2 Sheets--Sheet 1.

R. R. GREGG.

Pneumatic Railways.

No. 165,092. Patented June 29, 1875.

FIG. I.

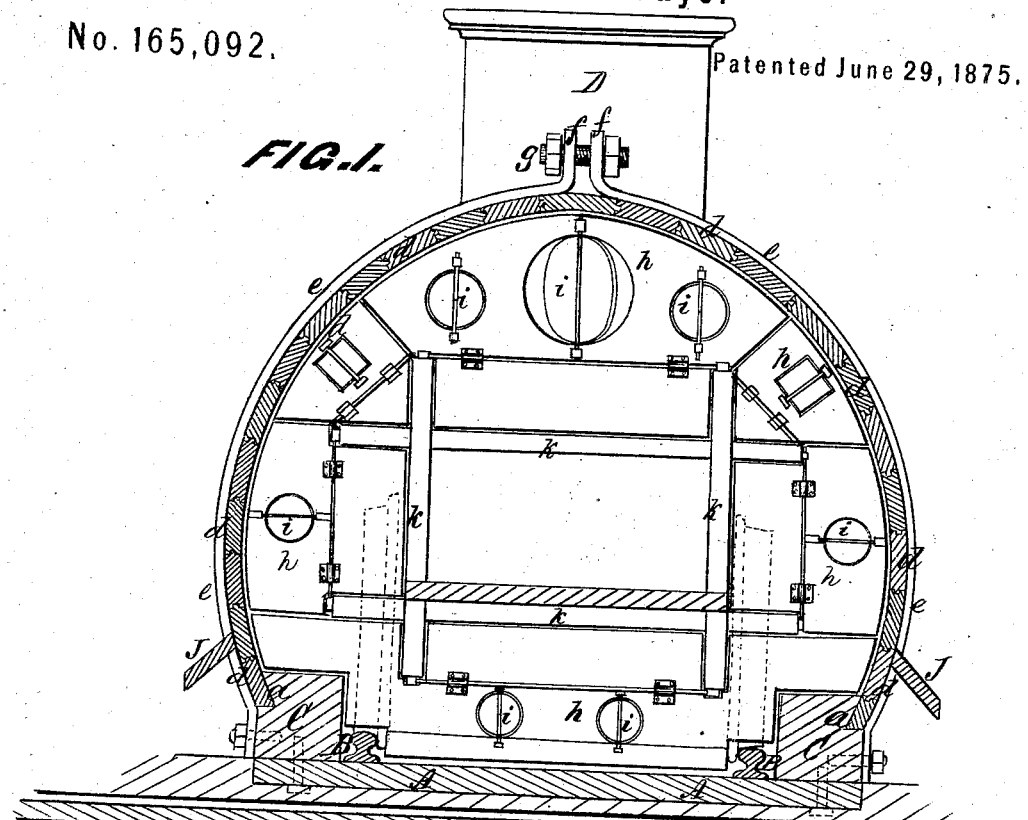
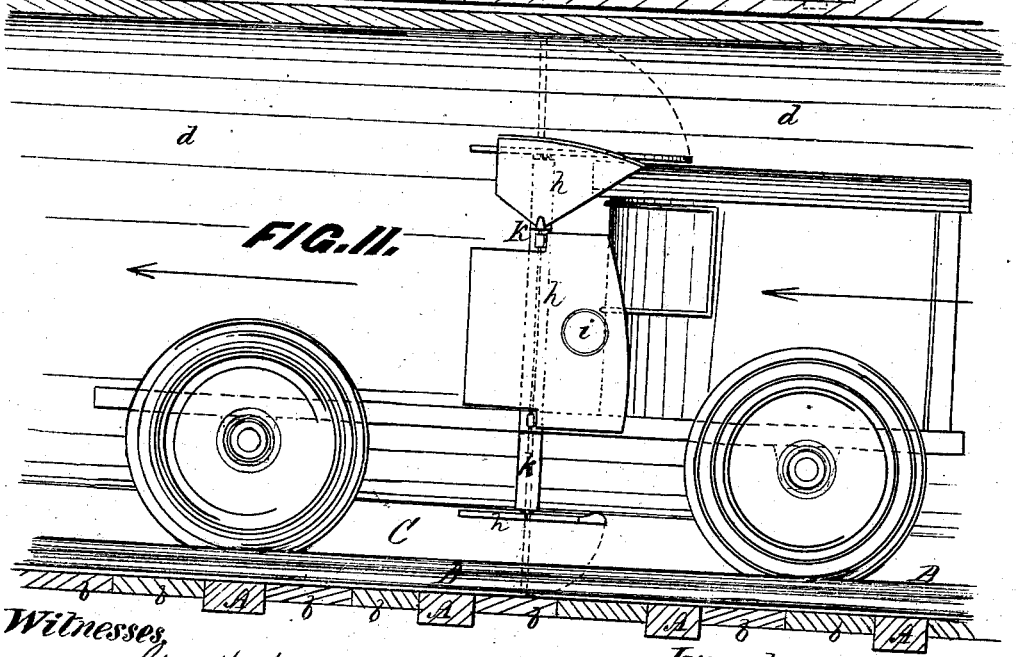


FIG. II.



Witnesses,
Geo. H. Miatt
Wheeler W. Phillips

Inventor.
Rollin R. Gregg
Per Burke, Fraser & Osgood Attys

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

2 Sheets--Sheet 2.

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FIG. III.

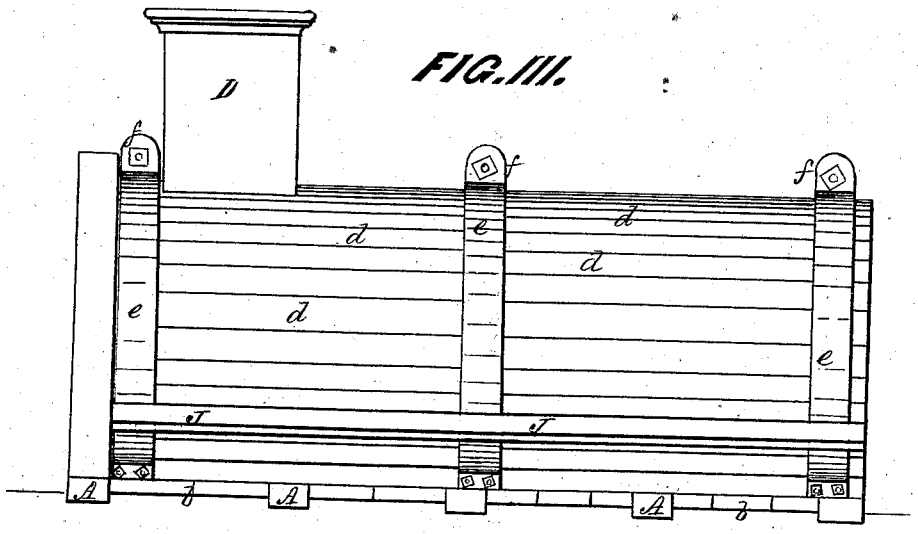
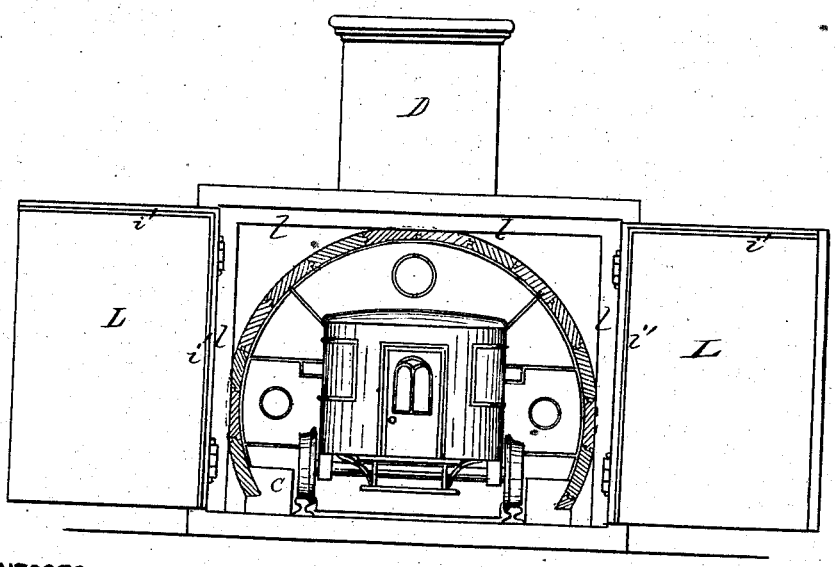


FIG. IV.



WITNESSES.

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UNITED STATES PATENT OFFICE.

ROLLIN R. GREGG, OF BUFFALO, NEW YORK.

IMPROVEMENT IN PNEUMATIC RAILWAYS.

Specification forming part of Letters Patent No. **165,092**, dated June 29, 1875; application filed March 16, 1874.

To all whom it may concern:

Be it known that I, ROLLIN R. GREGG, of the city of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in the Construction of Pneumatic Railways and Cars, of which the following is a full and exact description:

My invention consists, first, in a pneumatic railway-tube, formed in cross-section, with a horizontal base, and sides and top circular or arched; second, in the mode of constructing the same; third, in the mode of constructing draft-cars to be operated in such tubes by atmospheric pressure.

In the drawings, Figure 1 is a transverse sectional view of the tube, with a draft-car shown within it; Fig. 2, a side elevation of the propelling-car; Fig. 3, a side elevation of the pneumatic tube. Fig. 4, is an end view of the same at a station, with the doors open.

The method of constructing my pneumatic tube is as follows: On a prepared road-bed of gravel or other suitable material, I lay ordinary wooden ties A A at suitable distances apart, and to these spike the rails B B of the track in the ordinary manner, placing them at the required width of gage. Outside of the rails, parallel with them, and as close as will allow the free passage of the car-wheels, I lay a succession of square timbers, C C, of considerable size, in continuous line, the whole length of the track, and firmly bolt them to each of the ties. These serve as the base, from which spring the sides of the tube, and, being connected with the ties, the whole constitutes a strong frame as a foundation for the structure above. The outer side of each of these timbers is grooved, as at *a*, Fig. 1, to receive the lower edge of a series of planks, *d d*, which compose the arched or circular portion of the tube. These planks may be from two to three inches or more in thickness, and from five to eight inches wide, more or less, and are closely fitted together at their edges and ends by tongues and grooves, and joined with lead and oil or other suitable cement, to render them air-tight. The end joints will alternate to insure the greatest strength, and at short intervals apart iron bands *e e* inclose the planked portion. These bands are formed in two segments, each being bolted to the string-timbers C C, and their opposite ends, which are provided with vertical ears *f f*, approach near to each other at the top of the tube, and are connected by a screw-bolt, *g*, by the tightening of which the planking can at any time be compressed to compensate for any shrinkage which might tend to open the joints. At a point a little above where the planks are jointed to the string-timbers C C, and preferably at or near the point of greatest horizontal diameter of the tube, on either side, are placed inclined boards J, (or, if preferred, metal flanges or gutters may be used,) to carry off the rain which falls on the tube, and prevent it entering the joints at *a a*, and subjecting the timbers to decay. The space at the bottom of the tube is then closed by planking between the ties, the planks being laid transversely, as shown at *b*, Fig. 2, and secured to the under sides of the timbers C C, all the joints being calked or otherwise made tight, so that the entire tube may be hermetic.

If found practicable, the bed or under surface of the tube may be laid with water-lime or other cement, level with or covering the surface of the ties, so as to exclude the air.

At intervals of five or ten miles (more or less, as experience may determine) hollow shafts or towers D are erected, which communicate through openings with the interior of the tube; and connected with these are engines for exhausting a sufficient portion of the air contained within the tube to obtain, by the pressure of air admitted on the opposite side of a car adapted to the purpose, sufficient motive-power for the propulsion of a train at the required speed. Sufficient strength of materials and their fastenings must be had to resist the external pressure of the atmosphere, which will equal, on all parts of the tube, that required to be exerted on the area of the transverse section to propel the train. At stations in towns and cities the tube will terminate within the depot building, and recommence at the opposite side thereof, the track being continuous as usual. The ends of the tube are to be provided with swing-

doors L L, Fig. 4, which open for the passage of the cars, but are closed when the train is approaching, in order that a partial vacuum may be maintained within the tube. An air-tight joint may be provided by a flat strip of rubber packing, *l l*, on the door casing or frame, and correspondingly arranged angular ribs or strips of wood or metal, *i'*, on the doors, having a projecting edge or angle which indents the rubber when the door is closed. At small stations where depot buildings are not provided, doors may be made through the side of the tube at distances apart corresponding with the length of the cars, through which passengers and small freight pass, these doors to be constructed with air-tight joints in the manner described or in some other suitable way. At large stations suitable provision for the passage of meeting trains would be provided by side tracks in the depot building, where the power of the stationary engines used for exhausting the tube could be made available by simple means to transfer trains and move and transport cars, as required.

The propelling-car is constructed with a platform mounted upon ordinary wheels having a transverse frame, *k*, erected preferably near its center, back of which is an apartment to be occupied by the driver or engineer. To the sides of this frame are hinged a series of valves, *h h h h*, of such size, and so arranged that when shut they form, in connection with the car body, a diaphragm which closes the aperture of the tube, or nearly so, like a piston, the extreme edges of those at the top and sides being segmental to conform to the shape of the tube. The axes of these hinged valves are eccentric in respect to area, allowing the larger proportion of surface outside of the hinges, and they are so hung that the edges of the inner portions rest against the frame *k*, on the forward side in relation to its direction of travel, the outer portions turning backward when opened, as in Fig. 2. By this arrangement the pressure of the atmosphere from behind acts on the excess of surface on the outer side of each to maintain them in their closed position—that is, transversely of the tube, so as to form, collectively, a diaphragm or piston, against which the atmospheric pressure is exerted to propel the car. The diaphragm or piston, while conforming to the walls of the tube, does not fit closely enough to come in contact therewith, and hence friction is avoided, the retarding influence of which would much exceed the slight loss of power due to that portion of the air which would pass through the surrounding interstices without exerting pressure on the piston.

In order to reduce the speed or stop the train, the valves *h h h h* must be partially or wholly opened, to diminish the pressure of the air. This is effected by means of one or more auxiliary valves, *i i*, hung in the larger outer portions of the segmental valves. The dimensions of these smaller valves is such that when opened the remaining area of the major part of the valves *h* is reduced to less than that of the inner part of said valves, so that the pressure of air becomes greatest on the inner part from the opening of the valves *i i*, and the valves *h h* turn automatically in the direction of the motion of the car, or nearly so. The axes of the valves *i i* are placed at right angles to those of the segmental valves in which they are hung, being vertical in those of the latter, which are hinged to swing horizontally, and vice versa, by which arrangement both classes of valves (*h* and *i*) present only their edges to the current of air when both are open, and thus all pressure is removed. The valves *i i* have rods or chains connected with them in any suitable manner, which extend to the cab of the engineer, and enable him to open or close them at will. Stops may be provided to keep the valves *h h* at a little incline when opened, so that the current of air from behind may act upon them, and when the engineer shuts the smaller valves increasing the area will close them automatically. By opening a lesser or greater number of these segmental valves the speed of the train may be regulated and varied as required.

In crossing streams or gullies the tube should be constructed upon bridges, built in the ordinary manner, and securely fastened thereto.

The inner edge of the large valves *h h* may be made to strike against pins or bolts, instead of against rabbets, the said pins or bolts being inserted in a manner that they can be withdrawn at pleasure and placed upon the opposite side of the inner edge of these valves, thus permitting the draft-car to back the train at any point in the tube without having to turn the car around, and also to avoid the necessity of building so many turn-tables. This mode of construction is specially devised to obviate an objection which appertains to pneumatic-railway trains for conveying passengers, viz: that the smoke, gases, &c., accumulate and are carried along with the train, having a deleterious effect on the passengers and exposing them to suffocation; but the provision herein described, viz: the space around the periphery of the piston allows a circulation and passage of currents of air from the front to the rear of the train, by which deleterious gases and foul air are carried back from the train and left in the rear.

What I claim as my invention, is—

1. A pneumatic-railway tube formed of the longitudinal stringers C C, with cross-ties A A, and planks *b b* bolted thereto, in combination with the circular arched shell composed of the pieces *d d* and bands *e e*, constructed and arranged as and for the purposes set forth.

2. In combination with the track, the

stringers C′ C′ forming a continuous guard the entire length of the road, to prevent the wheels jumping the track, as set forth.

3. In combination with the segmental sections *h h*, the auxiliary valves *i i*, arranged and operating substantially as and for the purpose shown and described.

4. In combination with the curved sides *d d* and longitudinal stringers C C, the inclined water-guard J, as and for the purpose set forth.

5. The angular ribs *i′ i′* in combination with the flat rubber strips *l l*, for excluding air from the pneumatic tube when the doors L L are closed, substantially as set forth.

6. A diaphragm for a pneumatic-railway car, portions of which are formed of hinged sections *h h*, substantially as and for the purpose set forth.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

ROLLIN R. GREGG.

Witnesses:
J. R. DRAKE,
BENJ. H. AUSTIN.