(No Model.)

2 Sheets—Sheet 1.

L. M. HOSEA.

STREET RAILWAY.

No. 401,352. Patented Apr. 16, 1889.

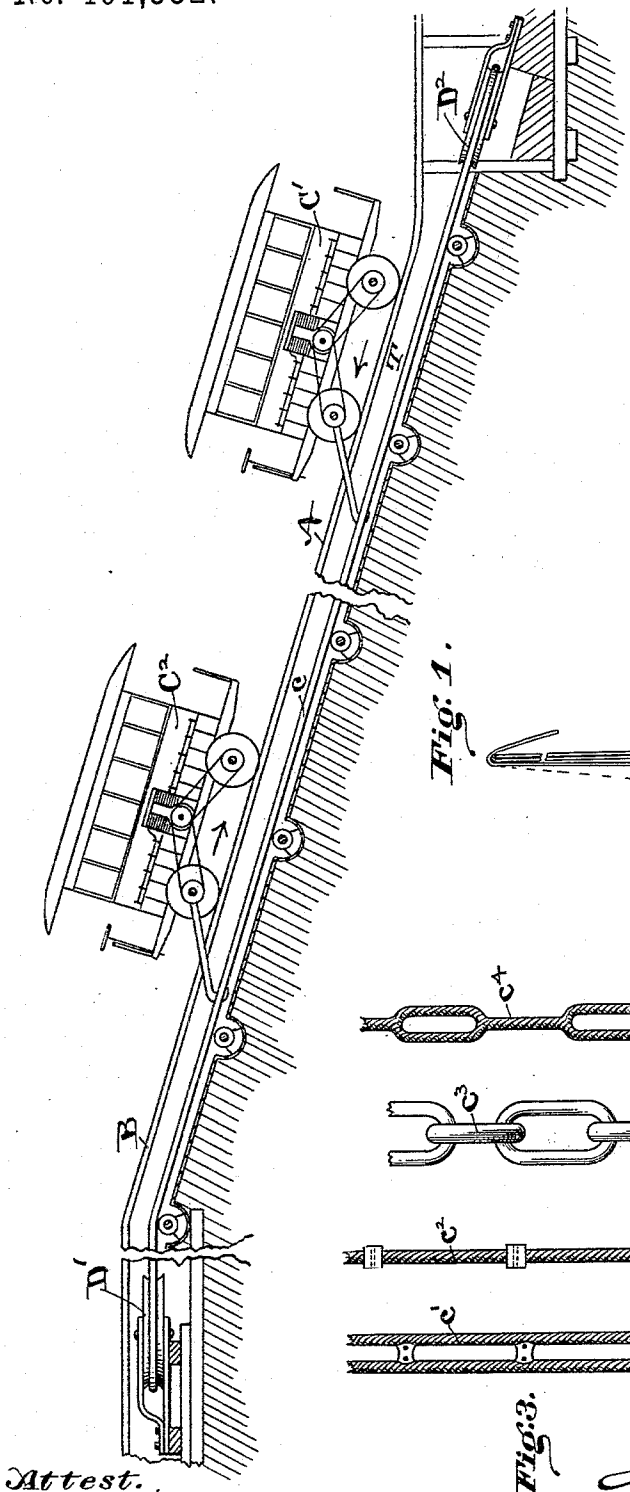

Fig. 1.

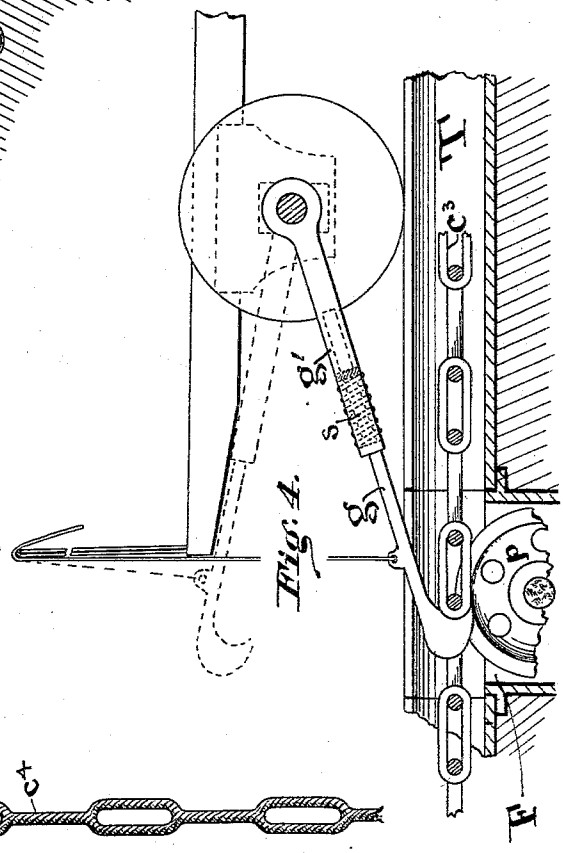

Fig. 4.

Fig. 3.

Attest.
C. W. Bogart.
C. D. Kerr.

Inventor.
Lewis M. Hosea

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

L. M. HOSEA.

STREET RAILWAY.

No. 401,352. Patented Apr. 16, 1889.

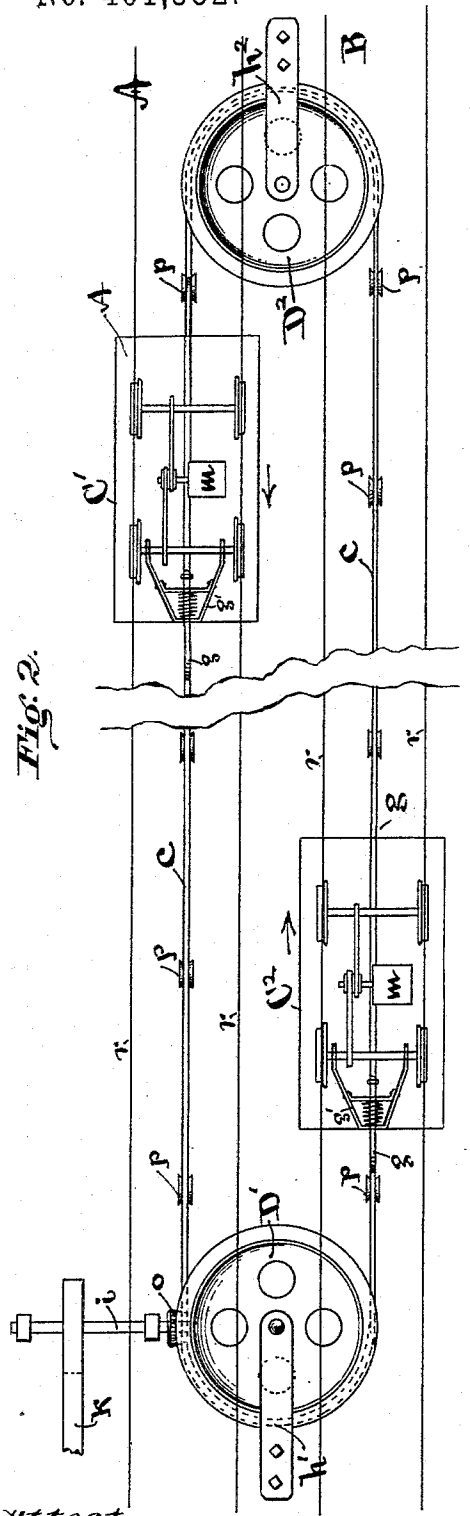

Fig. 2.

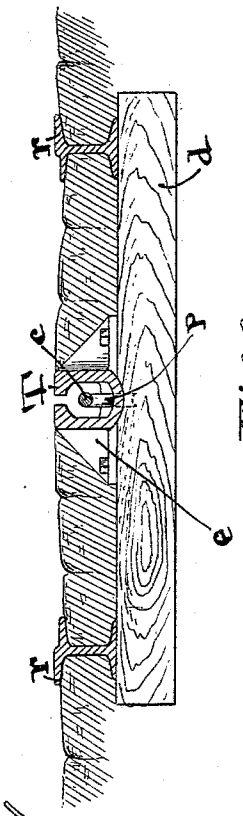

Fig. 6.

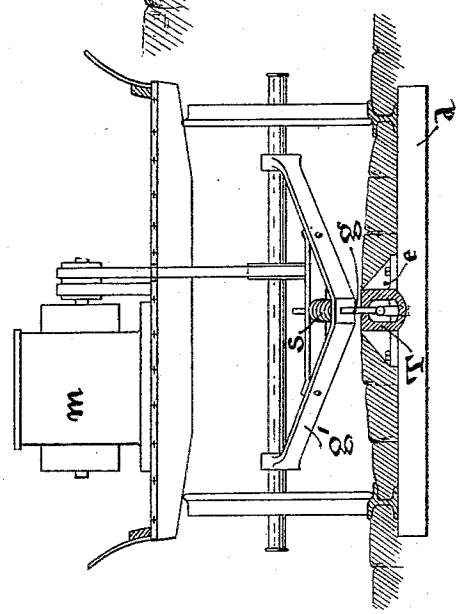

Fig. 5.

Attest:
C. H. Bogatt,
C. D. Kerr.

Inventor.
Lewis M. Hosea

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

LEWIS M. HOSEA, OF CINCINNATI, OHIO.

STREET-RAILWAY.

SPECIFICATION forming part of Letters Patent No. 401,352, dated April 16, 1889.

Application filed February 17, 1888. Serial No. 264,327. (No model.)

To all whom it may concern:

Be it known that I, LEWIS M. HOSEA, a citizen of the United States, residing at Cincinnati, Ohio, have invented new and useful Improvements in Street-Railways, of which the following is a specification.

My invention relates to that class of street or other railways in which the motive power is carried upon or independently applied to the cars or motors as distinguished, for example, from ordinary traction cable railways, in which cars possess no independent motive power.

In the class of railways to which my invention is applied (for example, steam, air, horse, or electric street-railways) several circumstances combine to increase the expense both of construction and operation. Cars must be equipped to carry or exert a maximum propelling-power at all times and under all circumstances of grade, condition of track, amount of load, &c. Where, in addition to the ordinary variations of load, due to conditions of travel, the propelling-power is further taxed to carry the car and load over gradients, it is obvious that to provide the mechanism and carry the power at the limit necessitated by these conditions is unduly expensive in construction and maintenance of both motor and roadway, because upon levels and declivities the power required would ordinarily be much less, and the same remarks apply to variations of load. It will be equally obvious, therefore, that if, by providing cars with only such power as would be required to meet average conditions, (for example, to carry a car upon a level with an average load,) such a road could be successfully operated, a considerable reduction in expense both of construction and maintenance would ensue.

It is the object of my invention to reach this result, and in doing so a further advantage is secured peculiar to itself in respect to this class of railways—to wit, the difficulties of traction in ascending inclines is overcome in cars applying the propelling-power to the wheels.

To the ends thus indicated, my invention consists, primarily, in the combination, with a railway of the class specified, and cars operated thereon by independent means of propulsion, of an endless normally-idle cable (which may be a chain or rope of any suitable kind or construction) carried in a slotted conduit beneath the roadway, as in ordinary "traction cable railways," around idler-pulleys arranged in terminal bights of the cable, and connecting devices whereby cars passing upon the railway may temporarily couple to said cable and give any temporary excess of propelling-power they may possess to or receive any residuum of power they may require from the same. For instance, in the ordinary operation of street-railroads, where the load of passengers varies in both directions, there will be occasions where the excessive weight of a down car upon a grade (irrespective of other propelling-power) may be sufficient to draw another car up without expenditure of local motive power on either, thereby economizing such power, and in cases of such use of the system the dead-weight of car-structures will be counterbalanced, leaving only the excess of "passenger" weight to be provided for or utilized, as the case may be.

My invention consists, secondly, in combining with such idler-cable and cars an auxiliary means of propulsion applied directly to the cable, to be brought into play, as occasion may require, to supply any balance of power that may be required—as, for example, to draw or assist an "up" car over a grade where no "down" car is at hand.

It consists, finally, in certain details of construction and arrangement hereinafter pointed out.

The nature and details of my invention will be more fully understood from the following description of a system of mechanism embodying the same, as applied to a street-railway gradient, and illustrated in the accompanying drawings, in which—

Figure 1 is a diagram side elevation of a gradient of a street-railway to which my improvement is applied, showing the up and down cars engaged with the cable. Fig. 2 is a diagram plan view of the same, in which I have indicated, as an addition, a counter-shaft for transmitting power derived from any source to the upper cable-pulley. Fig. 3 represents examples of several forms of cable which may be selectively used. Fig. 4 is a partial elevation of a car, showing a hook device for engaging the cable. Fig. 5 is an end elevation

of a car, showing the same; and Fig. 6 is a cross-section of the roadway, showing more clearly the tunnel construction.

Referring now more particularly to the drawings, A B designate the up and down trackways, respectively, of a gradient upon a street-railway, and C′ C² up and down cars moving thereon, respectively; and *c*, an endless cable (in the sense indicated) carried around horizontal pulleys D′ D² at the head and foot, respectively, of the gradient. The cable *c* is carried between the pulleys D′ D² in parallel lines in opposite directions and runs in a suitable conduit, T, (which for the purposes of my invention is preferably a cast-iron tube,) whose upper side is slotted longitudinally, laid and secured between the track-rails *r* upon the cross-ties *d* by suitable bracket-supports, *e*, and made in sections of suitable length separated by boxes F, in which are carried idler-pulleys *p*, for supporting the cable, as in ordinary cable railways.

The details of construction of the tunnel or conduit and the carrying-pulleys are not material to my present invention, as the structure of ordinary cable railways may be used in so far as practicable. The structure of the cable, however, must be such as to enable the car to readily connect and disconnect at will. I have shown in Fig. 4 a simple hook-bar, *g*, carried in a bifurcated frame, *g′*, attached directly to the car-axles, and an ordinary chain carried in the conduit T, as the cable. The hook engages directly in a horizontal link of the chain and around the rear of the adjacent vertical link and readily disengages by lifting up the hook. The latter is held up upon the car, as indicated by the dotted lines of Fig. 4, and when dropped down through the open slot of the conduit engages the nearest open link. The shank of the hook *g* is provided with a coiled spring, *s*, acting against a cross-bar of the frame *g′* to relieve the jerk at starting.

The cars C′ C² are provided with motors of any description, storage-battery motors *m* being indicated in the drawings, belting to the axles.

The sheaves or pulleys D′ D² are carried in suitable hangers or frames, *h′ h²*, and one or both should be adjustable to take up the slack of the cable, as required.

Selective forms of cable are exhibited in Fig. 3 as follows: *c′*, a double cable having links between at regular intervals; *c²*, a wire rope with collars fixed thereto at regular intervals; *c³*, an ordinary steel or iron chain, and *c⁴* a wire rope having eyelets woven therein at regular intervals. To use cable *c²*, the hook is bifurcated at its end to drop over the cable behind one of the collars. I prefer, however, to use an ordinary chain, as indicated in Fig. 4, for short sections of road.

The mode of use is as follows: Suppose the down car, C², to be at the top of the grade empty, and the up car, C′, at the bottom of the grade loaded. Both cars couple to the cable *c*—the down car at the rear and the up car at the front—and at a proper signal both cars apply their motive power. It will be seen that the cars balance each other, leaving only the load of the up car to be lifted and the slight cable friction to be overcome. But suppose the down car to be empty and the up car to be loaded; to lift said load the motive power of both cars acting upon the track is combined through the medium of the cable *c*. It will be seen that even in this extreme case the excess of power applicable to the lifting of the load would be ample in all cases in practice, even where the motive power of cars is only sufficient to drive them on levels. On arriving at the top and bottom of the grade, respectively, both cars disconnect (which may be done without stopping) and proceed on their way without loss of time. As the excess of load would often be the other way—that is, in favor of the down car at such times—the propelling-power of the cars would be disused and gravity alone relied upon. The brakes of either car would also thus act upon the other through the medium of the cable, so that setting the brakes on one car would ordinarily stop both, or indicate by retardation through the cable the signal for brakes.

To provide for emergencies—such as the absence of a down car to assist the up car—power may be applied to either pulley D′ D² from any source—for example, a steam-engine doing other work on the line of road, whose power is brought to the station by shafting or belting and applied at will. To this end I have shown a counter-shaft, *i*, Fig. 2, driven by a belt, *k*, from any source of power, and connected directly to the pulley D by a bevel-gear, *o*, (a suitable line of cog-teeth being cast upon the pulley D.) A special motor may, however, be provided for this purpose. The power may be thus applied upon signal or in any suitable mode. In such case, since the up car has its own motive power, that required at the gear *o* will be only such remainder as is necessary to overcome the resistance of the grade.

It will be obvious that any number of the gradients of a railway may be thus provided, and also that street-railways may thus be operated upon much steeper grades than would otherwise be practicable, and with much less expense than by present systems, provided cars are run with such regularity as to "make" the opposite ends of the gradients at about the same time, so as to aid each other in the manner indicated.

While it is preferred to carry the cable between the rails of each track, a double tunnel or two tunnels may be used, located between the two tracks, with the returned cable passing in opposite directions.

The system may be applied where the up and down tracks are laterally removed from each other, as upon separate streets, by extending the cable in the lines of a parallelogram with horizontal pulleys at the corners

and using a proper system of signals. It may also be used with advantage for bridge or hill crossings where the incline ascends from both directions to a central summit, the cable being extended beyond in either direction to accommodate a proper arrangement of meeting-points according to respective conditions of load.

A further illustration of the principles of the invention is where a single track only ascends an incline and power is applied to the upper or lower pulley to assist the car up the grade by means of the cable.

A still further illustration of the principles of the invention is where the trackway descends to cross a valley or depression. In such case a "balancing" car, normally kept at the bottom of the grade, is drawn up by the descending car, and (one of the cars changing the grip to the oppositely-moving portion of the cable) by its descent assists the car up the opposite slope.

A further illustration of the system within the spirit of my invention is a continuous idler-cable carried over the entire length of a street-railway where a number of cars are constantly in operation, all cars coupling and giving motion thereto or receiving motion therefrom while in operation. In such case, inasmuch as the bulk of travel at a given time sets in one direction, with empty cars coming in the other, the empty cars would through the medium of the cable give their excess of motive power to the loaded cars. This would, however, only be practicable where so large a number of cars are in use as to secure at all times a sufficient propelling-power, regardless of stoppages, &c.

These illustrations are given merely to indicate the nature and scope of the invention, and might be extended, for example, to include a power-driven cable used in connection with independently-driven cars, which give motion to or receive motion from the cable, the terminal cable-driving power being employed only to assist or make good any temporary diminution of the power derived from the cars.

I claim and desire to secure by Letters Patent of the United States—

1. In a tram or rail way system, in combination with cars or motors provided with independent means of propulsion, an endless normally-idle cable carried in a surface-slotted conduit or conduits in or parallel with the trackway, fixed carrying-pulleys arranged in the terminal bights of the cable, and means for temporarily connecting the cars or motors to said cable through the surface slot of the conduit, substantially as set forth.

2. In a tram or rail way system, in combination with cars or motors provided with independent means of propulsion, an endless normally-idle cable carried over a gradient or other section of said railway in a surface-slotted conduit or conduits in or parallel with the trackways, fixed pulleys arranged at the terminus of such railway-section in the bights of the cable, and means for connecting cars or motors to such cable through the surface slot of the conduit while passing over said section of the railway, substantially as set forth.

3. In a tram or rail way, in combination with cars or motors provided with independent means of propulsion, an endless normally-idle cable arranged upon a section of the railway and carried around fixed carrying-pulleys at the termini of such section, a surface-slotted conduit inclosing the cable between said pulleys, power-connections for the temporary application of power to one or both of said terminal carrying-pulleys to drive the cable, and means carried by the cars or motors to connect with said cable temporarily while passing over said section, substantially as set forth.

4. In a double-track tram or rail way system operating cars provided with independent means of propulsion in opposite directions over said tracks, the combination, with such cars so provided, of an idler-cable carried in opposite directions in surface-slotted conduits in or parallel with the trackways, respectively, and means for connecting said cars with said cable through the slot, whereby the cars moving in one direction may impart motion through the medium of said cable to cars moving in the opposite direction, substantially as set forth.

5. In a tram or rail way system, the combination, with the trackway, of a cable-conduit having a surface slot, a cable having engaging-stops thereon carried in said conduit, cars or motors provided with independent means of propulsion traveling said railway, and adjustable engaging devices carried by said cars for connecting to or disconnecting from said cable at will to give power thereto or receive power therefrom, substantially as set forth.

6. In a street-railway, in combination with a section of double trackway upon which cars move in opposite directions, a surface-slotted cable-conduit arranged at or parallel with the trackway, a horizontal carrying-pulley at each terminus of such trackway-section, and an endless normally-idle cable passed around said pulleys and through said conduits in opposite directions, and means carried upon the cars for temporarily attaching to said cable at either track upon reaching said section of trackway and while passing the same, and for disconnecting from the same upon reaching the terminus of said section, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LEWIS M. HOSEA.

Witnesses:
C. D. KERR,
E. L. KERR.