No. 650,030. Patented May 22, 1900.

A. BALLANCE & S. A. JEFFERSON.

APPARATUS FOR OPERATING CONTACTS FOR ELECTRIC TRACTION.

(Application filed Nov. 10, 1899.)

(No Model.) 4 Sheets—Sheet 1.

FIG. 1.

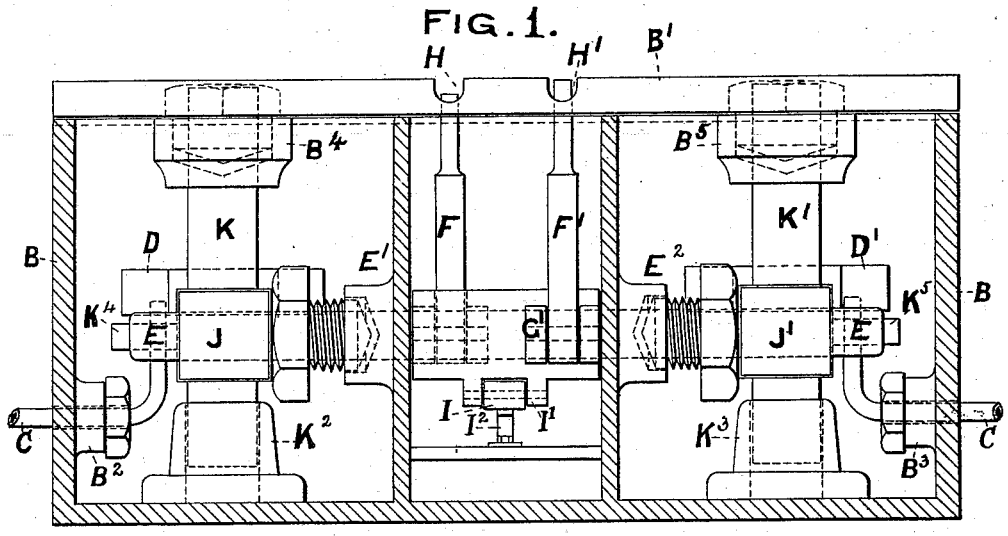
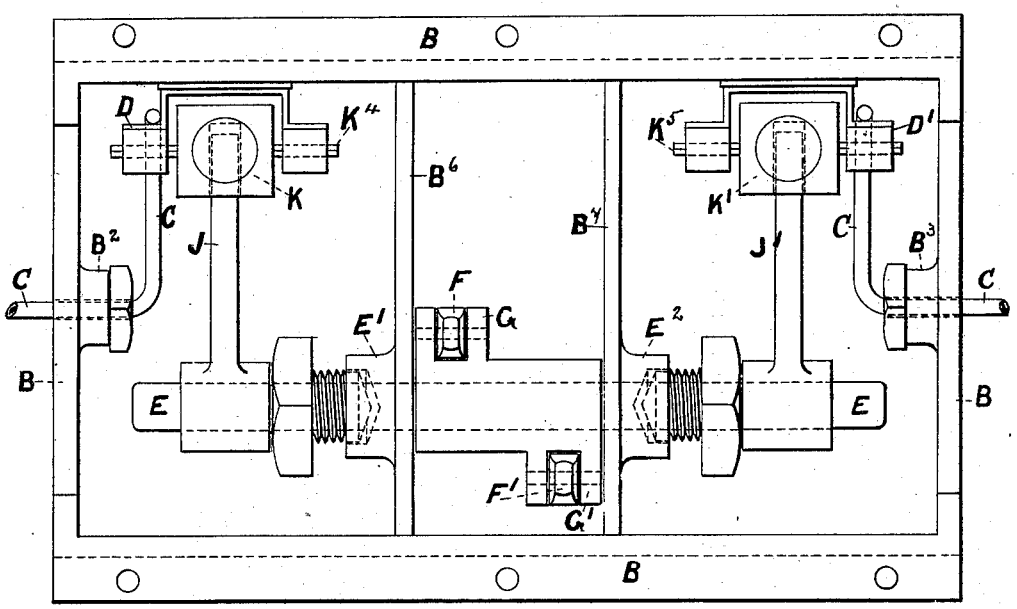


FIG. 2.



Witnesses,
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Inventors
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FIG. 3.

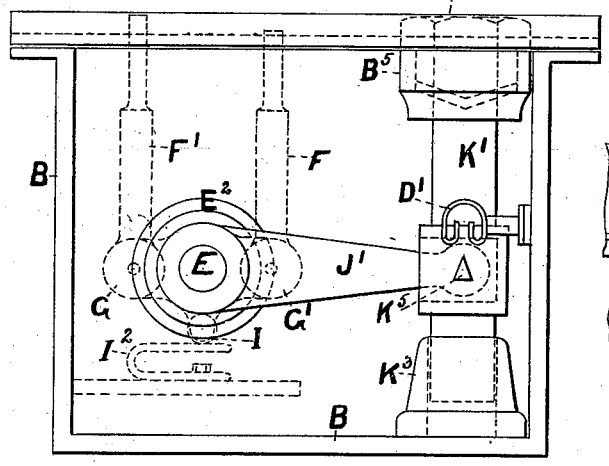

FIG. 8.

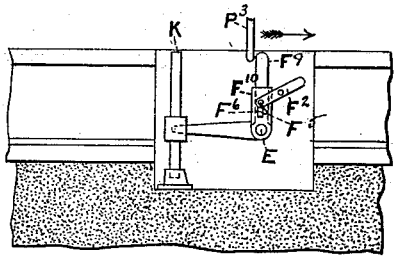

FIG. 9.

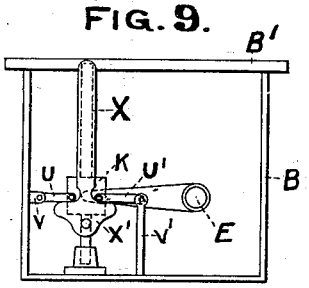

FIG. 4.

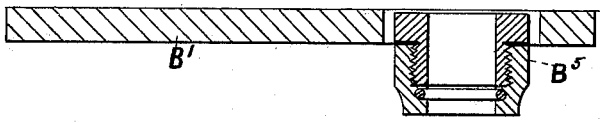

FIG. 10.

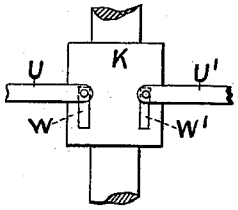

FIG. 7.

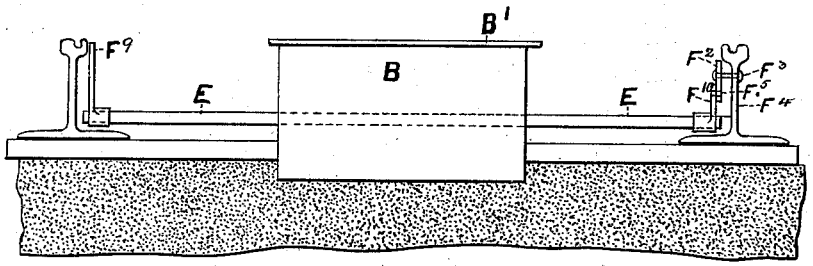

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FIG. 5.

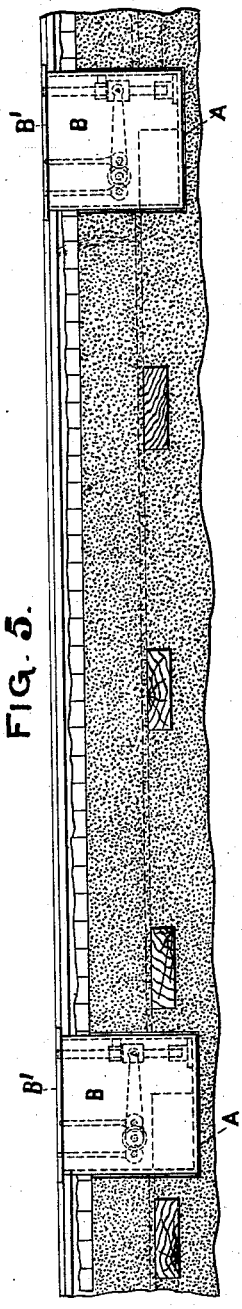

FIG. 6.

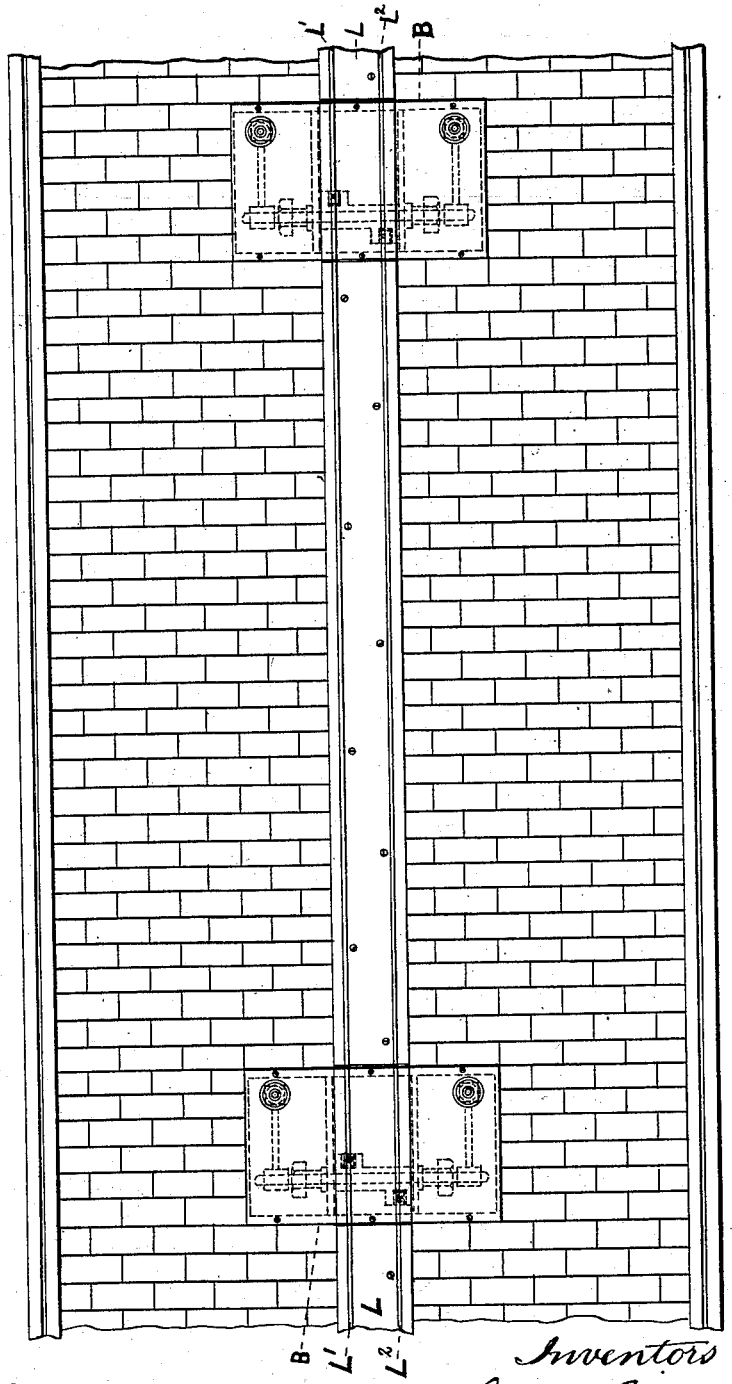

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FIG. 11.

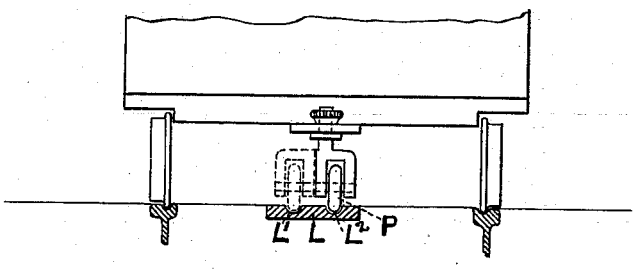


FIG. 12.

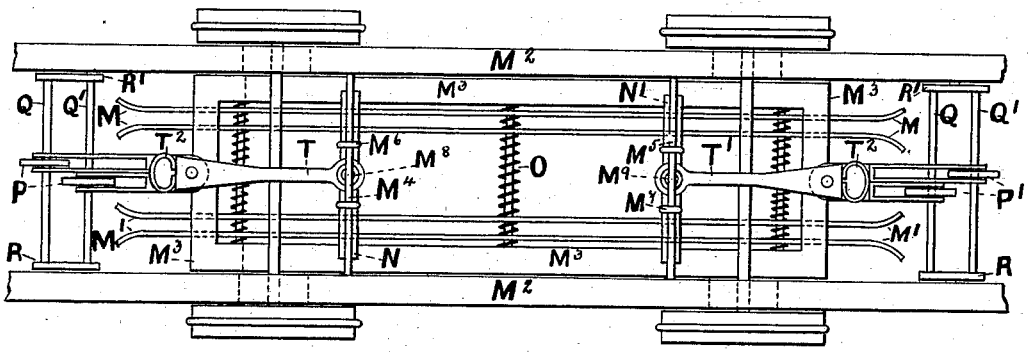
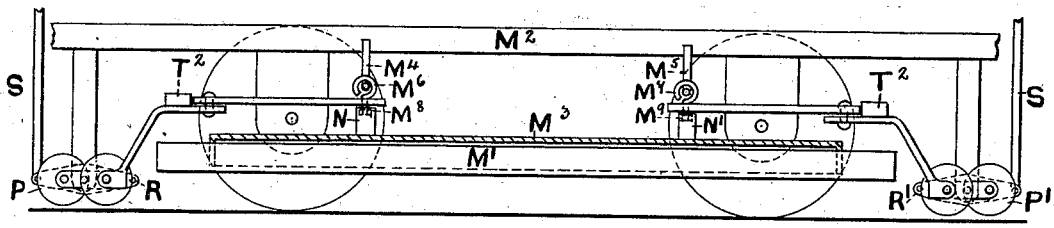


FIG. 13.



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Arthur Ballance
Samuel Ambrose Jefferson

UNITED STATES PATENT OFFICE.

ARTHUR BALLANCE AND SAMUEL AMBROSE JEFFERSON, OF HULL, ENGLAND.

APPARATUS FOR OPERATING CONTACTS FOR ELECTRIC TRACTION.

SPECIFICATION forming part of Letters Patent No. 650,030, dated May 22, 1900.

Application filed November 10, 1899. Serial No. 736,568. (No model.)

To all whom it may concern:

Be it known that we, ARTHUR BALLANCE and SAMUEL AMBROSE JEFFERSON, subjects of the Queen of Great Britain, residing at Hull, in the county of York, England, have invented a new or Improved Method and Apparatus for Operating Contacts for Electric Traction, of which the following is a specification.

The object of our invention is to construct a simple contrivance for the purpose of giving current at intervals, and yet continuously, to an electric motor fitted to tram-cars and the like, the car moving forward operating the mechanism itself by means of a roller or rollers or the like attached to the car, our invention being applicable for use in connection with a culvert, bare copper conductor, insulated main and rail, or two bare copper conductors side by side, one divided into sections the length of the car, or for single or double pole surface contacts. In the latter case a culvert is not essential, a flat strip of iron, with a groove or grooves or the like longitudinally for the rollers on the car to run in, being employed, fastened to the sets or to the track between the rails and running the whole length of the system.

Figure 1 is a side view of one of the boxes, showing the mechanism therein, the box having its near side or wall removed, so that the mechanism can be more clearly seen. Fig. 2 represents a plan view of Fig. 1, but with box-cover removed. Fig. 3 is an end view of Fig. 1, but with near end or wall removed. Fig. 4 is a sectional view through box-cover crosswise, showing packed gland. Fig. 5 is a longitudinal section of the road-bed, showing the contact mechanism. Fig. 6 is a plan view of the same. Fig. 7 represents a side view of a box, with levers instead of plungers for operating the mechanism, as would be used on light railways having a double track. Fig. 8 is an end view of Fig. 7. Fig. 9 is an end view of lever arrangement for operating mechanism when the apparatus is used for light railways having a single track. Fig. 10 is a view of one of the studs, showing struts and cam-lever for lifting it. Fig. 11 represents an end view of car under frame with reversible roller for depressing the plungers. Fig. 12 is a plan view of the under frame of a tram-car, showing trolley, brush, or collector for engaging with contact studs and rollers for operating plungers. Fig. 13 is a side view of Fig. 11, showing the collector-frame in section.

For the purpose of our invention we may employ a culvert of cast-iron or any other suitable metal, material, or substance, running the whole length of the system, or in place thereof we provide recesses or openings in the roadway at suitable distances apart. Within this culvert at the required intervals or within the recesses A we place boxes B, containing the switch and mechanism, each box being made water-tight by means of a jointed or other packed cover B′ and brass or other suitable packed glands B^2 and B^3 where the cables C or the like pass through any part of the box or its cover.

The switch-contacts D D′ are mounted on porcelain or any other suitable material or substance with suitable lugs or the like for cable connections.

The switch mechanism within the box B consists of an oscillating or rocking shaft E, having, preferably, two perpendicular plungers F F′, mounted in brackets or on jointed levers G G′, which are fixtures, one projecting from each side of the said shaft E. These plungers pass up through holes H H′ in the box-cover B′. The plungers F F′ are shown of different lengths, and they may be made in that manner; but this is not material, and, if desired, they may be both of the same length, as also may the levers F^9 and F^{10}, hereinafter described. Under the jointed levers or brackets aforesaid is a roller I, mounted in a cam-like or other bracket I′, such roller bearing on a ⊂-shaped spring I^2, which holds the plungers F F′ up or down as they operate the shaft E. Also to the said shaft E are fixed the make-and-break contact levers or arms J J′. These levers have ends in the shape of vertical studs or pins K K′, which pass up through packed glands B^4 B^5 in the cover B′, such studs being loose on the ends of the levers J J′, which may work in recesses within such studs, so that the said studs may be free to rise and fall perpendicularly by the action of the shaft rocking

on one or other of the plungers F F′ being depressed. The bottom ends of these studs preferably work in insulated guides K^2 K^3. These studs may have projections K^4 K^5 on them to engage with the switch-contacts D D′, which are fitted within the box B in such a position that as the studs or pins K K′ rise the projections touch such switch-contacts and complete the electric circuit, and as they fall they leave them and break the electric circuit. The box may be divided into compartments by means of dividing-walls B^6 B^7, so as to prevent water, dirt, or the like from getting to the levers or arms, studs, and switch-contacts, and for more satisfactorily attaining this object packed glands E′ E^2 may be employed for the oscillating or rocking shaft E to pass through.

We employ a flat strip of iron or any other suitable metal or material L, running the whole length of the system and provided with grooves L′ L^2 for rollers on the front and back ends of the car to run in, the grooves being continued in the box-covers, the plungers F F′ passing up through holes H H′ therein.

The trolley, brush, or collector M M′ is mounted on the bottom of the car-frame or bogie M^2 and consists, preferably, of brass or other suitable metal strips, each collector being formed, by preference, of two metal strips, their ends opened somewhat. The space between the collectors is just sufficient for the two strips which constitute it to brush against its contact-stud K or K′ when raised, each strip passing on one side of such stud. In the case of double-pole surface-contact systems two collectors are employed, one for each stud; but in single-pole surface-contact systems one collector only is necessary, as only one contact-stud is employed; but any suitable number of studs may be employed.

To allow of the car passing around curves without breaking the circuit, the collectors M M′ may be mounted in a swivel-frame M^8, (see Figs. 12 and 13,) this frame being suspended from cross-bars M^4 M^5 on the under carriage or bogie M^2 of the car, the suspenders or supports M^6 M^7 allowing the frame to move sidewise. Pins M^8 M^9 pass through the supports and also through cross-pieces N N′ on the collector-frame to form loose joints. These allow of the said frame twisting to conform to the curve around which it is passing. As the car rounds the curve the collector-frame as it engages with the contact-studs automatically adjusts itself to the curve by means of the sliding supports and joints, springs O, of preferably helical construction, being employed between each of the strips which form the collectors, so that they may open or close, as required.

On the front and back ends of the car-bogie M^2, or in any suitable position we attach rollers P P′ for operating the plungers. These rollers run in the grooves L′ L^2, each running in a separate groove, and each roller may be mounted eccentrically, so that by twisting it around it may run in one groove when the car is going in one direction and in the other groove when the car is going in the opposite direction; but to obviate this setting of the rollers we may employ two rollers at each end of the car and mount them on two separate axles Q Q′, set in brackets or attached to distance-pieces R R′, common to both. A rod S or the like runs up from each of the brackets to the driver's seat. The driver operates the rods S in any approved manner. By means of them he raises one roller out of the groove it is in and lowers the other roller into its corresponding groove, two rollers always being down at one time, each running in a separate groove—that is, one roller at the front end of the car running in one groove and the other roller at the back end of the car running in the other groove.

The brackets at each end of the car, which take the rollers, may be articulated each to a lever T T′, which in its turn is movably attached to the pins M^8 M^9, on which the collector-frame turns. The levers T T′ are each provided with a broad nosepiece at the point where it is articulated to the bracket, and a bent spring T^2 is mounted on the bracket. The nosepiece of the lever bears against the bent spring. The pressure of the spring on the nosepiece brings the trolley or collector frame into its normal position when the car is traveling on a straight line.

For electric tramways or light railways running through country districts, where the track is railed off, we may dispense with the plungers employed for operating the shaft and the rollers on the car for depressing these plungers as employed for street-tramways and instead thereof employ an arrangement of levers fitted at or near the ends of the oscillating shaft, which is preferably continued through the box and carried up to or within a short distance of the rails, the arrangement consisting of two levers F^9 F^{10}, one keyed onto each end of the shaft E, so as to move only with such shaft, the lever F^{10} being preferably shorter than the lever F^9. A second lever F^2, independent of the shaft, is employed and is articulated at F^3 to the rail F^4 or other suitable support. This lever F^2 has a pin F^5 at its bottom end, which works in a slot F^6 in the lever F^{10}.

The bogie of the car is provided with projecting legs or the like P^3—one at either end of the car and at opposite sides. These take the place of the rollers, this arrangement being applicable for a double track where the cars travel in one direction on one set of lines and in the other direction on another set.

When set for operation, the levers F^9 F^{10} are in a vertical position and the lever F^2 at an angle in the direction of the way the car is traveling. The projection on the front end of the car comes in contact with the lever F^9

and knocks it over. The short lever F^{10}, moving in the same direction at the same time, brings the articulated lever F^2 up into a vertical position. The projection on the back end of the car as it passes over the articulated lever F^2 knocks it down, and this as it drops back to its original angle brings the levers F^9 and F^{10} into their upright position again. These levers operate the shaft and switch mechanism in the same manner as do the plungers.

For light railways where there is only a single track the mechanism may be so constructed that the car can operate it whichever way it is traveling. In such a case each of the studs K K′ is provided with two struts U U′, each of which may be articulated at their outer ends to the wall of the box or to an upright V V′, the other ends of such struts working in recesses W W′ on the body of the stud. A vertical lever X, having a cam-shaped bottom X′, is employed. This lever is articulated at its bottom end to any suitable support or the like, and the top rounded parts of the cam-piece bear on the under side of the struts which rest upon such cam-piece, the lever of which projects above the box. Each stud is provided with a set of struts and a lever with an enlarged end. As the car comes along a projection on it comes in contact with the lever at its side of the track and knocks it over, so tilting the cam-shaped piece, which raises one of the struts, which raises the stud. Whichever way the lever is knocked the cam-shaped piece tilts, and one of its shoulders raises a strut, which lifts the stud. The rocking shaft connecting both studs lifts the one at the opposite end to the one which the lever operates, so that, whichever side is operated by the car, both studs are raised.

It will be understood that many of the parts both of the switch mechanism and parts working in connection with the same must be insulated at the parts where there is any liability to short-circuit; but as the methods of insulating are so varied it is unnecessary to enumerate these; but we would have it understood that we do not claim any particular way of insulating and that insulating in any manner whatever will not avoid the scope of our invention.

Where the mains are laid in a culvert, insulated bridges are formed in such culvert for the said mains to bear on, and in the case of bare copper mains insulators are provided over which the bare copper main or mains is or are strained.

Our improvements are applicable in all cases where mains or cables are underground ones—as, for instance, where the mains are laid in culverts, where there is a bare copper conductor or insulated main and rail or two bare copper conductors side by side, one of which may be divided into strips the length of the car.

Our improved apparatus for street-tramways works as follows: The long plunger F being up in its groove and the car being on the rails, the roller on the front of the car running in its own groove comes in contact with the plunger in such groove and forces it down, bringing up the short plunger in its groove. This action, giving the oscillating shaft part of a turn, operates the levers thereon, which raise the studs, bringing the projections upon them into touch with the switch-contacts. The trolley, brush, or collectors underneath the car brush against such studs. The electric current flows from the main through the switch-contacts, through one stud to the motor on the car, and then from the motor to the second stud and switch-contact back to the other main as the car moves along, the boxes being so spaced that the switch-contact in the box immediately in front makes contact electrically before the hind roller on the car breaks contact in the box it is leaving. Hence sparking is entirely obviated, current being drawn from the mains to work the motor on the car either continuously or at intervals, as required.

What we claim as the invention, and desire to secure by Letters Patent, is—

1. The combination, with a switch-box B, and a shaft E journaled therein; of arms projecting laterally on opposite sides of the said shaft, operating-plungers F F′ projecting through the top of the said box and connected to the said arms, levers J J′ secured to the said shaft and projecting laterally on the same side thereof, contact-pieces carried by the said box and provided with conductors, slidable contact-pins K K′ operated by the said levers and projecting through the box-top, and projections on the said contact-pins for bearing on the contact-pieces, substantially as set forth.

2. The combination, with a switch-box B provided with partitions carrying stuffing-boxes, and a shaft E journaled in the said stuffing-boxes; of arms secured to the middle part of the said shaft between the said partitions and projecting laterally on opposite sides of it, levers projecting from the end portions of the said shaft, slidable contact-pins operated by the said levers and projecting through the box-top, and operating-plungers F F′ connected to the said arms and also projecting through the box-top, substantially as set forth.

3. The combination, with a switch-box, and a shaft E journaled therein; of arms projecting laterally on opposite sides of the said shaft, operating-plungers F F′ projecting through the top of the said box and connected to the said arms, a projection on the under side of the said shaft, a spring engaging the said projection and operating to hold the said plungers in their extreme positions, a lever projecting laterally from the said shaft, and a slidable contact-pin operated by the said lever and projecting through the box-top, substantially as set forth.

4. The combination, with a car-frame provided with cross-bars, of a collector-frame, swivel-joints supporting the collector-frame and free to slide laterally on the said cross-bars, and collector-bars M M′ carried by the said collector-frame, substantially as set forth.

5. The combination, with the car-frame, and the laterally-movable collector-frame supported by it; of rollers supported from one end of the car-frame, forked brackets straddling the said rollers, a spring carried by the said brackets, and a lever pivoted to the said brackets and provided with a broad end portion which bears against the said spring, and means for pivotally connecting the other end portion of the said lever with the said collector-frame, substantially as set forth.

In testimony whereof we affix our signatures in the presence of two witnesses.

ARTHUR BALLANCE.
SAMUEL AMBROSE JEFFERSON.

Witnesses:
LOUIS E. KIPPAX,
FRED H. RHODES.