(No Model.) 2 Sheets—Sheet 1.

B. S. HENNING.

SYSTEM OF TRANSPORTATION.

No. 418,718. Patented Jan. 7, 1890.

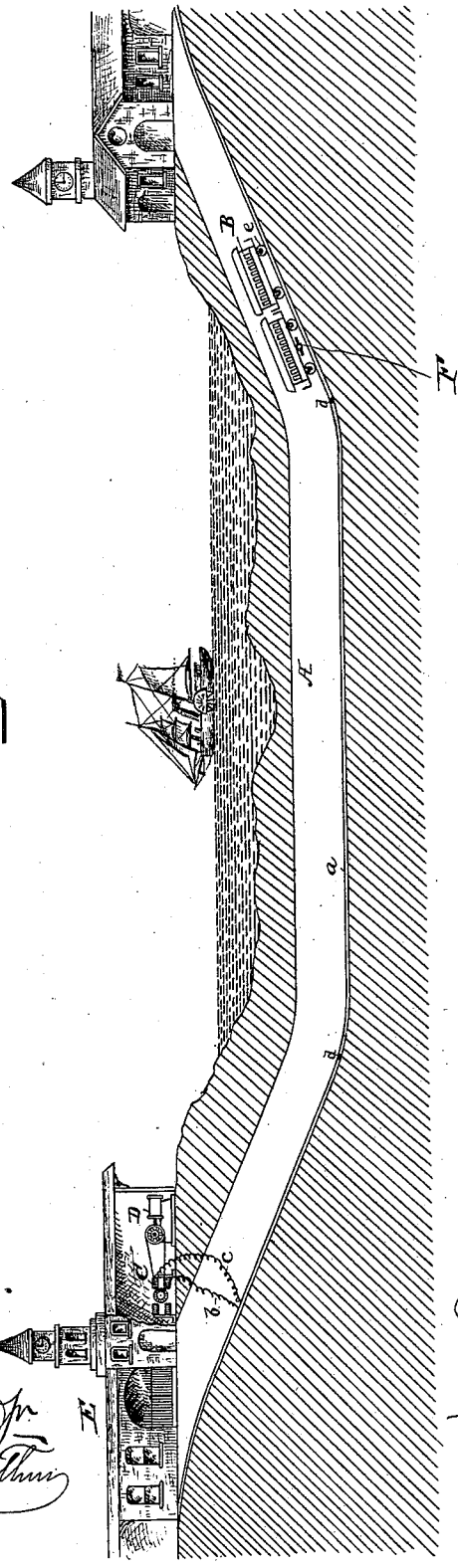

Fig. 1.

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Fig. 1.

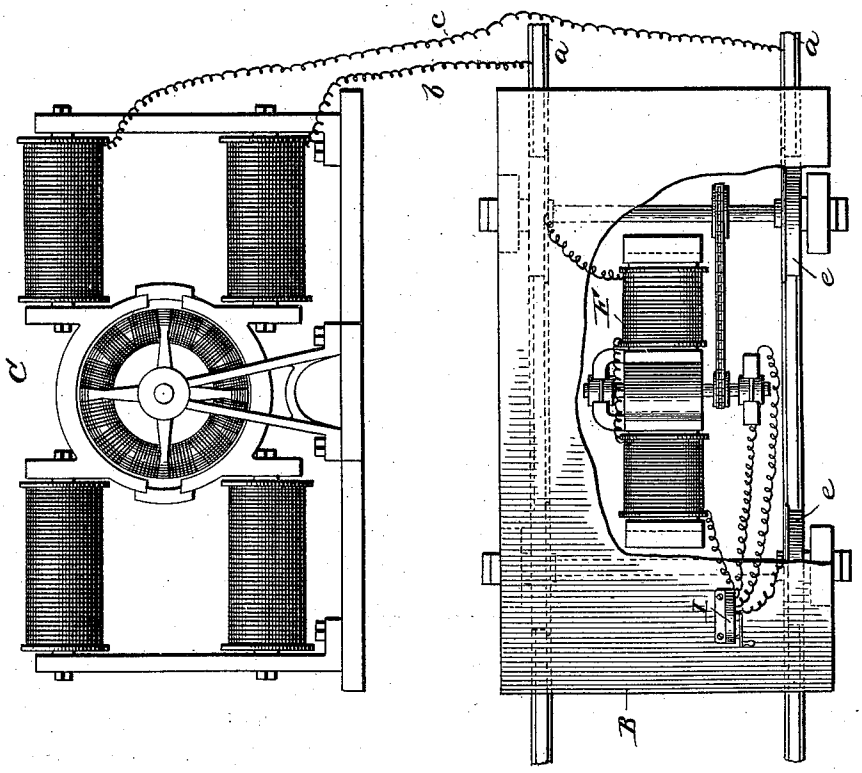
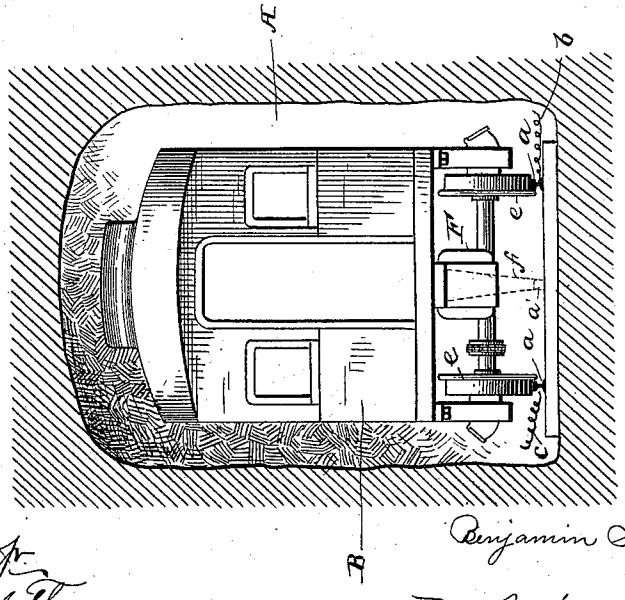


Fig. 2.



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UNITED STATES PATENT OFFICE.

BENJAMIN S. HENNING, OF NEW YORK, N. Y.

SYSTEM OF TRANSPORTATION.

SPECIFICATION forming part of Letters Patent No. 418,718, dated January 7, 1890.

Application filed June 10, 1889. Serial No. 313,753. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN S. HENNING, a citizen of the United States, residing at the city, county, and State of New York, have invented certain new and useful Improvements in Systems of Transportation, of which the following is a full, clear, and exact specification.

The use of steam for propelling cars through tunnels under rivers is objectionable for many reasons, principally because of the vitiating of the air by the gases from the engine, and of the necessity of employing heavy engines to secure sufficient track adhesion to draw the cars up the grades at the ends of the tunnel. Another objection is the necessity of making long inclines to reduce the pitch of the grades, involving extensive cutting, which would not be needed if steep grades could be used. In order to overcome these difficulties I dispense with the use of a drawing-engine carrying the power-generator, and so construct the track with steep inclines at each end that gravity alone will propel the train down the initial incline, and for a greater or less distance along the level portion of the track, according to the length of the latter, and, if the level portion is not too long, up the terminal incline for a part of its length, and I make use of an electromotor upon one of the cars of the train to propel the latter to the top of the terminal incline. By this means I avoid vitiating the air, reduce the amount of cutting by employing steep inclines, which are the best when gravity is made the propelling means, and render unnecessary the use of any separate hauling-engine.

Differently-constructed motors may be employed in carrying out my invention, and different devices may be used for carrying the electric current to the motors. I will now describe one arrangement embodying my invention, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal section illustrating a tunnel under a river with a train and electrical generator connected electrically with the rails of the track. Fig. 2 is an enlarged cross-sectional view of the tunnel and tracks and the car with its motor. Fig. 3 is an enlarged view showing the generator, track, car, motor, and connections.

A represents the tunnel, consisting of the central level portion and the end inclines, the latter being made of as steep a grade as practicable, and through the tunnel extend the track-rails *a a*, forming continuations in some cases of tracks leading to and from the tunnel.

The cars B are provided with trucks and wheels of such a construction (not requiring special description here) that the cars will maintain their positions on the track and afford proper accommodations for passengers while passing rapidly down and up the inclines, and the impetus imparted in descending the initial incline on entering the tunnel will be sufficient to transport the train rapidly along the level, and, if the latter is not too long, up the terminal incline for a part of its length.

With the rails *a a* of each inclined part of the track which is electrically disconnected from the central portion, as shown at *d d*, are connected conductors *b c*, extending to an electric generator C, driven by an engine D and arranged at any convenient point, (as shown, in the car house or station E,) and on one (or each) of the cars B is secured a motor F, which receives the electric current as soon as the wheels *e* or other contacts of the car are in engagement with those parts of the rails that are in the electric circuit, when the current will be transmitted to the motor, and the latter will act to propel the car until the mouth of the tunnel is reached and the circuit is broken.

The car has a switch I, similar to the one shown and described in Patent No. 320,630, granted to Leo Daft, June 23, 1885, to which reference is made for a more detailed description, whereby the current can be cut off, put on, or changed to reverse the motor.

When a third rail *a'* is used, a suitable contact *f* is carried by the car to engage with such rail.

In order to avoid waste of power, the motor-current should not be transmitted to the motor until the impulse imparted by gravity is nearly spent. This may be effected by arranging the connection of the conductors with

the rails at the proper point on the incline or level, or preferably by the use of a switch operated by the conductor to complete the circuit as soon as the speed becomes so reduced as to render it necessary.

While I have referred to my invention in connection with a tunnel, for which it is mainly desirable, it is adapted for use with surface tracks inclined at the ends.

An important feature of my invention is the arrangement of the circuits through the switch I, as above described, or otherwise, so that whatever may be the direction in which the car is traveling it will be propelled up the terminal incline in the direction in which it has been started by gravity in descending the other incline.

I claim—

1. The combination, with a track terminating at each end in an upwardly-inclined portion which is electrically disconnected from the central portion, of an electric generator in connection with said inclined portions only, cars upon the track adapted to be propelled along a portion thereof by gravity and momentum when starting from one end, an electric motor on one of the cars adapted to receive the current from the inclined portion of the track when moving upward on the same, and means for controlling the circuit through the motor, substantially as described.

2. The combination, with a tunnel having inclined approaches, of a track located within the same, the ends of which are upon the inclined approaches and electrically disconnected from the central portion, an electric generator in connection with the inclined portions only, cars upon the track adapted to be propelled along a portion of the track by gravity and momentum when starting from one end, an electric motor on one of the cars adapted to receive the current from the inclined portion of the track when moving upward on the same, and means for controlling the circuit through the motor, substantially as described.

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

BENJAMIN S. HENNING.

Witnesses:
J. C. O'BRIEN,
CHAS. E. HOTCHKISS.