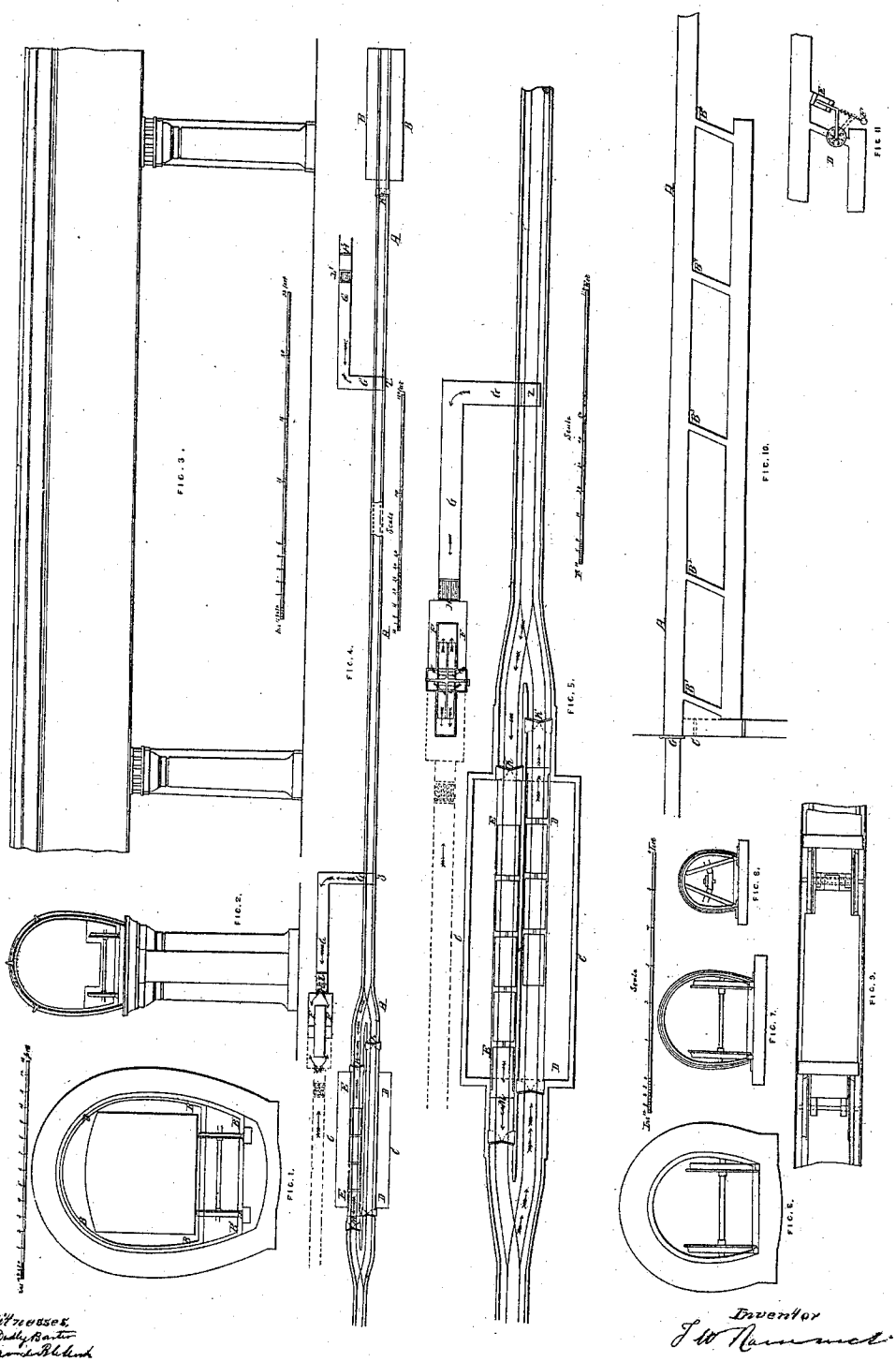
T. W. RAMMELL.

PNEUMATIC RAILWAY.

No. 42,509. Patented Apr. 26, 1864.



Witnesses
[illegible]

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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN PNEUMATIC RAILWAYS.

Specification forming part of Letters Patent No. 42,509, dated April 26, 1864.

To all whom it may concern:

Be it known that I, THOMAS WEBSTER RAMMELL, of London, in the county of Middlesex, civil engineer, a subject of the Queen of Great Britain, have invented or discovered new and useful Improvements in Pneumatic Railways and Tubes; and I, the said THOMAS WEBSTER RAMMELL, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof—that is to say:

This invention consists of improved railways and tubes for the carriage or conveyance of passengers, goods, parcels, or letters by means of atmospheric agency, and of improved means of propelling and regulating the traffic upon or through such railways or tubes. The rails, grooves, or trams constituting the way are in all cases placed within tunnels or tubes, and the traffic is carried within and through the tunnels or tubes. The carriages upon or in which the traffic is placed rest and move immediately upon and are directed in their motion by these rails, grooves, or trams.

The railways are peculiarly adapted for underground communication in large towns; but they may be placed upon the surface or upon a raised structure, and may be used either for town or for country lines.

I now proceed to describe the construction and mode of working of a railway for the conveyance of passengers and goods according to my invention.

I construct a hollow way or tunnel of brick-work, iron, or other suitable material, within which the train of carriages is to travel, having terminal stations and such intermediate stations (if any) as may be required.

Figure 1 shows a transverse section of a tunnel as constructed of brick-work for an underground railway. Fig. 2 shows a transverse section, and Fig. 3 a longitudinal elevation, of a tunnel or tube of iron or other metallic material upon a raised structure, as adapted for railways above ground, especially in towns.

I prefer to make the casing or internal surface of the tunnel of the usual tunnel form, as shown in those figures, but other shapes would answer. Upon the invert I place the frame-work and rails constituting the permanent way, preferring a rail and sleeper with a continuous bearing and filling in the frame-work solidly, and in such manner that it may present a perfectly even upper surface.

The carriages I employ are mounted in much the same manner as those in ordinary use upon railways, and I prefer to have them of the same form in transverse section as the interior of the tunnel, as shown at B B B B in Fig. 1, and a few inches less in each direction, and in order that the same clear space may be preserved all round I frame out the carriage (see B′ B′) in one or more places underneath, so that it may in like manner clear the bottom and lower sides of the tunnel by an equal space. I fill in the vacant space so left between the carriage and the tunnel with a soft or yielding material, which is fixed to and moves along with one or more of the carriages, and which in the passage through the tunnel yields to any inequality in the interior surface. The soft material I prefer to use for filling up the intermediate space left is some kind of matting made with a pile, and I apply it in strips of, say, a foot to fifteen inches wide, one or more to each carriage; but any other soft material which will prevent undue leakage of air may be used.

It is to be observed that the carriages need not necessarily be of the same shape as the tunnel, but that any form of carriage may be used, provided it be framed out in the manner described, so as to fit the tunnel, of whatever shape that may be, and also that only one carriage of a train, which may be called the "piston-carriage," need be made to fit the tunnel.

The soft material interposed is intended to prevent excessive leakage of air in the application of the power; but if the carriage fits closely, or nearly so, to the tunnel, and the leakage is inconsiderable, it may be dispensed with.

For propelling and working the train of carriage I make use of atmospheric agency, the pneumatic pressure being applied over the whole tranverse area of the carriage by rarefying and expelling the air in front of the train. For this purpose I use a pump worked by steam-power, or water or other power, and I much prefer one upon the rotary principle, in which the air is expelled or pumped out by the action of the centrifugal force; but any other form of air-pump may be used.

The arrangements I propose for the prac-

tical application of the power, and the working and regulating of the traffic, are as follows:

Fig. 4 shows a plan of a portion of a single line of railway, A A A, with a terminal station, B B, and an intermediate station, C C.

Fig. 5 shows a portion of the line of railway, and the intermediate station, C C, on a larger scale. The line is made double at the intermediate station, to allow the up and down trains to pass, the part D D being reserved for down trains, and the part E E for up trains. At the terminal and each intermediate station, or where necessary, I erect a steam-engine or other machine of the requisite power, and in connection with it proper pumping machinery, as above explained, working in a suitable exhaust-chamber, F F, into which is conducted the end of a shaft or air-passage, G G G′ G′, proceeding from the tunnel at a point, Z Z′, placed at some little distance—say from fifty to one hundred yards—from the station. I place in the air-passage a valve, H H′, communicating between the tunnel and the exhaust-chamber, and also another valve, L L′, communicating between the tunnel and the outer atmosphere, and both of which are made to open and to close, either by hand or automatically, as may be most convenient. I also place across the tunnel, at every terminal and intermediate station, valve-doors K K′ K″, covering the entire area of the tunnel and opening outward into the station. I connect the stations by electric wire or other telegraphic communication.

A train being in readiness at the terminal station B B, its head is brought up so as to be just within the mouth or extremity of the tunnel. The valve-doors K″ are opened, and the valves H′ and L′ are shut. A signal is then given to the station C, when the valve-doors K K′ are closed, the valve H opened, and the valve L shut. The engine and pump are then started, and by their action the air in the tunnel is quickly rarefied, and motion communicated to the train by the superior pressure of the air behind it. As soon as the train has moved off into the tunnel, and has reached the point Z′, the valve-doors K″ are closed after it, and the valve L′ opened, so as to admit a free supply of air behind the train and avoid a rush of air through the station B B. The train then soon acquires a high velocity, the air in front being drawn through the shaft and air-passage G G at the station C C, and that required to follow behind being supplied down the air-passage at the station B B through the valve L′, and this velocity is continued until the train has reached the point Z at the opening of the air-passage G at the station C C. After passing this point the power of the pumping-engine acting, though in a less degree, behind, instead of, as before, in front of, the train, has a tendency to draw it in the direction of the station B B, and practically assists in bringing the train to rest. Almost immediately after the train has passed the point Z the valve H is shut; but the train, being carried onward by the momentum it has acquired, and compressing the air in the remaining portion of the tunnel, forces open the valve-doors K, and enters the station C C, where, by the brakes, it is brought to rest, its head buffing against the air in the space in the next section of tunnel, as shown on the plan at M. The train remains in this position at the intermediate station so long as may be required, and is then ready to proceed to the next station in advance, in the same manner as has been already described, and so on from station to station.

It will be seen that while the engine and pump at the intermediate station, C C, are drawing an up train from the station B B they may at the same time be employed by means of the corresponding valves and air-passages in connection with the next length of tunnel, as shown in Figs. 4 and 5, in drawing a down train from the station beyond, which will enter the station C C at the same time, and will occupy the down platform; or two complete tunnels, with air-passages, &c., may be placed side by side, and one of these may be used for up traffic and the other for down traffic.

It is an essential condition for economical working of town railways that the sections into which the railway is divided should all be of nearly equal length, and I recommend a length of six hundred and sixty yards, or thereabout, as a very convenient length for the section. Provision should be made for the transfer of the trains from the up to the down line and from the down to the up line at the terminal stations, and this latter requirement I accomplish by means of traversing tables or by switch apparatus.

It is to be observed that in the working of a line, of whatever number of stations, the proportion of trains to stations may be regulated from time to time in accordance with the requirements of the traffic. Thus in the case of a line of ten stations it may be worked with a train to each station or with any less proportion of trains down to one for the whole line; and, further, that traversing tables may be established at any intermediate station or stations on a line, and thus a portion only of such line may be worked. For country lines, also, sections of greater length—say, of four, five, or six miles—may be worked with advantage, and both compression and rarefaction be applied to the propulsion of the trains, the pumps being connected for the purpose with suitable chambers, and the air passages and valves arranged accordingly.

I now proceed to describe the construction and mode of working when the invention is to be applied to the conveyance of parcels or small packages.

I construct a tube or small tunnel either of brick-work, as shown in Fig. 6, of iron and wood, as shown in Figs. 7 and 8, or of other suitable material.

The rails or grooves guiding and directing the motion of the carriage may or may not be

part of the body of the tube or tunnel. Fig. 9 shows a plan, and Figs. 6, 7, and 8 show sections, of convenient forms of carriage to be used in this case. The mode of propelling these carriages and the general arrangements will be similar to those already described, convenient arrangements being made at the stations for the receipt of the carriages. In this case I make use of the following contrivance for gradually reducing the speed of the carriages on their approach to a station, and for bringing them to rest:

Instead of connecting the exhaust-chamber with a single air passages proceeding from or leading into the tube, I use several smaller or branch air passages leading from the exhaust-chamber, and entering the tube A A at different points, $B' B^2 B^3$, &c., as shown in Fig. 10, the area of which branches collectively should be about equal to that of the tube. The effect of this arrangement will be that while the carriage in their main course will be drawn toward the station with the full force of the pump and full capacity of all the branches up to the point B^5, beyond that point the propelling power, and consequently the speed of the carriages, will be gradually reduced. For example, if there be five such branches, as shown in Fig. 10, then on passing the point B^5 the carriages will be acted upon only with the power due to the capacity of the remaining four branches. On passing the point B^4 they will be acted upon only with the velocity due to the capacity of the remaining three branches, and so on in succession. Under this arrangement the retarding force due to the rarefication of the air behind the carriages, as well as in front, so soon as they have passed the point B^5, may be allowed to act, and to assist in bringing the carriages to rest; but I prefer that this should not so act, and to avoid it, I place a self-acting valve upon each branch at the point where it enters the tube, as shown in Fig. 11, so contrived that the valve D will open by the action of the piston E (shown in that figure) upon the power being turned on in the conveying-tube through the valve C, (shown in Fig. 10,) and will close again, immediately after the passage of the carriages, by the action of the balance-weight F. The valve C in Fig. 10 should be closed as soon as the self-acting valves D D, &c., upon the several branches are opened.

The valve G (shown in Fig. 10) corresponds to the valve-doors K K′, (shown in Figs. 4 and 5,) and may be arranged so as to be kept shut during the approach of the carriage, until it arrives at the point B′ in Fig. 10, or thereabout, and to be then opened by any automatic contrivance. The velocities will then be regulated solely by the capacities of the several branches, (as influenced by the pumps,) and by the momentum of the carriage, and the carriage must of necessity be drawn home.

It should be observed that the capacity of each branch air-passage may be determined either by the size of the pipe itself, or by the greater or less opening of the valve within it.

I do not confine myself to the particular arrangements and contrivances above described; but

What I claim, as the invention to be secured by Letters Patent, is—

1. A pneumatic railway or tube in which the carriages are placed inside the tunnel or tube, but are independent of the tunnel or tube, and are wholly supported, and in their motion are guided and directed, by two or more rails, grooves, or trams, and in which the pneumatic pressure is applied over the whole or transverse area of the carriage.

2. The contrivance for filling up with soft material the space between the interior of the tunnel or tube and the outside of the carriage as applied to pneumatic railways and tubes, as above described.

3. The use of several smaller or branch air-passages leading into the tube at different points, either with or without self-acting valves, so as gradually to reduce the velocity of the carriages, as applied to pneumatic railways and tubes, as above described.

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