it will be seen that there is a series of these troughs. The troughs are preferably constructed of metal to provide for wear, and some of the same, designated f', are to be of conducting material and severally connected by electric feeders g with an electric main or mains a. The groove of a pulley may occupy substantially the same relation as the channel of the trough and is so shown in other views. An electric main may be run in some climates in the conduit itself, for instance, through suitable openings along the top at one corner in the position a', or the main conductor or feeder may be in a pipe supported as at a^2 in the bottom of the conduit, or as at a^3 in the ground in any desired position. In the construction shown cross ties h are employed to support rails i, i, of the deep pattern, and the conduit may, if desired, be constructed as shown so as to occupy substantially only the same height as the rails.

The conduit is shown constructed of flanged frames, j, shown detached in Figs. 14 and 15, which receive side plates k and longitudinal angles l, which latter rest upon the cross ties h, thus joining the several frames j which give shape to the conduit. The top of the conduit is in this particular case shown covered by wearing plates m, m, which in practice would be roughened, and the interior frames j are provided with suitable arms to support such wearing plates.

One method of constructing the wearing plates is shown in Figs. 6, 7, 8, 9 and 10, from which it will be seen that one end of each plate is to be provided with a downward projecting tongue to catch into a corresponding groove on the end of the next plate and thus

conduct any water laterally to the sides of the conduit. Notches on the end of the plate shown in Figs. 7, 9 and 10 may also catch over corresponding pins cast upon the other end of corresponding plate, as shown in Fig. 6, so as to prevent lateral movement, though in general the flanges at the sides will be sufficient for this purpose.

In Fig. 5 the alternate troughs f' are shown connected to the main feeder a or a', forming live supports, but in general several intermediate supporting troughs could be left without such connection so long as the drag rope touched one live support before leaving another.

Figs. 11, 12 and 13 show the construction of the drag arm and drag rope connections. The drag arm is preferably made of two parts grooved when straight for the conducting wire and then bent to the form shown in Fig. 11, although any method of mechanical construction may be adopted. It is only essential that the insulated conductor n be thoroughly protected where the drag arm passes through the slot. Such conductor n is shown leading into a groove at the top of the drag arm well above the slot e, and coming out of such groove near the eye at the lower end it connects with a conducting sleeve o, which in turn sets within an insulating sleeve p carried in the eye of the drag arm d. Within the sleeve o loosely fits the drag rope c provided with a head q which bears upon the sleeve o. By this construction it will be readily seen that current from the main line a transmitted to the supports f is received by the drag rope c, transmitted to sleeve o, thence through conductor n to the regulators on the car in any way equivalent to the diagrammatic representation in Figs. 1 and 2.

Fig. 16 shows the conduit and drag arm d with the trough f placed directly under the slot, a system that is applicable in dry countries, as any dirt that falls down will be dragged off the end of each support and the flow of the small quantity of water that comes down through the slot will not cause great loss by leakage.

It is preferred that a brick drain B be constructed the whole length of the conduit underneath the sleepers h and the same properly connected at intervals with sewers or with cesspools so that water which reaches the same will never rise high enough to cause injury.

A plan and vertical cross-section of an approved form of hand-hole for the main feeders is shown in Figs. 17 and 18. An opening, preferably on the top, large enough to permit a cable inside to be bared and the connection wound and soldered on, is provided for each feeder. This opening is covered by a cap provided with a small opening for the feeder g to pass through. The lead covering of the cable is then turned out above the main cover and held down by an auxiliary cover so as to make the joint absolutely water-tight.

Fig. 19 shows a double conduit with two rows of drag rope supports. This conduit may be used in connection with a double drag arm, d, as shown, each line of supports being connected to electric mains of different polarity and connections from the rope carried up separately through the shank of the drag arm d to the car as best shown in Fig. 20, which is a side view of the drag arm, or evidently the double conduit may be used with the drag arm in the shape shown in Fig. 4 and will in such case permit motion of the same with the offset on either side. It is evident that a drag arm provided with an offset in one direction only must operate with a conduit having the supports f on the same side as the offset. Therefore, both the drag arms and the conduit would for a double track be one-sided in the same direction when switches are used at termini and reversed in direction for the two tracks when the car turns at the end on a circle. The arrangement in Fig. 19 will permit a drag arm offset in one direction only to be run with a car turned around at the end of the route, and if such a system were used the polarity of both sets of supports f would in general be the same and the return made through the rail. Such an arrangement will be desirable frequently at termini.

Fig. 21 represents a portion of the length of the drag rope with small loops of chain attached in different positions thereon, which loops will more closely conform to the supports f when the drag rope c is rather stiff so that it does not quickly lie down upon the supports and thereby secure electrical contact. In many cases it is practicable to use a simple chain instead of a drag rope, in which case I prefer to have only one drag arm d, which may be located at any point on the length of the truck or car, for the reason that the chain will be so flexible that reversal of direction will be possible even when the drag chain is extended for a considerable distance behind the car and it is desired to run back over it. The arrangement for doing this is shown in Figs. 22, 23 and 24, in which it will be seen that the eye at the bottom of the drag arm lies substantially horizontal with its eye transverse to the rails and to be elevated a little distance above the bottom of the grooves or channels in supports f. The chain attaches to a swinging arm r, supported upon a bolt insulated within the eye, but connected by a conductor n through the drag arm with the car in the customary way.

In Fig. 24, which is a side view of the drag arm and shows the bottom of a trough support f, it is supposed that the car has been moved from right to left and extended the chain c, in which case the arm r would have been trailing toward the right. It is supposed that after this the car has moved to the right when the arm r reverses its direction and commences hauling the chain over the top of itself in the opposite direction. The use of a chain or a very flexible conducting wire rope

with but a single drag arm has the advantage that the length of the chain or rope dragged may be considerable, say twenty or thirty feet or more. Consequently the supports which are electrically connected to the main line may be farther apart than if the drag rope were attached to the car at each end, requiring two supports in the length of the car so that one will be at all times in contact.

The general system shown is equally well applicable for a conduit elevated above the ground. Fig. 25 shows a cross-section of a conduit F arranged on the inside of a fence D to be alongside a track. Fig. 26 is a side view and Fig. 27 a plan view of the same with the covering removed. As shown at the left in the plan view, Fig. 27, the drag arm d in this case extends laterally from the side of the car C or of the truck, preferably near the front end, and drags a chain or rope in sectional troughs or roller supports, f, f', f^2. The particular view shows rollers alternating with troughs, each roller f' being a live support and each trough, f^2, a neutral support. Evidently the live supports may be separated nearly the full length of the chain, and it is proposed to put roller supports in at such distances that the chain will not, when the car is at moderate speed, drop down upon the trough supports, the bottoms of which are purposely kept at a lower elevation than the grooves in the rollers. When stopped or running very slowly, however, the chain will drop into the trough supports, which may be put in sufficiently close that the chain will not fall between them or become caught in any way. In order to convey the current to the live roller supports f', the rollers are each provided on their sides with a hub upon which runs a brush t connected to the main line a' directly or through feeders g. All the supports are preferably arranged upon a longitudinal plank inside the fence and provided with a casing arranged as shown in Fig. 25, so that part of the front will be secured to the cover and lap down over a portion of the front secured to the bottom, leaving a narrow space through which the drag arm passes, such drag arm being turned up abruptly as shown and then continuing its original direction so as to carry the chain or drag rope c over the supports f. The narrow crooked slot makes it more difficult for boys or others to touch the live supports. Suitable covers K are to be provided at intervals for access to the rollers and live supports. Fig. 28 shows on a small scale the plan of a railroad of this type with a portion of a cross street. D, D, are fences containing inside the electric conduits F described, but shown here only by projections f designating the supports. This form of conduit may have gaps in it of considerable width without interfering with the passage of a car. If the openings are wide and provided with gates, evidently the drag rope may be supported on suitable projections on the gates, but generally for work in the country it will be sufficient to divide the cross streets up into channels each about the width of a wagon and make arrangements for a support f on a post E separating each channel. The rope will therefore be supported at intervals of six to nine feet or a little less, and if the fence is made reasonably high only the end of the drag chain will fall to the ground when the car passes and this may be insulated from the remainder of the chain as explained hereinafter. When desired, a single fence D', shown in dotted lines, Fig. 28, may be arranged between the tracks with conduits F', substantially like those described, arranged on each side thereof, one for each of the two tracks; or, in very cheap suburban work, a single conduit in the center will be sufficient, which in general will be uncovered like that shown in Fig. 30, but with the supporting post removed from the side and placed underneath in an obvious manner. In such case the conductor of one car will lift his pivoted drag bar as another car approaches so that the end of the corresponding drag bar of the other car will run underneath the uplifted one.

As shown in the side elevation of an electric road, Fig. 29, the conduit F, may, by connecting inclines, be arranged at different elevations; for instance, at one place as in center of drawing on the side of an ordinary fence as described. Then by an incline the conduit may rise above a cross street, as at the right in Fig. 29, and if admissible come back to nearer the surface again farther on. Again, as shown at the left in Fig. 29, the conduit may dip under ground just before the cross street is reached and the drag arm run in a slot for that distance. To secure these various adaptations it is necessary to pivot a drag arm, d', Fig. 29, to the side of a car so that it can move vertically something like a trolley arm, and to provide at the end thereof a contact shoe or guide roller, u, arranged to run on the edge of a trough-shaped conduit carrying within it the supports f, as shown in Fig. 29 and in cross sections of conduits, Figs. 30 and 31; the former showing the guide pulley u riding on the edge of a trough-shaped conduit containing supports f, designed to be on the line of posts above ground, Fig. 31 showing the guide pulley u similarly rolling on the edge of a trough-shaped conduit containing supports f under ground; the end of the drag arm in each case dragging after it a drag rope c to form the contact as in other cases.

By making the top of one edge of the conduit F of conducting material, a^5, shown in black in Figs. 30 and 31 and indicated by letter as the top line of conduit F, Fig. 29, and suitably insulating the same, and by making the roller u of conducting material connected to drag arm b' like a trolley roller, the apparatus may be used as a trolley, the roller u running on conductor a^5 and connected at intervals, as shown at the right in Fig. 29, by a feeder g with main line a. This arrangement would only be used where it was possible to

continue the subway without breaks. Where breaks occur it would be necessary to have supports *f* and the drag rope *c*, as has been previously described, and the roller *u* could be used part of the way and the drag rope the remainder. Evidently a combination of the two is possible, as shown in Figs. 30 and 31. If by using a double conductor in the drag bar, as shown in Figs. 19 and 20, one system of connection, the trolley roller *u* and conductor a^5 for instance, may be the ground or return wire, and the main line current brought through the other system, the drag rope *c* and supports *f* for instance, so that no actual grounding is necessary. The drag arm *d'* would be given a tendency to hold roller *u* in contact with conductor or guide a^5 in any customary way, for instance by a spring as with a trolley, or by gravity as shown.

In order to prevent the last few links of a chain from falling between the supports *f*, it is generally desirable to provide the drag chain with a tail composed of a cylinder of pipe or wood of sufficient length to bridge the gap between the supports and of sufficient weight to keep the chain fairly taut. Such a tail, designated *v*, is shown in connection with the supports in Figs. 26 and 27. It is also desirable that the end of the chain be non-conducting, or at least insulated from the active part of the chain. In this case, even if the cylindrical termination be not employed, the dropping of a chain through the supports need not necessarily create a short circuit, but in general it is desirable that a tail be provided short enough to turn upward and over in the conduit when the direction is reversed, and that the same, as well as a part of the end of the chain, be insulated from the remainder. This can be done as represented in Figs. 34 and 35, showing respectively a longitudinal sectional view and a side view of a swinging joint in which each part of the joint is by insulating tubes and washers, shown in black, insulated from the other part.

As shown, one part of the chain, viz., the upper part 50 in the drawings, terminates in a clevis or double eye bent link 51, and the other part of the chain 52 is provided with a single eye termination 53 and is connected to the double eye termination 51 by means of a bolt 54. The sides of the eyes on connections 51 and 53 and the surface of the bolt are covered with rings and sleeves of insulating material designated 55, so that part of the chain 50, which may be connected to the drag arm, is insulated carefully from the other part of the chain 52, which may form the terminal end and may or may not be provided at will with the special prismatic tail *v* shown in Fig. 26. Another way is to simply insert a wood block with iron attachments at the ends, as is frequently done in the regulator and sometimes the brake gear of electric cars, but the arrangement shown in Figs. 34 and 35 is typical of mechanism employed to insulate the tail end of a drag chain from the main portion of the same.

In portions of the road where water is likely to lodge in the subway it is desirable to cut off the electric connection with the live supports at all times except when a car is passing. Figs. 32 and 33 show diagrammatically one way of doing this. In Fig. 33, *a* represents a conductor forming the main line, which may be either underground, as at a^3 or aerial from which feeders g^2 are individually connected to an arm *w* on each of a series of switches controlling the current to the different sections, there being one switch for each section at the commencement of such section. Two such switches are shown, designated respectively G and G'. A section to the left is supposed to extend to the left from switch G, and a^4 is a section line wire connected at intervals to live supports *f'*. A second section to the right is supposed to commence to the right of switch G with another sectional line wire a^4 connected to a number of live supports *f'*, and at the right-hand end of such section the switch G' is supposed to be located. As shown, the arm *w* of switch G' is in the right-hand position and the end thereof in contact with a conducting segment *x* connected to the right-hand sectional line wire a^4 so that the current is turned on that section. As shown, the end of the lever *w* of switch G is out of contact with the segment *x* and no current is supplied to the next or left-hand section, a^4. The several switches G, G', &c., are each provided with pendent rock arms K', and from the bottom of each a rod J connects through a pin with a slot L' in the upright rocking lever *w* of the next switch to the right, as may be noted by observing the connection J between pendent arm K' of switch G and the slot L' of switch G'. A similar arm K' is also shown for switch G' with a connection J leading to another switch to the right not shown. There is also on each switch a curved rocking arm H so arranged that when the particular switch is closed and imparting current to the section as at G' the arm is nearly horizontal, but when the switch is open and no current going to that section such arm is thrown down as at G. Motion is imparted to these arms by a roller I carried by a drag arm *d*. In Fig. 32 the motion of the car is supposed to be from right to left; and the drag arm *d* has struck the arm H of switch G' and carried it from the position of H at G to the position shown for switch G', thereby closing the circuit through arm *w* and segment *x* from the main line *a*, Fig. 33, to the section line a^4 at the right, Fig. 32. As the car moves to the left the roller I will, near the end of the section, come in contact with lever H of switch G and through arm *w* and segment *x* supply current to sectional line a^4 at the left, the drag chain *c* being at the time in contact with one live support *f'* of the right-hand section and one of

the left-hand section, but as the lever H of switch G nears the end of its movement upward, the pendent lever K′ pulls the pin in the end of rod J to the left and as it approaches the left-hand limit of the slot L′ the arm *w* is pulled to the left and out of contact with segment *x* so as to open the circuit in the right-hand section; the arm H being thrown down and the arm K′ thrown to the right into the positions shown for switch G′. This operation will leave switch G′ in position to be operated upon by a roller I on another car in the same way that the roller I will operate upon arm H of switch G in the drawings. The slot L′ should be long enough so that successive switches can be left open and only one be closed at a time as the roller I on the drag arm strikes the arm H of the previous switch. This movement should open the switch on the section behind the car, thus leaving all the switches behind open, and those in front, except that upon which the car is running, will have been left open behind the previous car. This apparatus is chiefly intended to typify for use in the particular system herein applied, any well known cut-out apparatus heretofore applied for the same purpose in connection with different details of construction.

The system of making connection between an electric car and underground conductors by means of a drag rope has the advantage that no very great accuracy is required in the construction and live conductors are only required for a portion of the length of the conduit. The arrangement is comparatively cheap and compact, and is moreover very efficient in the neighborhood of crossings, switches and curves. At crossings the two different lines may cross without interchange of current, for there is no necessity of putting a live support at the intersection of the tracks, as evidently a live support can be put in each line on either side of the crossing track, when by having a neutral support at the intersection each line will cross with its own current. On switches and curves the conduit would be made in plan with open channels following the direction of the tracks above, but without switch points, and the drag rope will necessarily follow into the channel under the track to which the car is directed above. The distinction between this system and one in which a flat bar carried by the car is used, flexible only in one direction so as to accommodate itself to curves, will be at once readily seen. The bar system requires comparatively close alignment of the supports, at least in one direction and better in all directions. It is necessarily limited in length, and to make it operate with certainty under all conditions, requires a much higher order of original workmanship and inspection during operation than the drag rope system herein described.

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

1. The combination with railroad tracks and with a car thereon carrying electric apparatus, of a non-insulated conduit, a drag arm passing from the car within such conduit and carrying an insulated electric conductor connected with the electric apparatus on such car, a flexible conductor connected to the conductor carried by such drag arm, a series of live supports connected to an electric generator through a main electric conductor, and a series of intermediate supports arranged within the conduit to support the flexible conductor between the live supports, all operating substantially as and for the purposes specified.

2. The combination with railroad tracks and with a car thereon carrying electric apparatus, of a non-insulated conduit, a series of live supports connected to an electric generator through a main electric conductor and a series of intermediate supports both arranged within the conduit and adapted to support a flexible conductor, and a drag arm passing through a slot in such subway and carrying an electric conductor insulated from such slot and connected to electric apparatus on the car and to a flexible conductor operating in connection with such supports, substantially as and for the purposes specified.

3. In combination with a non-insulated electric conduit containing live and intermediate supports adapted to support a flexible drag conductor for making connection with electric apparatus on a car, a series of electric sub lines or sections connected to live supports distributed throughout the length of each section and suitable means for turning the current on and cutting it off such sections successively as the car passes over the same, substantially as and for the purposes specified.

4. A line of posts contiguous to a railroad track and extending above the surface, and an electric conduit supported on such posts and carrying an electric conductor, in combination with a connecting inclined plane and with a subway carrying a continuation of such electric conductor, and with a car on such track carrying an electro mechanical device for making contact with such electric conductor in its various positions, substantially as and for the purposes specified.

5. In combination with a non-insulated electric railway conduit, a series of insulated live supports and a series of insulated intermediate supports arranged therein and adapted to support a flexible conductor arranged to convey electric current from such live supports to apparatus on a car, substantially as and for the purposes specified.

6. In an electric drag rope system, in combination with a non-insulated conduit, a series of insulated live supports in combination with a series of intermediate insulated supports connected to main conductor only during the passage of such drag rope, both supports being arranged within the conduit, substantially as described.

7. In an electric railway drag rope system, a drag rope provided with a prismatic rigid termination or tail of limited length insulated from the leading portion of the rope, substantially as and for the purposes specified.

8. In an electric railway drag rope system, a drag rope or chain provided with a termination or tail insulated from the leading portion of the rope or chain, substantially as and for the purposes specified.

CHAS. E. EMERY.

Witnesses:
LIVINGSTON EMERY,
CHAS. B. CURTIS.