(No Model.) 2 Sheets—Sheet 1.

E. P. NEEDHAM.

PNEUMATIC RAILWAY AND CAR THEREFOR.

No. 268,715. Patented Dec. 5, 1882.

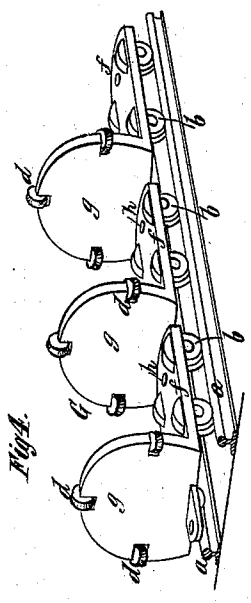


Fig 4.

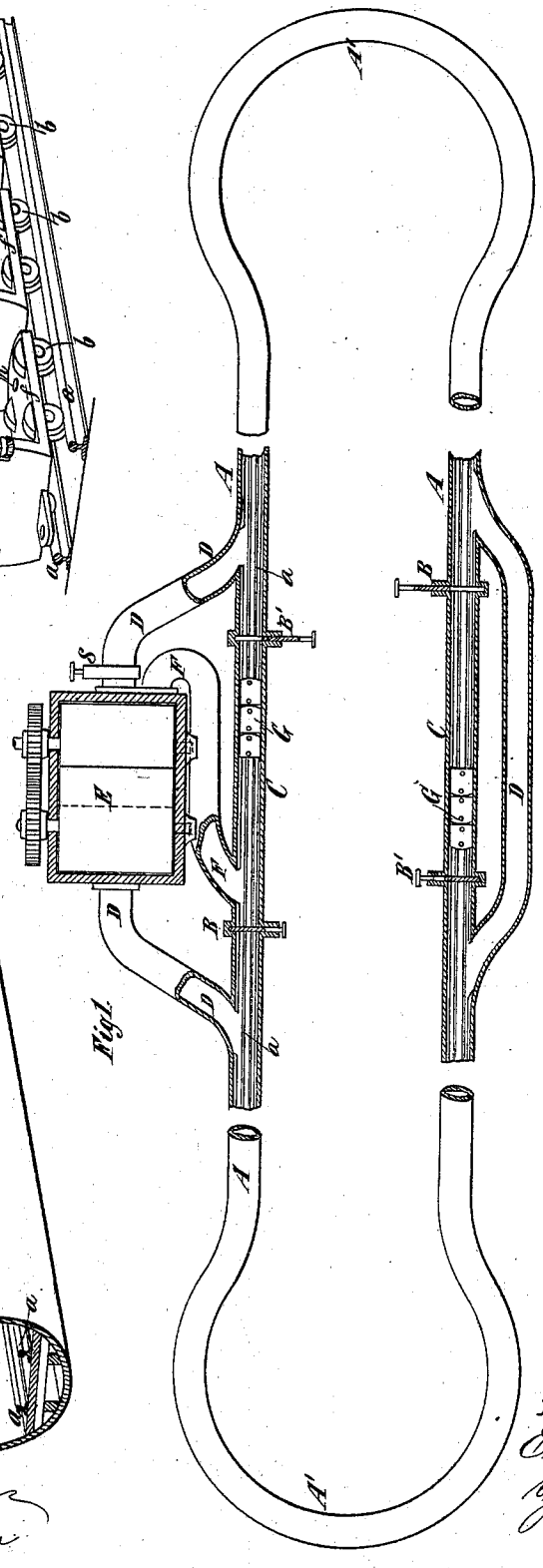


Fig 1.

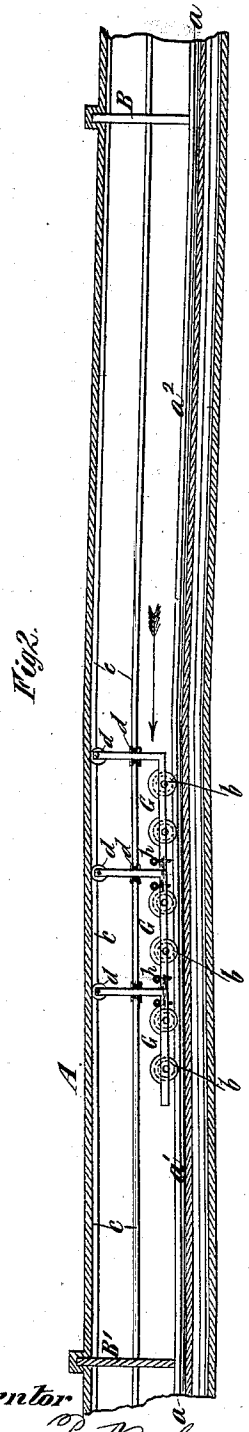


Fig 2.

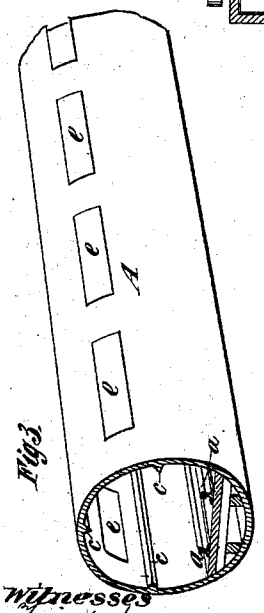


Fig 3.

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(No Model.)

2 Sheets—Sheet 2.

E. P. NEEDHAM.

PNEUMATIC RAILWAY AND CAR THEREFOR.

No. 268,715. Patented Dec. 5, 1882.

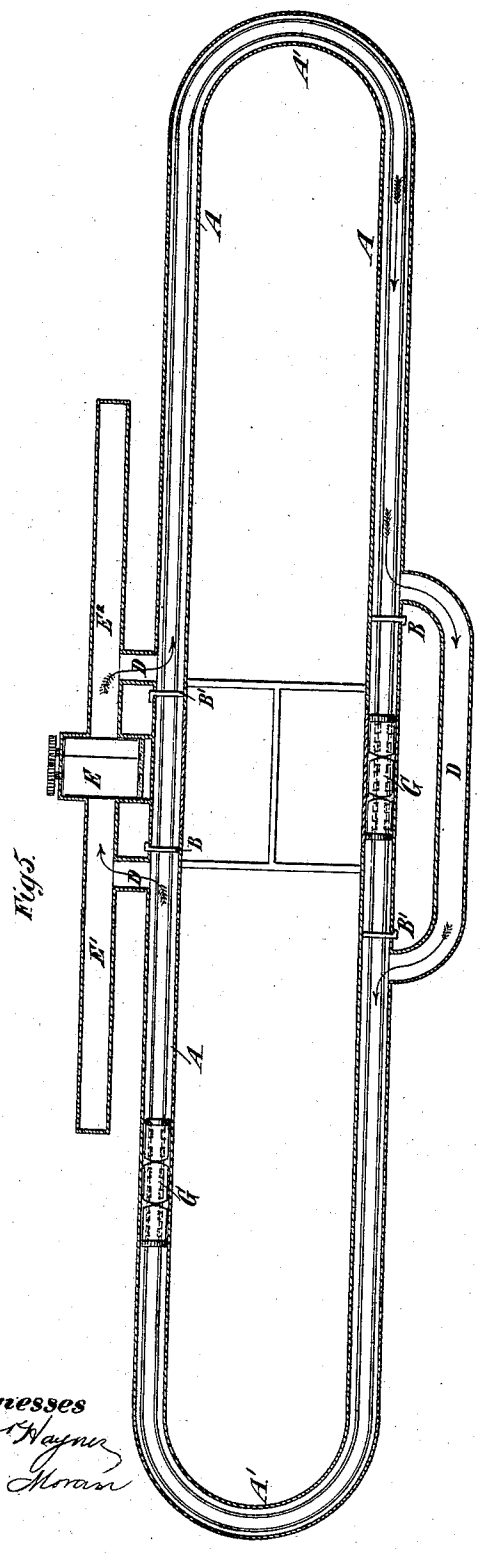


Fig. 5.

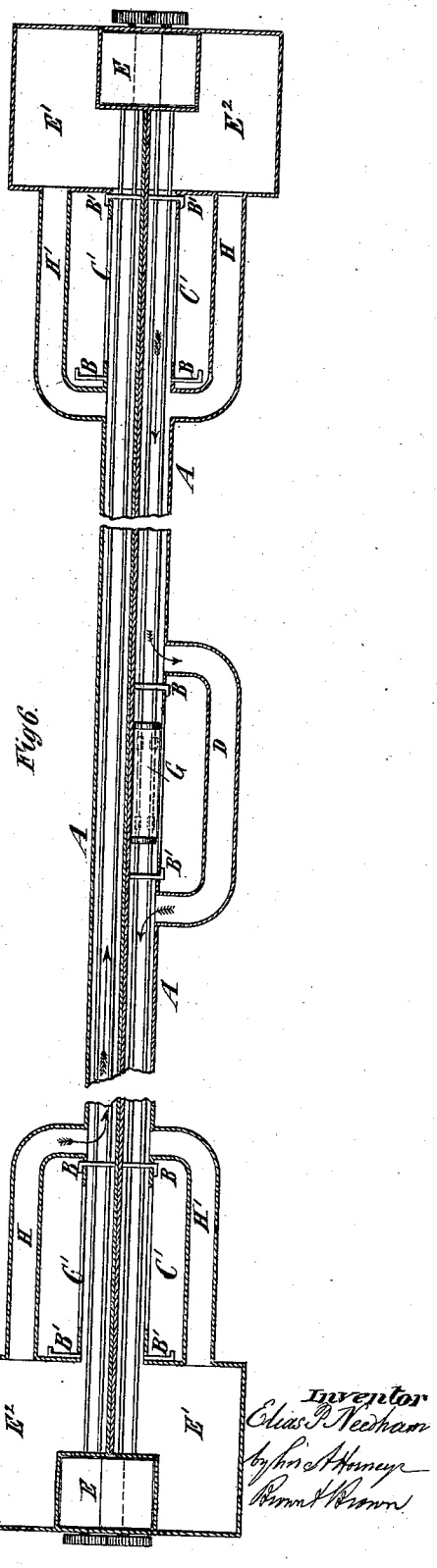


Fig. 6.

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UNITED STATES PATENT OFFICE.

ELIAS P. NEEDHAM, OF NEW YORK, N. Y.

PNEUMATIC RAILWAY AND CAR THEREFOR.

SPECIFICATION forming part of Letters Patent No. 268,715, dated December 5, 1882.

Application filed February 24, 1882. (No model.)

To all whom it may concern:

Be it known that I, ELIAS P. NEEDHAM, of the city and county of New York, in the State of New York, have invented certain new and useful Improvements in Pneumatic Railways and Cars Therefor, of which the following is a specification.

My invention relates particularly to continuous pneumatic railways in which the cars are impelled through a tube by exhausting air from the tube in advance of the cars and supplying compressed air to the tube behind the cars; but certain features of the invention are applicable to railways in which the cars are impelled solely by compressing the air behind them or solely by exhausting the air in advance of them.

The invention consists in the combination, with a pneumatic-railway tube and two gates or valves therefor, forming between them a station, at which a car may be stopped, of a branch air-tube communicating with said main tube behind and in advance of said gates or valves, a pump in said branch air-tube, and a pipe for conducting air from the discharge of said pump to the main tube between said gates or valves and in rear of a car for the purpose of starting the same.

The invention also consists in the combination, with a pneumatic-railway tube provided with pairs of gates forming stations between them, and a pump for compressing air, of a pressure-equalizing chamber, into which air is forced by said pump, and from which the compressed air is conducted to said tube outside the gates, whereby I provide for maintaining a more uniform pressure in said tube behind the cars. Where the cars are impelled solely by exhausting air from the tube in advance of them I combine with the tube and pump a vacuum-equalizing chamber from which the air is exhausted by the pump, and which communicates with the tube outside the gates; and in case cars are to be impelled by both pressure and vacuum both equalizing-chambers are used.

The invention also consists in the combination, with two railway tubes extending between two terminal stations, providing for traffic in opposite directions, and provided with pairs of gates forming stations between them, of pressure and vacuum equalizing chambers at each station, the former communicating with the tube for outgoing traffic outside said pairs of gates, and the latter communicating with the tube for incoming traffic outside said pairs of gates, and a pump at each station for exhausting air from the vacuum-chamber and compressing it in the pressure-chamber. Where the two tubes are parallel the pumps in the above combination may be used without the pressure and vacuum chambers.

The invention also consists in the combination, with a pneumatic-railway tube containing a car-track, and having guide-rails upon its sides and upper portion, of cars adapted to run upon said track, and provided with guide rollers or wheels for running upon said guide-rails.

In the accompanying drawings, Figure 1 represents a plan partly in section of a pneumatic-railway tube embodying my invention. Fig. 2 represents a longitudinal vertical section through a portion of said tube at one of the stations, showing a car therein and upon a larger scale. Fig. 3 represents a perspective view upon a larger scale of a tube for such railway. Fig. 4 represents a perspective view of one of the cars upon the same scale as Fig. 3. Fig. 5 represents a partly-sectional plan of a railway similar to that shown in Fig. 1, with the addition of pressure and vacuum equalizing chambers; and Fig. 6 represents a sectional plan of a railway also embodying my invention, and comprising two tubes extending between terminal stations, and providing for traffic in opposite directions.

Similar letters of reference designate corresponding parts in all the figures.

Referring first to Figs. 1 to 4, inclusive, A designates a tube, of any suitable material, which may or may not be under ground, and which, as represented, consists of two parallel lines, which are adapted for traffic in opposite directions upon one or two streets, and which are united at one or both ends by a curve, A′, which is as broad or large as possible, if the two portions of the tube are placed upon opposite sides of a single street. The two parallel portions are intended to be united at both

ends in all cases where cars pass from one to the other.

At certain intervals in the tube A, where it is desired to have stopping places or stations, I arrange two gates or valves, B B′, at a distance apart more than sufficient to receive a train or car between them, and the space C between the gates or valves I term "stations."

At each station is a branch pipe or tube, D, which communicates with the main tube A behind and outside the gate or valve B, and in advance of and outside the gate or valve B′, and in any or all of the branch pipes along the line are arranged pumps E, which are here shown as rotary pumps, though air-pumps of any construction might be employed. Each pump E exhausts air from the tube A behind the gate or valve B of the station at which it is placed, and forces air into the said tube in advance of the gate B′, and it will be clearly understood that the several pumps produce a continuous current of air through the tube A.

When it is desired to stop a car at any station the gate or valve B′ of that station is shut, and as the car approaches said gate it is cushioned by the air ahead of it, and finally stopped without jar or shock. Of course brakes might be used for stopping the cars. The gate or valve B is afterward closed, thus isolating the station from the tube A and permitting the tube to be opened at that point to enable the cars to be loaded or unloaded.

When the car is to be started the gate or valve B′ is opened; and in order to first start the car I employ a tube or pipe, F, extending from the discharge side of a pump, E, to the station C between the two gates B B′ and in rear of the car G, which is shown at one of the stations, and, by delivering air between the closed gate or valve B and the rear of the car, impel the latter forward. When the air is to be used for starting the car a valve or gate, *s*, in the branch tube D is closed to direct air through the starting pipe or tube F.

In order to aid in starting the cars, the track *a* between the gates B and B′ is preferably inclined, or has a descending portion, *a′*, as shown in Fig. 2, and the car is stopped upon said incline. As here shown, the bottom of said incline *a′* is on a level with the main portion of the tube, and a second incline, a^2, extending downwardly in the reverse direction, is formed in the track. The cars will then have to ascend one incline, which will assist in stopping them, and will stop upon the other incline, upon which they may be readily started. The two inclines in the track are here formed by inclining the tube A; but they might be formed by using a straight tube and inclining the track within the tube. As clearly shown in Fig. 3, the tube A is round or cylindric; but it may be square or rectangular in transverse section, or of other desired form.

The car G is provided with wheels *b*, which run upon the track-rails *a;* and in order to properly guide the car I provide the two sides and upper surface of the tube with guide-rails *c*, and I provide the car with guide rollers or wheels *d* for running upon said guide-rails.

In the sides of the tube A may be provided openings, which are fitted with tightly-sealed windows *e*, of glass or other transparent or translucent material, to admit light to the tube A.

In order to adapt the car for turning curves of comparatively small radius, I construct it of separate sections, each section being composed of a platform-section, *f*, and an upright portion, *g*, to which the guide rollers or wheels *d* are pivoted.

The several car-sections are hinged or pivoted together at *h*, and are each adapted to turn on its pivot, as may be necessary in rounding a curve.

Referring now to Fig. 5, A designates the tube in which the tracks *a* are laid, and the two parallel sections of which are united by curves A′. The tube A is provided with valves or gates B B′, which form stations or depots between them. E designates an air-pump, which I employ to exhaust the air in advance of the cars G, and to create a pressure behind them. This pump communicates on one side with a vacuum-equalizing chamber, E′, which communicates through a pipe, D, with the tube A behind and outside the gate B, and from which the air is exhausted by the pump; and the said pump compresses air in a pressure-equalizing chamber, E^2, which communicates through a pipe, D, with the tube A in advance of and outside the gate B′. The chambers E′ E^2 serve to maintain a uniform degree of vacuum and pressure, and enable the cars to be operated smoothly and at a uniform speed, notwithstanding any small variations in the speed of the pump. The two chambers E′ E^2, with the pipes D D, may be considered as forming a pipe or passage around the station, similar to one of the pipes D shown in Fig. 1.

Referring now to Fig. 6, A A designate two tubes, which extend between two terminal stations, C′, and provide for traffic in opposite directions. These tubes are broken away to reduce the length of the drawings, and between the two terminal stations each tube may have any number of intermediate or way stations, which are formed by gates or valves B B′, and turnout or branch tubes D, and one or more of these branch tubes may have in them air-pumps, as previously described. At each terminal station C′ is a pressure-equalizing chamber, E^2, which communicates with the tube for outgoing traffic outside the gates by a pipe, H, and a similar vacuum-equalizing chamber, E′, which communicates with the tube for incoming traffic outside the gates by a pipe, H′. At each terminal station C′ is an air-pump, E, which constantly operates to exhaust air from the vacuum-chamber E′ and compress air in the pressure-chamber E^2. At each terminal station C′ are gates or valves B B′, the former of which are always closed when a car is at the station.

It will be seen that my invention possesses

great advantages, because when the pumps are arranged in the branch tubes a car is enabled to make a complete circuit of the tube—as, for instance, cars might be run continuously round and round in a circular tube without changing their direction. As here represented in Fig. 1, the railway is only adapted for running cars in one direction, and if it is desired to run cars in either direction two starting-pipes, F, should extend one from each side of the pump to the opposite end of each station, and two valves, *s*, be provided, one on each side of the pump.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with a pneumatic-railway tube, and two gates or valves forming a station between them, of a branch air-tube communicating with said main tube behind and in advance of said gates or valves, a pump in said branch air-tube, and a pipe for conducting air from the discharge of said pump to the main tube between said gates or valves and in rear of a car, substantially as specified.

2. The combination, with a pneumatic-railway tube provided with pairs of gates, forming stations between them, and a pump for compressing air in said tube behind the cars, of a pressure-equalizing chamber into which air is forced by said pump, and from which compressed air is conducted to said tube outside the gates, substantially as specified.

3. The combination, with a pneumatic-railway tube provided with pairs of gates forming stations between them, and a pump for exhausting air from the tube in front of the cars, of a vacuum-equalizing chamber into which air is conducted from said tube outside the gates, and from which air is exhausted by said pump, substantially as specified.

4. The combination, with a pneumatic-railway tube provided with pairs of gates forming stations between them, of pressure and vacuum equalizing chambers, both of which are in communication with said tube outside said gates, and a pump for exhausting air from said vacuum-chamber and compressing air in said pressure-chamber, substantially as specified.

5. The combination, with two parallel pneumatic-railway tubes extending between two terminal stations, providing for traffic in opposite directions, and provided with pairs of gates or valves forming stations between them, of a pump at each station for exhausting air from the tube for incoming traffic outside said pairs of gates, and at the same time compressing the air so exhausted and supplying it under pressure to the tube for outgoing traffic outside said pairs of gates, substantially as specified.

6. The combination, with two pneumatic-railway tubes extending between two terminal stations, providing for traffic in opposite directions, and provided with pairs of gates forming stations between them, of pressure and vacuum equalizing chambers at each station, the former communicating with the tube for outgoing traffic outside said gates and the latter communicating with the tube for incoming traffic outside said gates, and a pump at each station for exhausting air from the vacuum-chamber and compressing it in the pressure-chamber, substantially as specified.

7. The combination, with a pneumatic-railway tube containing a car-track, and having guide-rails upon its sides and upper portion, of cars adapted to run upon said track, and provided with guide rollers or wheels for running upon said guide-rails, substantially as specified.

ELIAS P. NEEDHAM.

Witnesses:
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CHAS. A. NEEDHAM.