

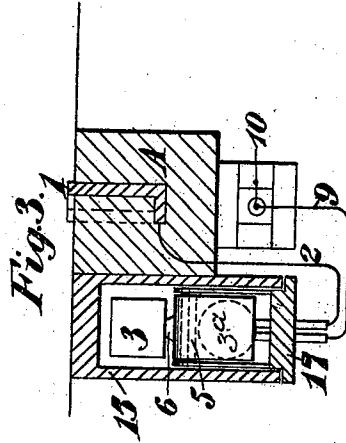
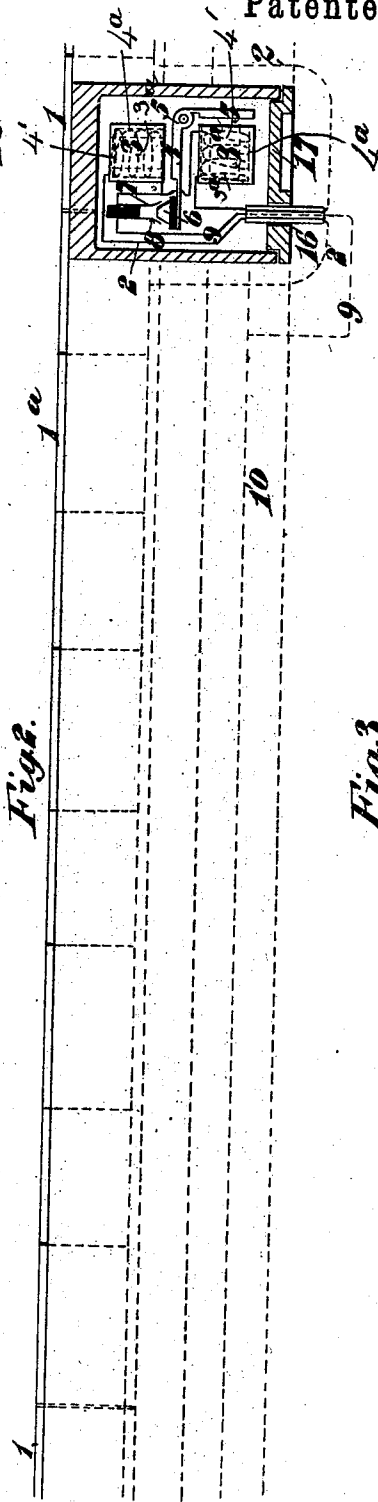
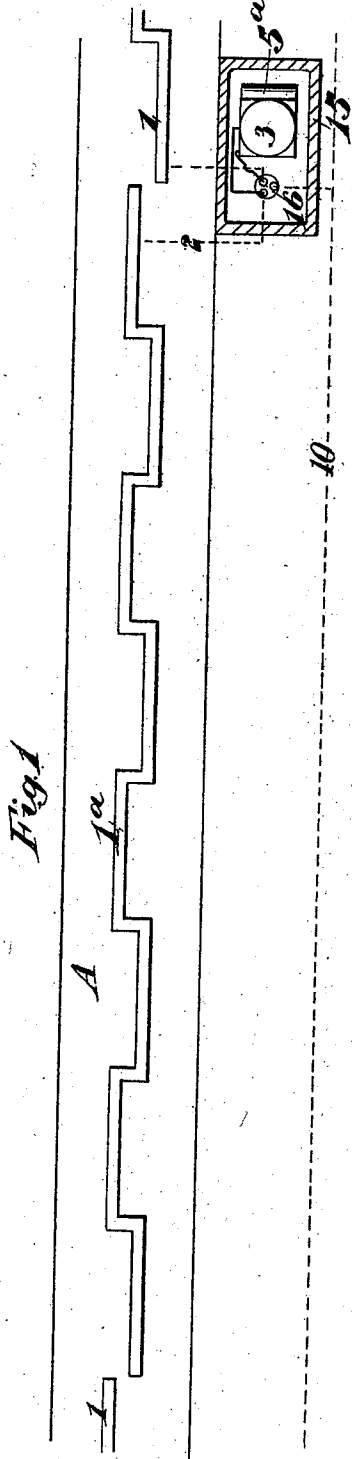
(No Model.)

4 Sheets—Sheet 1.

F. WYNNE.
CONDUIT SYSTEM FOR ELECTRIC RAILWAYS.

No. 502,216.

Patented July 25, 1893.



Witnesses
E. C. Duffy
J. E. Peck

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CONDUIT SYSTEM FOR ELECTRIC RAILWAYS.

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Fig. 5.

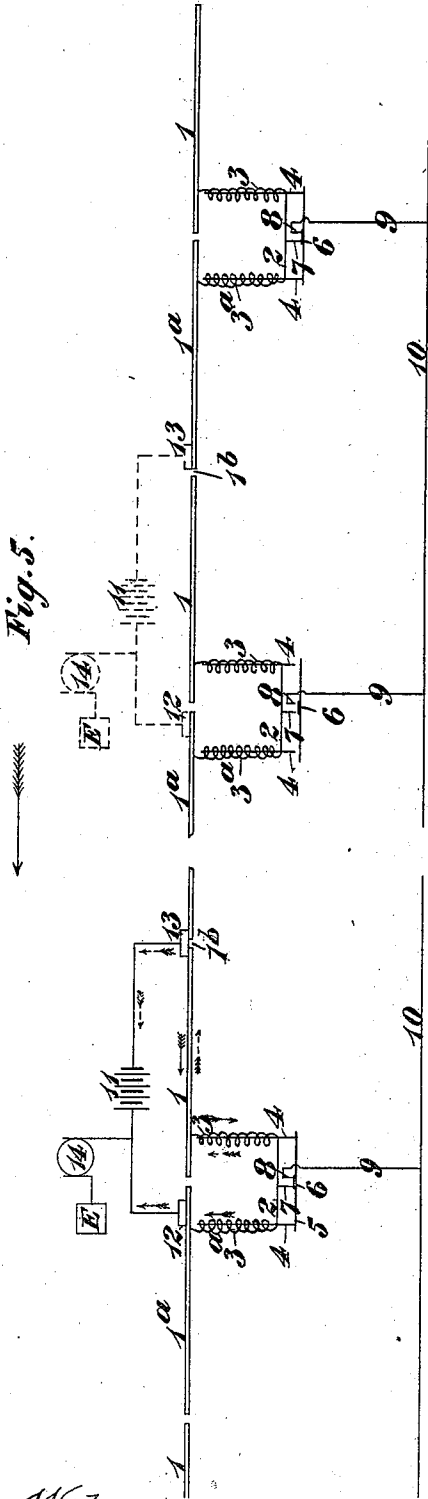
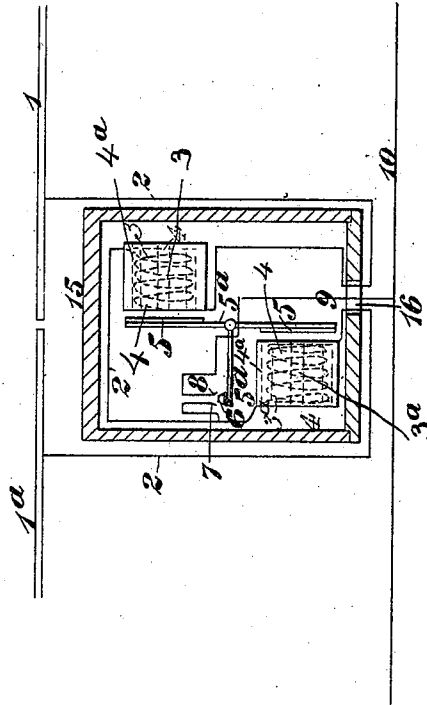


Fig. 4.



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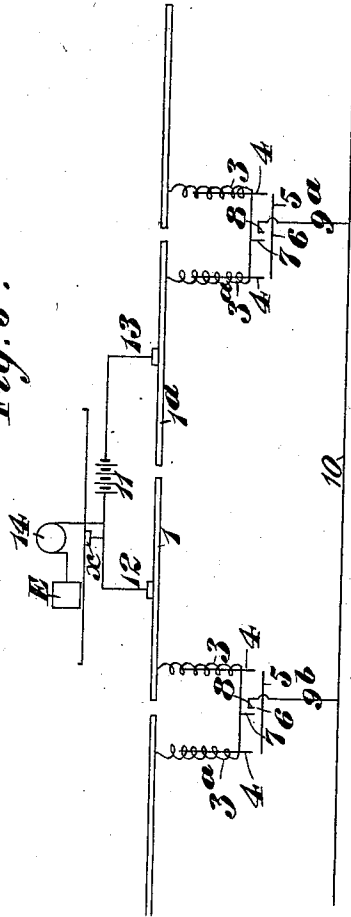
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Fig. 5^a.



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Fig. 6.

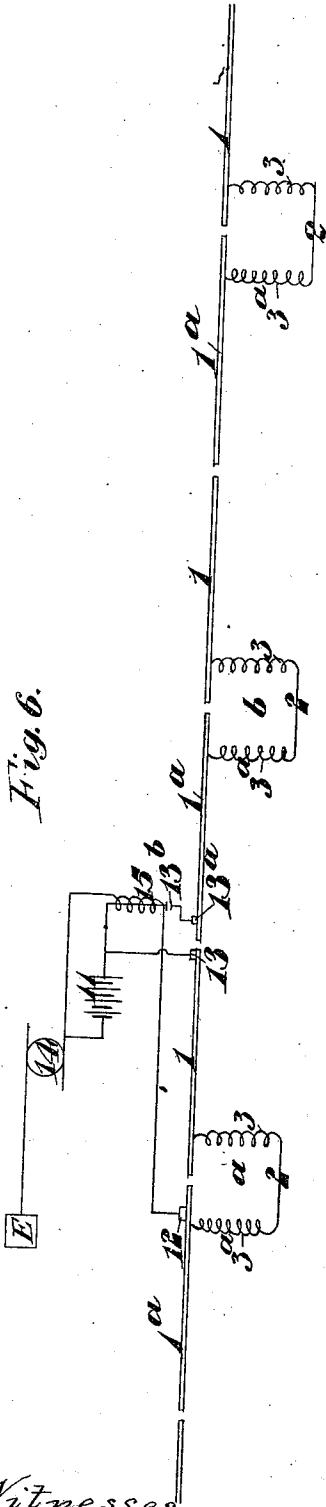
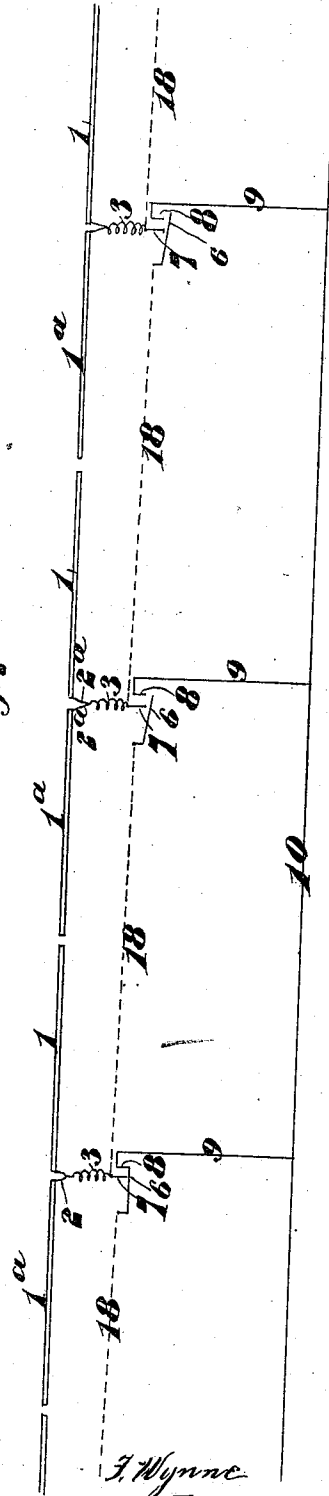


Fig. 7.



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UNITED STATES PATENT OFFICE.

FRANK WYNNE, OF LONDON, ENGLAND.

CONDUIT SYSTEM FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 502,216, dated July 25, 1893.

Application filed April 3, 1891. Serial No. 387,561. (No model.) Patented in England December 4, 1890, No. 19,811; in Germany March 18, 1891, No. 64,132; in France September 17, 1891, No. 216,184; in Canada July 30, 1892, No. 39,555, and in Austria-Hungary October 23, 1892, No. 26,047.

To all whom it may concern:

Be it known that I, FRANK WYNNE, a subject of the Queen of Great Britain and Ireland, residing at Victoria Street, Westminster, London, England, have invented Improvements in Apparatus for Supplying Electricity to Electrically-Propelled Vehicles, (for which I have obtained Letters Patent in Great Britain, No. 19,811, dated December 4, 1890; in Germany, No. 64,132, dated March 18, 1891; in France, No. 216,184, dated September 17, 1891; in Austria-Hungary, No. 26,047, dated October 23, 1892, and in Canada, No. 39,555, dated July 30, 1892,) of which the following is a specification.

This invention has reference to improvements in apparatus for supplying electricity to electrically propelled vehicles of the kind in which road contacts insulated as well as is practically convenient, and normally disconnected from an insulated main conductor, are, as the vehicle travels, connected in consecutive order with the said main conductor by automatically operating contact-making devices. Arrangements of apparatus for this purpose are described in the specifications of British patents granted to me No. 747*, of 1887, and No. 16,537, of 1887. In the former specification there is described *inter alia*, an arrangement in which two parallel series of insulated road contacts are used. One of these series is the main series for conducting the current from an insulated main conductor of electricity to the car motor. The other series, called the earth contacts, is for completing the circuits of the solenoids used for initially exciting contact making devices at starting, and afterward for exciting them in consecutive order as the vehicle travels along the road. In the secondly mentioned specification there is described an arrangement in which a series of additional road contacts are provided for remaking the car motor circuit, only after the same has been broken.

An object of my present invention is to dispense with the second series of road contacts and to make one series serve two purposes; namely (first) for conducting electricity from the insulated main conductor of electricity to

the car motor; and (second) for completing the circuits of the solenoids for initially exciting one or more of the contact-making devices for the purpose (a) of remaking the car motor circuit at starting; or (b) after the same has been accidentally or otherwise broken; and (c) for afterward completing the circuits of the solenoids in consecutive order as the vehicle travels along. For this purpose I arrange the road contacts longitudinally of the roadway one behind the other, and electrically connect them in pairs by a conductor. In the circuit of this conductor is or are one or more solenoids or electro-magnets, forming part of an electro-magnetic contact-making device. On the vehicle to be propelled I provide an electric generator.

In the accompanying drawings, Figures 1, 2 and 3 are respectively a plan, a longitudinal vertical section, and a transverse section, of part of a roadway provided with apparatus according to this invention. Fig. 4 is a vertical section illustrating a modified construction of contact making device. Figs. 5, 5^a, 6 and 7 are diagrams.

In Figs 1 to 4 inclusive, 1 1^a are road contacts, arranged in pairs one behind the other, and longitudinally of the track A. These road contacts may advantageously be in the form of crenellated bars as shown as by this means I insure a better bonding or interlocking of the wooden or other road sets both with one another and with the road contacts, than can be obtained with road contacts in the form of straight plates or rails as heretofore used, and which injuriously affect the bonding of the road-pavement-sets. Each pair of these road contacts 1, 1^a is connected by a conductor 2 in circuit with which are two solenoids 3, 3^a. Each solenoid has a magnetic core 4, for operating an armature 5 carried by or forming part of the lever 5^a.

6 is an insulated contact piece carried by the lever 5^a. In electrical connection with the solenoids is a contact 7. In proximity to 7 is another contact 8 electrically connected by a conductor 9 with an insulated main conductor 10. When the circuit of the pair of solenoids is completed, the armatures 5 will be attracted,

and cause the contact piece 6 to bear against the contacts 7 and 8. These contacts will then be placed in electrical connection with each other and will consequently electrically connect the pair of road contacts 1, 1^a (to which the conductor 2 is secured), to the main conductor 10. When the current ceases to flow through the solenoids, the armatures will assume by gravity the normal positions shown, and automatically break the connection between the road contacts and the main conductor.

The solenoids 3 and 3^a may be made as shown each with a core 4 and magnetic sheath 4^a to form a pot electro magnet, that is to say an electro-magnet one pole of which is concentric with the other with the magnet winding between the two. They may be arranged at right angles to each other as in Figs. 1, 2 and 3, or parallel as in Fig. 4. These solenoids, the armatures 5, and the contacts 6, 7 and 8 are supported within, but preferably not connected to a removable air tight box 15 that acts after the manner of a diving bell to exclude water. This box may be arranged with its top level with the roadway so as to form part thereof. The conductors 2 and 9 may pass through an opening 16 in the bottom 17 of the box.

In Fig. 5, 11 is an electric generator (hereinafter called a battery) placed on the vehicle to be propelled. It is provided with forward and backward contacts 12 and 13 respectively, arranged to travel in contact with the road contacts 1, 1^a.

14 is the car motor having one pole electrically connected to one pole of the battery and with the contact 12, and its other pole to earth E, or to other return conductor.

When the vehicle is in the position shown in dotted lines, (Fig. 5) the current from the main conductor 10 will pass wholly to the car motor through the rear contact 13 and battery 11. The battery in this case would be a secondary battery, and would at this time be charged by the current passing through it. When the vehicle moves into the position in relation to the road contacts, shown in full lines, part of the current supplied to the road contact 1^a of the pair of road contacts located to the rear of the pair over which the vehicle is traveling, may pass to the car motor through the battery. But most if not all will at first pass to the forward contact 12 and car motor, through the said pair of road contacts 1, 1^a over which the vehicle is traveling and through the conductor 2 and solenoids connecting these road contacts, as indicated by the arrows in full lines, the battery in this case having no function to perform. The armatures 5 will then operate the contact piece 6 and place contacts 7 and 8 and the corresponding pair of road contacts 1, 1^a in connection with the main conductor 10 through the corresponding conductor 9. The current will then pass to the car motor mainly, if not altogether, through the solenoid 3^a in the same direc-

tion as the exciting current previously sent through it, but a smaller current may also then pass to the car motor through the solenoid 3, road contact 1, contacts 13, and battery 11 in the direction indicated by dotted arrows. Should the car motor circuit be broken, when the vehicle is say in the position shown in full lines, the contact-making device to the rear of the vehicle will by gravity break connection with the main conductor. The battery 11 will then discharge, or can be discharged when necessary through the pair of road contacts 1, 1^a upon which the contacts 12 and 13 bear, and the conductor 2 connecting them. By this means the contact-making device will be caused to (a) maintain the electrical connection between the said pair of road contacts and main conductor; or (b) to remake this connection if it has been broken. It will be seen that when the battery is thus employed to excite a contact-making device, its circuit is not completed through earth.

If the vehicle happens to stop in a position in which the ordinary contacts 12 and 13 have not a contact box between them (for example as indicated in Fig. 5^a) they have to be slid along to such a position as to have a contact box between them, a sliding connection x being indicated to permit of this; or other suitable means may be provided to include a contact box between the front and rear contacts.

By the construction described several advantages in the construction and working of electrical tramways or railways of the kind mentioned are or can be obtained of which the following may be mentioned. The road contacts can be made shorter than otherwise for a given distance between the contact making devices, thereby enabling them to follow the curvature of a road and facilitating their being readily laid; contact can at all times and in any position of the vehicle on the track, be remade between a road contact and the main conductor after such contact has been accidentally or otherwise broken; the use of auxiliary charging conductors each adapted to place a solenoid and its connected road contact in connection with the main conductor by a contact making device immediately in rear of such solenoid and road contact as described in my said former specifications can be sometimes dispensed with; the contact making devices can be placed farther apart than heretofore for a given length of car while the same covers and thereby protects the ordinary traffic from the charged road contacts; and, when the auxiliary charging conductors are dispensed with, one line or track is rendered available for working vehicles in either direction.

As will be obvious, the relative arrangement of the battery 11, and the contacts 12 and 13, and the car motor 14 can be variously modified, though I prefer that shown in Fig. 5, but where provision is not made for the current to normally keep the battery charged, a spare

battery should be kept charging in the motor circuit to replace the other when it is exhausted. Thus in Fig. 6, the battery has shown connected to one of its poles, two contacts viz. 13 and 13^a. 15 is an electro magnetic contact breaker in circuit with the forward contact 12. When 12 reaches the road contact 1^a of the pair of road contacts 1, 1^a controlled by the circuit making device at *a*, the battery will discharge through this contact making device, and the contact breaker 15 will break the circuit at 13^b. This circuit will be remade when contact 12 is in a position in which no current passes through it. The distance between the contacts 12 and 13 must always be greater than that of a road contact 1 or 1^a.

For working vehicles in opposite directions on one line, without turning the vehicles round end for end, the contacts 12 and 13 must be so mounted and arranged that they can be reversed in position so that the contact 12 shall always lead.

As will be obvious my improved arrangement of road contacts can be used without a battery on the vehicle to be propelled. The contact making devices will then be operated in successive order as hereinbefore explained, solely by the current that passes to the car motor from one pair of road contacts to the other through the contact 13, when this contact is bridging the gap 1^b between the two pairs as shown in full lines in Fig. 5. In this case sufficient resistance should be placed in the direct circuit between the contact 13 and car motor to cause sufficient current to flow in the direction mentioned some convenient means being provided such as well understood, for remaking connection with the main conductor after the car motor circuit has been broken from any cause.

What I claim is—

1. In apparatus for supplying electricity to electrically propelled vehicles, the combination of an insulated main conductor, a series of insulated road contacts extending along the line and a series of contact making devices, said road contacts being connected so as to form pairs of conductors each of which is independent of the adjacent pairs, by conductors each of which is connected with one of said contact making devices substantially as herein described.

2. In apparatus for supplying electricity to electrically propelled vehicles, the combination of an insulated main conductor a series of insulated road contacts normally disconnected from said main conductor, arranged one in advance of the other with spaces between them in the longitudinal direction of the road, and connected across each alternate space by conductors to form independent pairs of road contacts and a series of contact making devices each in circuit with one of said conductors, substantially as herein described for the purpose specified.

3. In apparatus for supplying electricity to electrically propelled vehicles, the combina-

tion of an insulated main conductor, a series of insulated road contacts arranged one in advance of the other in the longitudinal direction of the road and connected by conductors in pairs each of which is independent of the adjacent pairs, a series of contact making devices each in circuit with the conductor connecting the corresponding pair of road contacts, a car motor, a motor contact, a battery on said vehicle and contacts in connection with the poles of said battery, one of these latter contacts being arranged in advance of said motor contact, substantially as herein described for the purpose specified.

4. In apparatus for supplying electricity to electrically propelled vehicles, the combination of an insulated main conductor, a series of insulated road contacts arranged one in advance of the other in the longitudinal direction of the road and connected by conductors in pairs each of which is independent of the adjacent pairs, a series of contact making devices each in circuit with the conductor connecting the corresponding pair of road contacts, a battery on said vehicle, contacts connected to the poles of said battery and arranged to travel in contact with said road contacts, and a car motor connected to one pole of said battery and to one of said contacts, and to a return conductor substantially as hereinbefore described for the purpose specified.

5. In apparatus for supplying electricity to electrically propelled vehicles, the combination of an insulated main conductor, a series of insulated road contacts arranged one in advance of the other in the longitudinal direction of the road and connected by conductors in pairs each of which is independent of the adjacent pairs, a series of contact making devices each in circuit with the conductor connecting the corresponding pair of road contacts, a battery on said vehicle, a forward contact connected to one pole of said battery, rearward contacts connected to the other pole of said battery, a contact breaking device in the circuit between said forward contact and the battery and adapted to break the circuit between the rearmost contact and said battery and a car motor connected to one pole of said battery and one of said contacts, and to a return conductor substantially as herein described for the purpose specified.

6. In apparatus for supplying electricity to electrically propelled vehicles, the combination of an insulated main conductor, a series of insulated road contacts arranged one in advance of the other in the longitudinal direction of the road and connected in pairs each by a conductor, and a series of contact making devices each comprising two contact making devices each in circuit with the conductor connecting two road contacts constituting a pair, an armature for each of said solenoids, an insulated movable contact piece, a lever carrying said armatures and contact piece, and separate contacts connected to said solenoids and to

said main conductor and arranged in proximity to said contact piece substantially as herein described for the purpose specified.

7. In apparatus for supplying electricity to electrically propelled vehicles, the combination of an insulated main conductor, a series of insulated road contacts arranged one in advance of the other in the longitudinal direction of the road and connected in pairs each by a conductor, and a series of contact making devices each comprising two solenoids in circuit with a conductor connecting two road contacts constituting a pair, an armature for each of said solenoids, an insulated movable contact piece, a lever carrying said armatures and contact piece, separate contacts connect-

ed to said solenoids and to said main conductor and arranged in proximity to said contact piece and a removable air tight box or lid inclosing said solenoids, armatures, lever and contacts and adapted to act after the manner of a diving bell substantially as herein described for the purpose specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANK WYNNE.

Witnesses:

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THEODORE ALLPRESS,

Both of 2 Pope's Head Alley, Cornhill, London, E. C., Gent'n.