No. 635,252.

Patented Oct. 17, 1899.

L. D. HOWARD.

ELECTRIC RAILWAY.

(Application filed Sept. 30, 1891.)

(No Model.)

3 Sheets—Sheet 1.

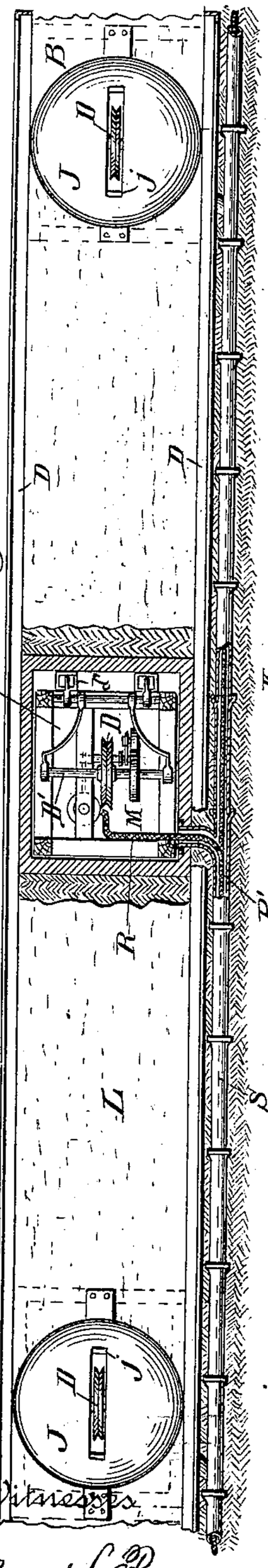

Fig. 1.

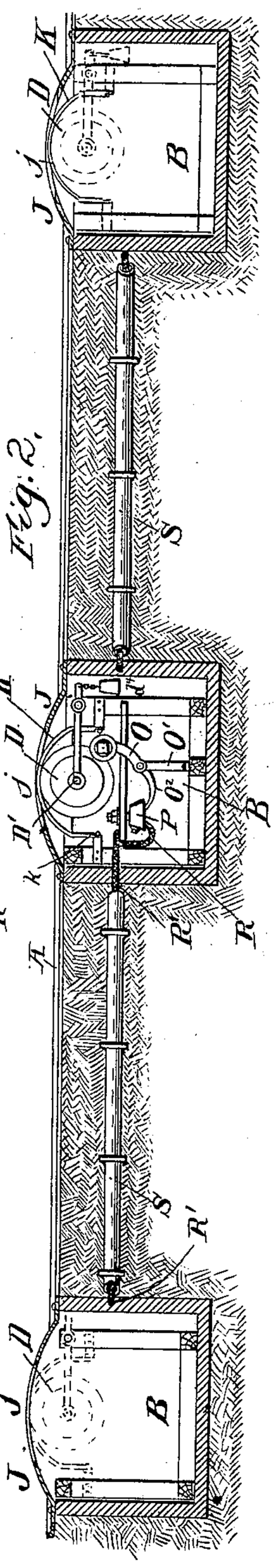

Fig. 2.

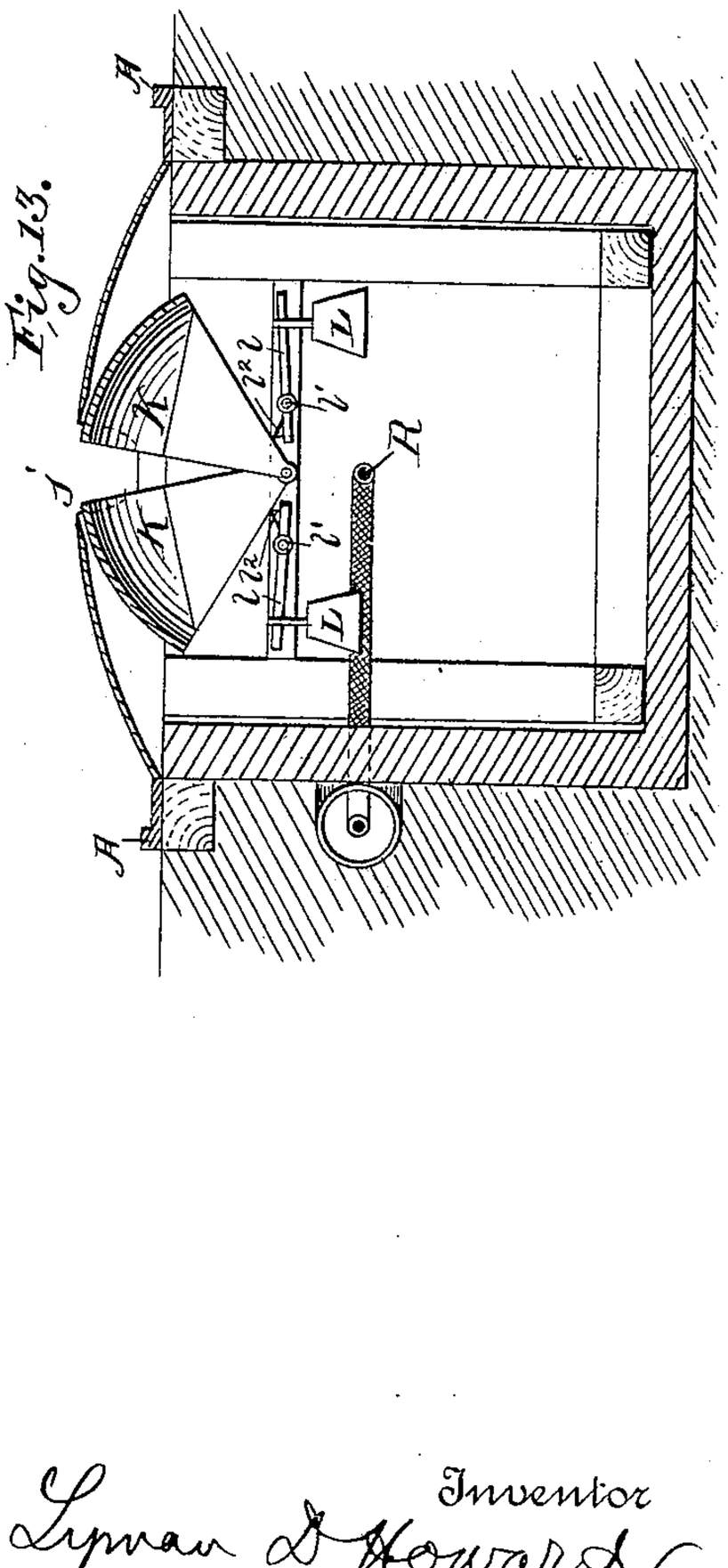

Fig. 13.

Witnesses.

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Fig. 3.

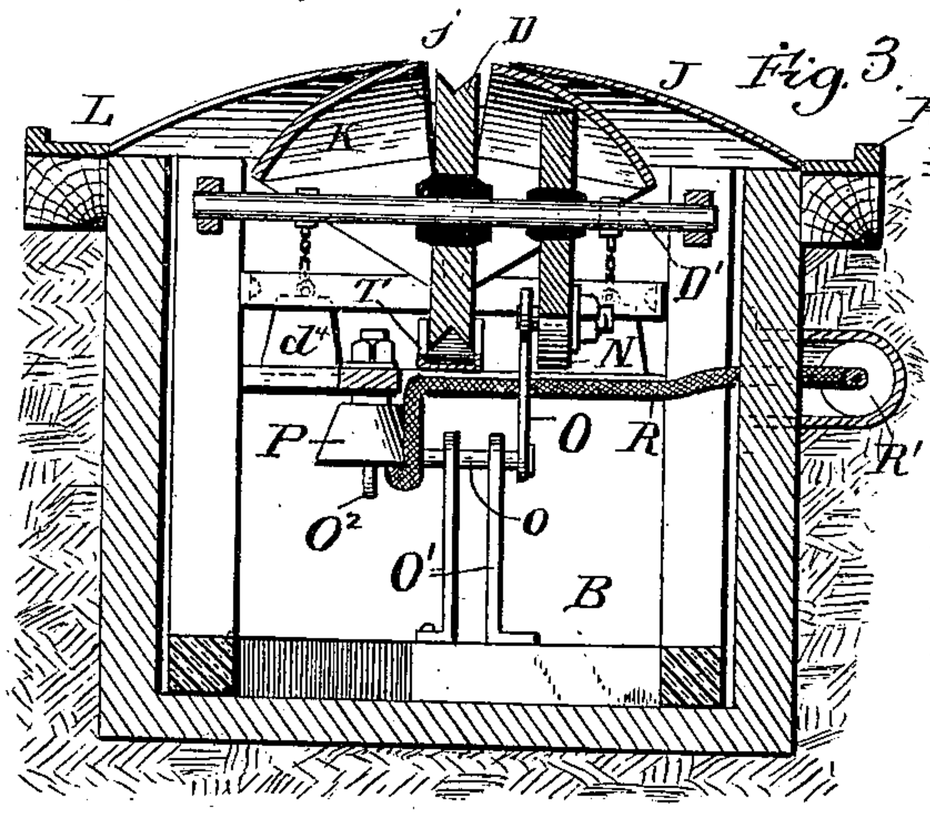


Fig. 4.

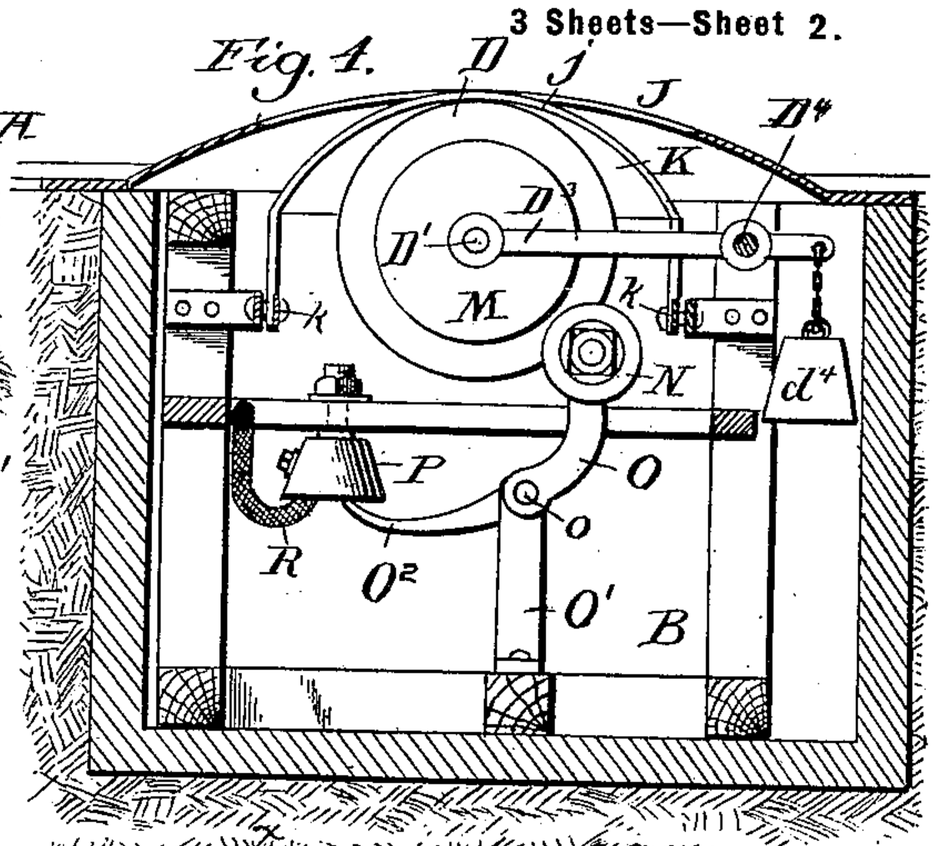


Fig. 6.

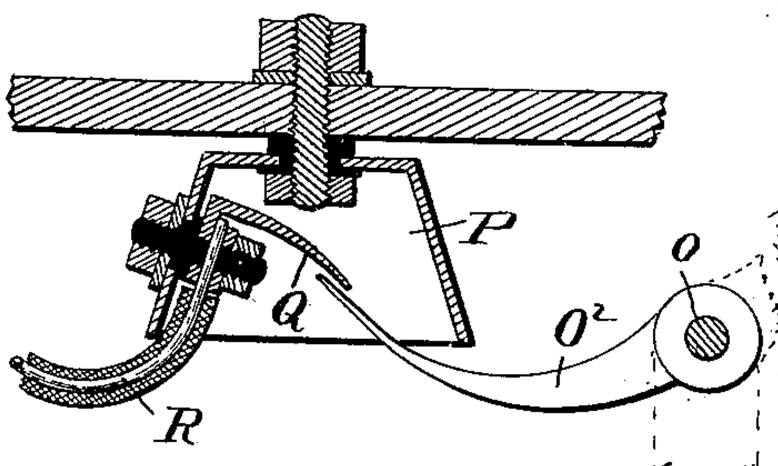


Fig. 5.

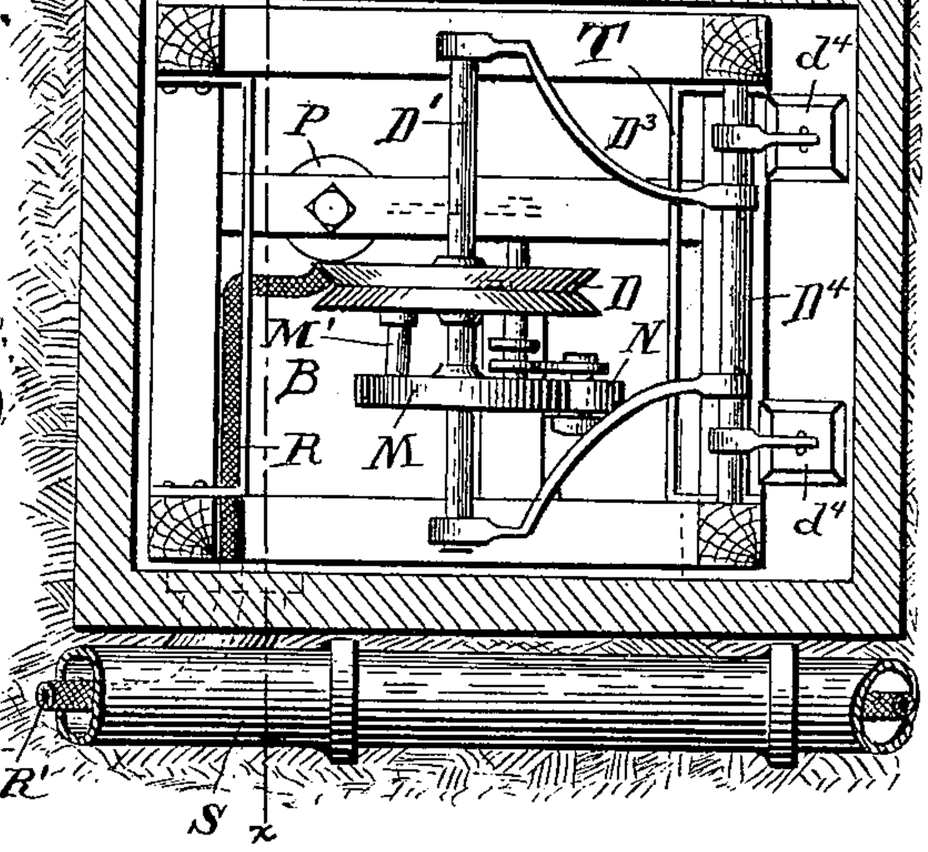
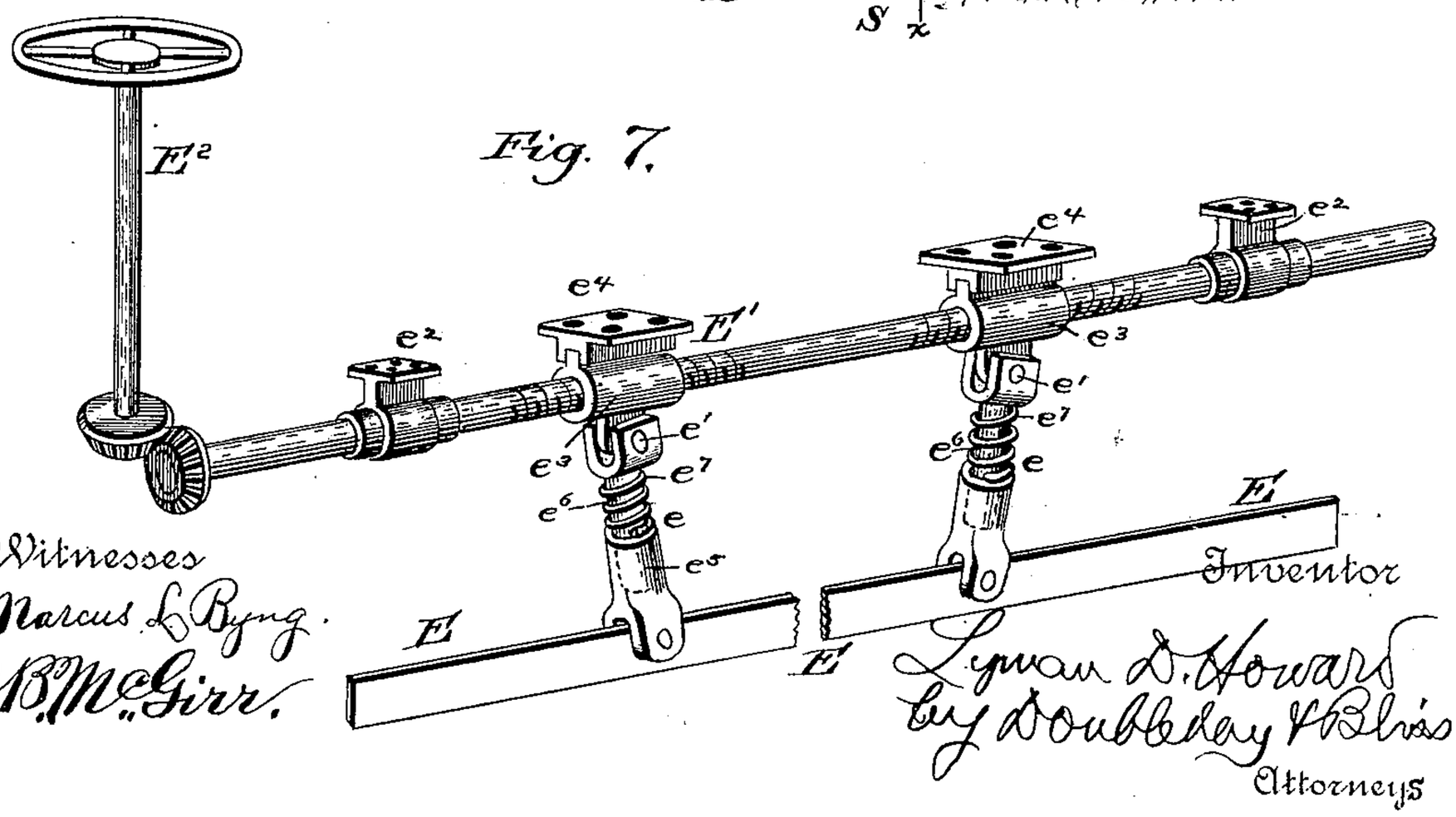


Fig. 7.



Witnesses
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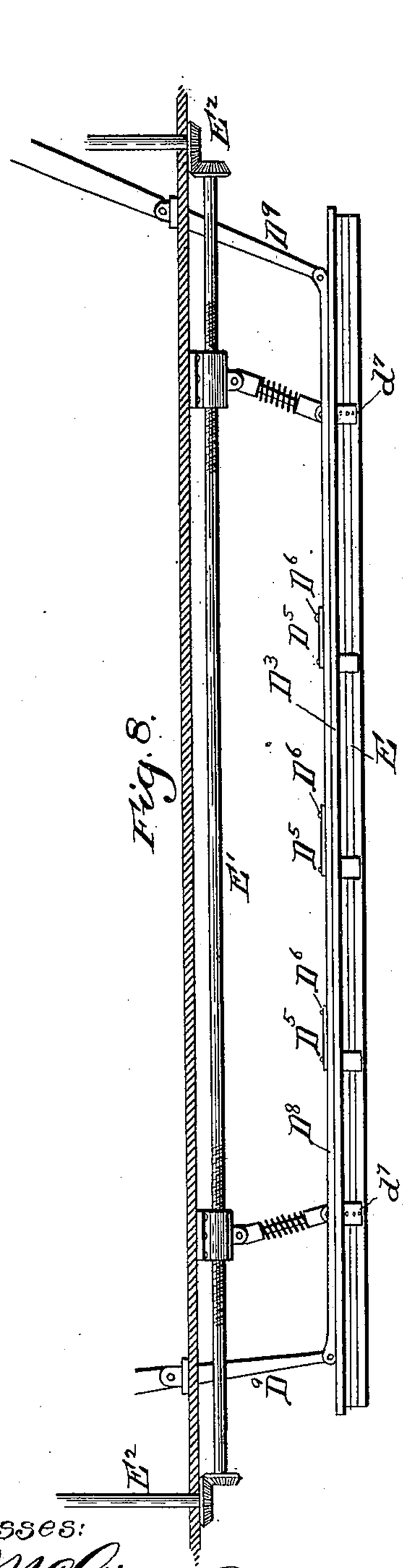

Fig. 8.

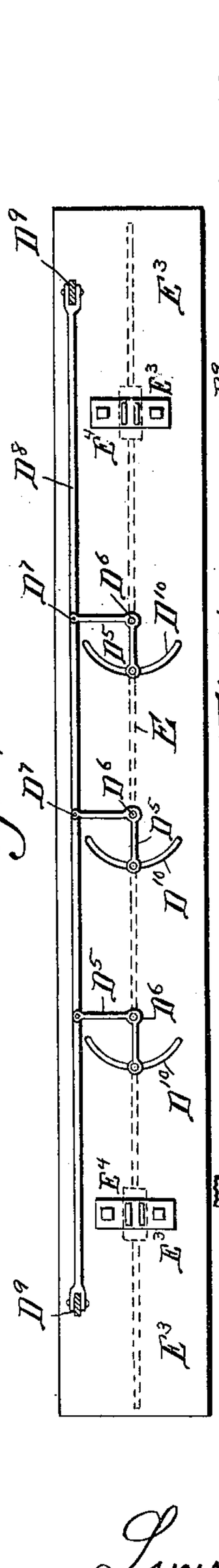

Fig. 9.

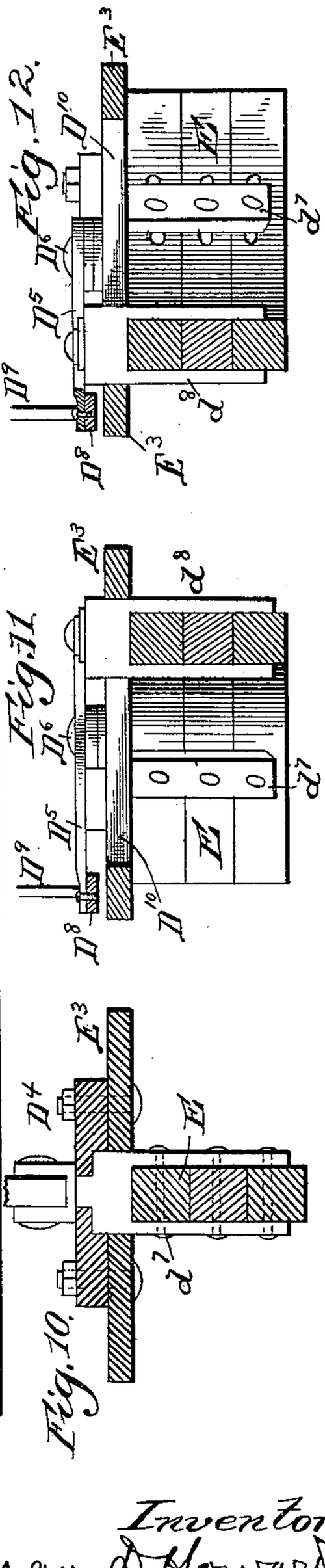

Fig. 10.

Fig. 11.

Fig. 12.

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UNITED STATES PATENT OFFICE.

LYMAN D. HOWARD, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 635,252, dated October 17, 1899.

Application filed September 30, 1891. Serial No. 407,301. (No model.)

To all whom it may concern:

Be it known that I, LYMAN D. HOWARD, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Vehicle-Propulsion Systems, of which the following is a specification, reference being had therein to the accompanying drawings.

The present invention relates to improvements in a system for the electric propulsion of cars.

Figure 1 is a view, partly in plan and partly in section, of an embodiment of my invention. Fig. 2 is a sectional view of the same. Figs. 3 and 4 are respectively a transverse vertical sectional view and a longitudinal vertical sectional view through one of the pits. Fig. 5 is a top plan view of one of the pits, the top or cover being removed. Fig. 6 is a detail view. Fig. 7 is a view of the contact mechanism on the car. Fig. 8 is a side view of a modified form of contact-bar. Fig. 9 is a view of the same. Figs. 10, 11, and 12 are cross-sectional views. Fig. 13 is a sectional view on the line $x\ x$ of Fig. 5.

In the drawings, A A represent generally a track, such as a steel railway-track, along which it is desired to propel vehicles. At a suitable point a power-house is established, and at intervals along the road-bed I form pits to receive the devices to which the electric current is conveyed from the power-house and from which it is taken to the cars above the surface. The pits B may be of whatever dimensions as to depth and width that are found necessary; but ordinarily they will not be large, and one of the purposes of the present invention is to provide a system whereby the labor and expense incident to constructing and maintaining continuous and comparatively deep conduits are avoided. In each pit there is arranged a suitable framework to provide mountings for the moving parts.

D designates a movable contact wheel or roller which is mounted on a shaft D′. This shaft is supported by arms or carriers D^3, which are mounted upon a shaft or axial part D^4. The wheel D is thus adapted to move vertically, and it may be normally held in an elevated position, as indicated in Fig. 4, by springs or weights, as indicated at d^4. The parts are so arranged that when the wheel D is in its elevated position it will not be in the electric circuit; but when the said wheel is depressed by a suitable contact device on a car the electric circuit will be closed and current conveyed through the wheel D and contact on the car to the motor.

In the embodiment of my invention here illustrated a disk M is mounted on the shaft D′, and this disk is adapted to contact with a small wheel N, carried at one end of an arm O. The arm O is connected to one end of a short rock-shaft *o*, mounted on a suitable insulated bracket or stand O′, and to the opposite end of said rock-shaft is connected an arm O^2, which is adapted to contact with a stationary contact Q, arranged at the inner terminal of a branch R of the electric main or supply circuit R′.

The contact Q is preferably protected by a hood-like insulator P, of glass or other suitable material, adapted to prevent the access of water to the contact. The main conductor R′ can be supported in any suitable way, either upon poles or insulating-supports or in conduits S. The latter method is preferred, as by means thereof I provide an entirely "underground" system of distribution.

The manner of operation of the parts above described will be readily understood. As a car moves over the pits B a contact thereon acts to successively depress the wheels D. As the arms D^3 rock about the shaft D^4 the disk M contacts with and forces downward the roller N. This moves the free end of the arm O^2 upward against the stationary electric terminal Q, and thereby closes the circuit between the main conductor and the motor on the car. From the latter the current may be either returned to the generator through the ground in the common way or may be returned through a contact mechanism substantially similar to that shown and described.

Preferably as many of the parts as possible in each pit are insulated, so that when the current is passing from the conductor R to the motor it shall have as few places as possible for leakage to the ground. It will be seen that when the car is remote from the pit the track-circuit is completely broken at the terminal Q, and as this terminal can be housed and protected practically perfectly

the loss of current is reduced to the minimum. The wheel D and disk M are preferably insulated from the shaft D′ and joined by one or more connecting-bars M′ at a distance from the main shaft, the purpose being to prevent the water which will necessarily pass down over the wheel D during rainy weather from carrying through the parts D^3 D^4, &c., any of the current. The water which thus passes down the wheel can be carried away by means of a trough or spout T, arranged below the wheel.

The contact mechanism on the car for taking current from the wheels D may be of several sorts. That which I at present prefer to employ has as its principal part a flexible bar E, so arranged that at the will of the operator it can be pressed down upon the wheels D and in turn move the arm O^2 into contact with the terminal Q. This bar can be supported in any suitable way. One way of supporting it is shown in Fig. 7, wherein *e e* are carriers pivoted to the bar E and also pivoted to nuts e^3, which are carried by a shaft or bar E′. The nuts can be prevented from rotating by stops or holders at e^4, which will permit them to slide longitudinally, and which holders may be secured to the frame of the car. Shaft E′ is held in bearings e^2 and can be rotated from the platform by a hand-wheel and bevel-gearing at E^2. The nut-carriers at e^3 are oppositely threaded, and when the shaft E′ is turned in one direction they will be caused to approach and force down the contact-bar E, and when the shaft is turned in the other direction they will be separated and the contact-bar elevated.

It is necessary that the bar E should be flexible laterally to allow for bends or creases in the track and for other purposes. Provision for such flexibility can be made in any of several ways. I have shown the carriers *e* as made in two parts e^5 e^6, united pivotally to each other, and they are held together by a pin or other suitable device. A spring at e^7 insures that the parts shall tend to occupy the proper normal positions. The contact-bar E can be bent at either end or throughout its entire length without resistance from the carriers. By having a lateral movement it is allowed to yield even when going along a straight track, and the evil results are avoided which would be met were it held against such lateral movement. The same ends can be reached if a bar of modified form be used or if it be supported and moved in other ways.

The length of the bar E is a little greater than the distance from one wheel D to the next.

In Figs. 8 to 12 I have shown one of the modified ways of constructing and supporting the contact device carried by the car. In this case there are several bars E. They are used in connection with a horizontally-arranged plate or bar E^3. This latter bar or plate is itself flexible vertically, and as the bars E are comparatively small in cross-section they are also flexible vertically. The bars E are pivotally connected to the plate E^3 at E^4, and at points intermediate of these connections they are pivoted to levers D^5, which are in turn pivoted at D^6 to the plate E^3 and are pivoted at D^7 to an operating-bar D^8. This bar D^8 is connected to one or more levers D^9, which are pivoted to the car platform or body and have handles within reach of the operator. When the lever D^9 is moved in one direction, the bar D^8 through the levers D^5 causes the contact-bars E to swing to the right, and when said lever is moved in the opposite direction it causes the bars E to bend to the left at the central part and toward the right at the ends. Preferably the levers D^5 are above the plate E^3 and the bars E are below it, the plate E^3 being curvilineally slotted, as at D^{10}, to permit the passage of the part which connects the levers to the contact-bars. These bars are at d^7 secured to clips or ears, which hold them together and connect them to the plate E^3, and at intermediate points the levers D^5 carry clips d^8, which bear loosely against the sides of the bars E. The whole of this mechanism may be supported in a way similar to that above described—that is to say, may be suspended from a threaded rod E′ by means of links and nuts, which rod can be turned by shaft *s* and gearing at E^2, as above set forth, the shafts, gearing, and rod in this case lifting up or forcing down the vertically-flexible plate E^3 as well as the vertically and laterally flexible rods E. With such a mechanism the operator has it within his power to at any time cause a lateral bending of the contact-bars E in such way that they can properly engage with the wheels D.

The wheels D D are shown as extending slightly above the surface of the road, but not to such a degree as to constitute obstructions of any seriousness. Then they are protected by iron covers J J, preferably concavo-convex and of sufficient horizontal dimensions to reduce the elevation practically to nothing as far as concerns the free movements of wheels of carriages, horses' feet, &c. This cover may be extended from one track-rail to the other, and thereby be braced and held firmly. At the center there is a small aperture *j* directly over the wheel D, which aperture may be a mere slot of two or three inches in width. This slot is normally closed by means of an automatically-movable cover or covers of such nature that they will not yield to a pressure downward, but will move sufficiently to permit the contact-bar of a car to reach the wheel D. One of the ways for arranging and supporting these covers is shown in Figs. 3 and 4.

K K represent two curved plates under the roof part J. They are separable on a line in the plane of the wheel D, their upper edges lying under the slot *j*. They are supported vibratably around an axis at *k*. They may

have arms connected to a shaft or shafts at *k* or be cast with plates at the ends. They may be normally held up in any suitable way by springs or weights, the latter being shown at L. *l l* are levers supported on fulcrum-pivots *l'* and the short arm of each bearing at *l²* against one of the cover-pieces K. The adjacent edges of the cover-pieces K are chamfered to form a throat to receive the contact-bar of a car. Said bar on entering said throat acts like a wedge to separate the covers K, so that it can throughout its length act freely to contact with the wheel D. As soon as the vehicle and its contact-bar have passed beyond the wheel D the covers are automatically brought back to their closed position by the weights at L.

In respect to many of the features of construction and arrangement of parts herein described it will be seen that there can be modifications without departing from the essential features of the invention.

What I claim is—

1. In a system for electric propulsion of cars, the combination of the roadway, the series of isolated pits, along said roadway, each pit having a rising-and-falling counterbalanced wheel adapted to contact with a contact on the vehicle, a rising-and-falling contact carried by the said wheel, a vertically-yielding contact mounted in the pit and adapted to engage with that connected with the wheel, a stationary contact, a hood or casing for the stationary contact, a main conductor extending along the roadway, and a series of branch conductors respectively connecting the main conductor with the said stationary contacts, substantially as set forth.

2. In a system for electric propulsion of cars, the combination of the roadway, the series of isolated pits along the roadway, a yielding contact in each pit, means for supplying said contact with current from a main conductor, a slotted plate or hood covering the said pit, and a supplemental yielding shield or cover for the slot in the said hood, substantially as set forth.

3. In a system for the electric propulsion of cars, the combination of a roadway, a series of isolated pits along said roadway, each pit having a rising-and-falling contact-wheel adapted to be in contact with a bar on the car, a supplemental contact-wheel rising and falling with the aforesaid wheel, means for counterbalancing the said contact-wheel, a third contact-wheel intermittingly connected electrically with the second aforesaid wheel, a contact-bar carried by the last said wheel, a stationary contact in the pit adapted to be impinged upon by the said contact-bar, a hood or cover for the stationary contact, a main conductor extending along the said roadway, and a series of branch conductors respectively connecting the main conductor with the stationary contacts, substantially as set forth.

4. In an electrically-propelled vehicle, the combination of a flexible contact-bar, a vertically-yielding support for said bar, and means for moving said bar laterally of said support, substantially as set forth.

5. In a system for the electric propulsion of cars, the combination of a series of pits, a main conductor arranged at one side of said pits, a contact arranged within each pit and adapted to be electrically connected with the main conductor, a car having a contact-bar adapted to enter a slot formed in the top of each pit and form electrical connection with the aforesaid contacts, and a hood or shield, for each pit-contact, consisting of two sections pivotally mounted within the pit and having their meeting edges in the plane of the slot and the path of the contact-bar on the car, whereby they will be automatically separated by said bar as the car passes, substantially as set forth.

6. In an electrically-propelled vehicle, the combination with a contact bar or arm F, of a shaft mounted in bearings on the car, an internally-threaded sleeve fitted on a threaded portion of said shaft, a hanger pivotally connected to said sleeve and to the contact-bar, and means for rotating the shaft, substantially as set forth.

7. In an electrically-propelled vehicle, the combination of a shaft journaled in bearings on the car, a sleeve fitted on said shaft, and adapted to be moved longitudinally thereof, and a hanger pivotally connected to said sleeve and to the contact-bar, substantially as set forth.

8. In an electrically-propelled vehicle, the combination, of a contact-bar, a shaft mounted in bearings on the car and provided with two series of external threads, internally-threaded sleeves engaging the threaded portions of the shafts, stops on the car for preventing rotation of such sleeves, hangers pivoted to the sleeves and to the contact-bar, and means for rotating the shaft, substantially as set forth.

9. In an electrically-propelled vehicle, the combination of a contact-bar, a shaft mounted on the car, carriers adapted to be moved longitudinally of the shaft, and hangers pivoted to said carriers and connected with the contact-bar to allow it to yield laterally, 17, substantially as set forth.

10. In a system for the electric propulsion of cars, the combination of a roadway, a main conductor extending along said roadway, a series of stationary contacts electrically connected with said conductor and each arranged in a pit below the roadway, a movable contact arranged adjacent to each stationary contact, rising-and-falling devices arranged within the pit and acting to normally hold said movable contact away from its coacting stationary contact, a cover or shield normally covering the pit and preventing access to the aforesaid devices, and means on a car for automatically moving said cover and actuating said mechanism within the pit to force the

movable contact against its stationary contact, substantially as set forth.

11. In a system for the electric propulsion of cars, the combination of a main conductor, a series of stationary contacts connected with said conductor, a movable contact carried by a lever fulcrumed on a support adjacent to each stationary contact, a counterbalanced lever adapted to actuate the lever carrying the movable contact, a shield normally covering and preventing access to all of the aforesaid parts, and a contact-arm mounted on a car and adapted to enter the pit and contact with the counterbalanced lever therein to move the movable contact against the stationary contact, substantially as set forth.

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

LYMAN D. HOWARD.

Witnesses:
SAML. R. MOUNTAIN,
R. GEO. HUTCHINS.