

(No Model.)

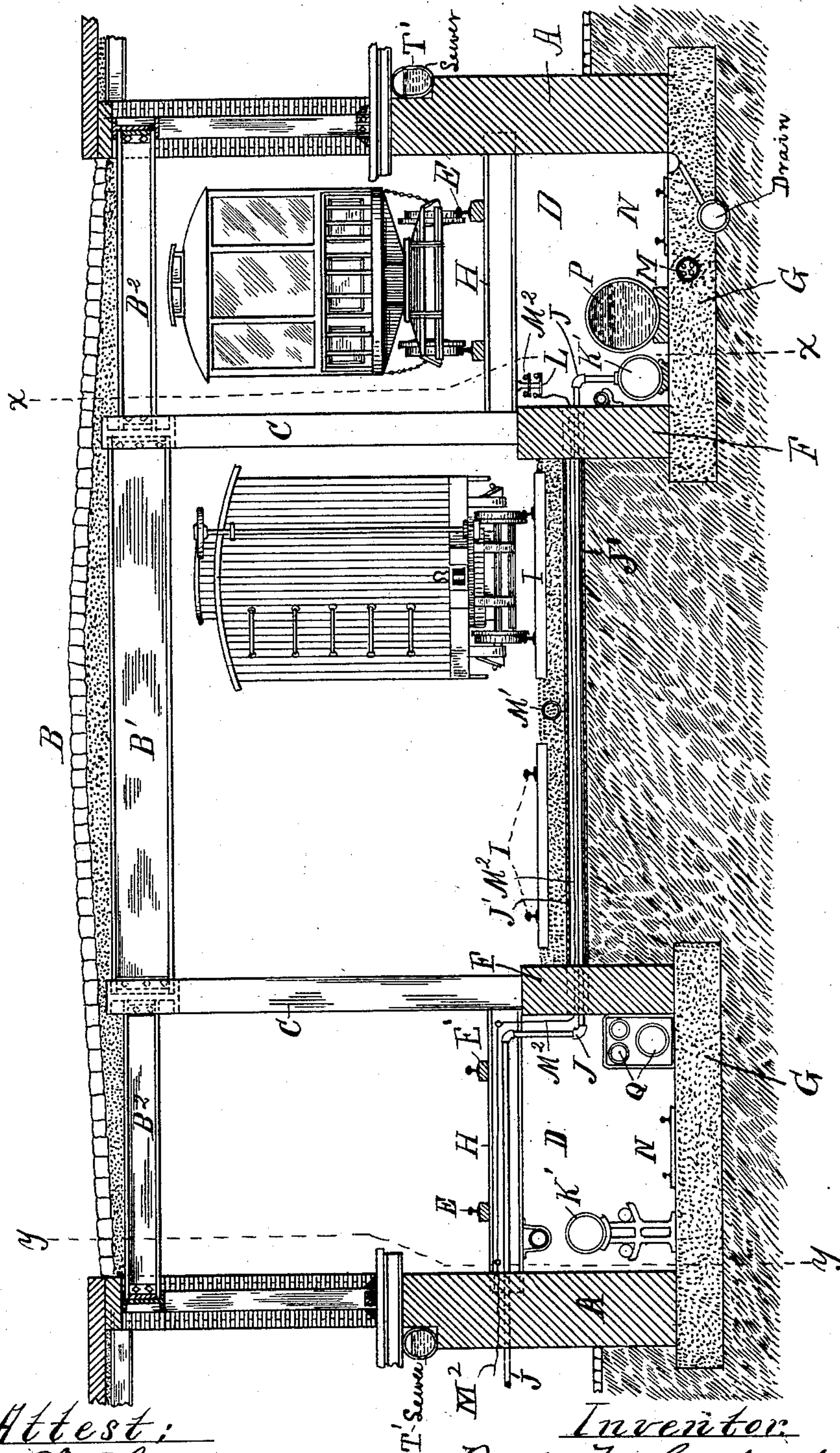
2 Sheets—Sheet 1.

B. F. CARPENTER.

## UNDERGROUND RAILWAY AND PIPE SUBWAY.

No. 360,655.

Patented Apr. 5, 1887.



Attest:

L. L. L.  
Henry Heberath,

Inventor

Benj. F. Carpenter  
per Crane & Miller Atty

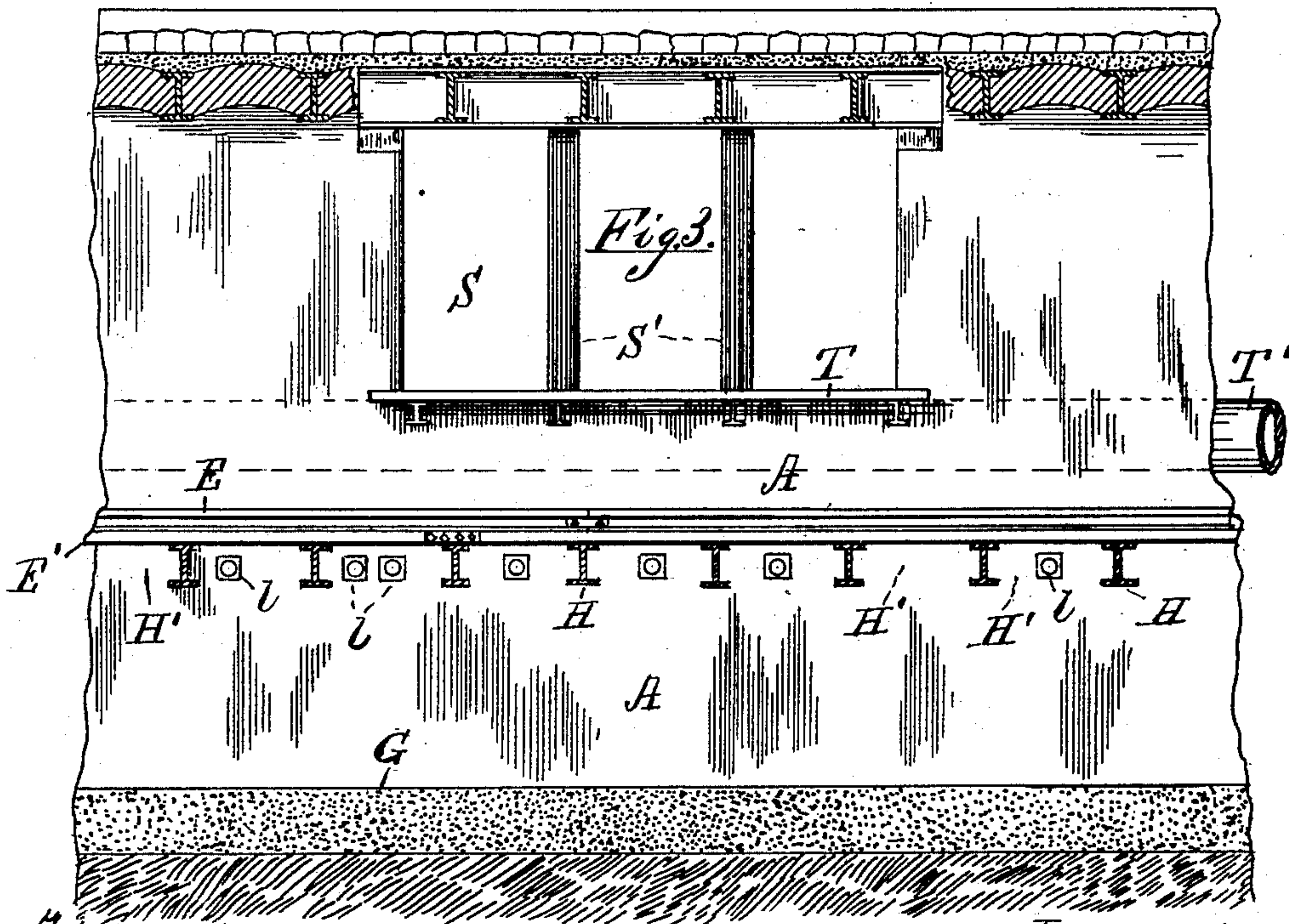
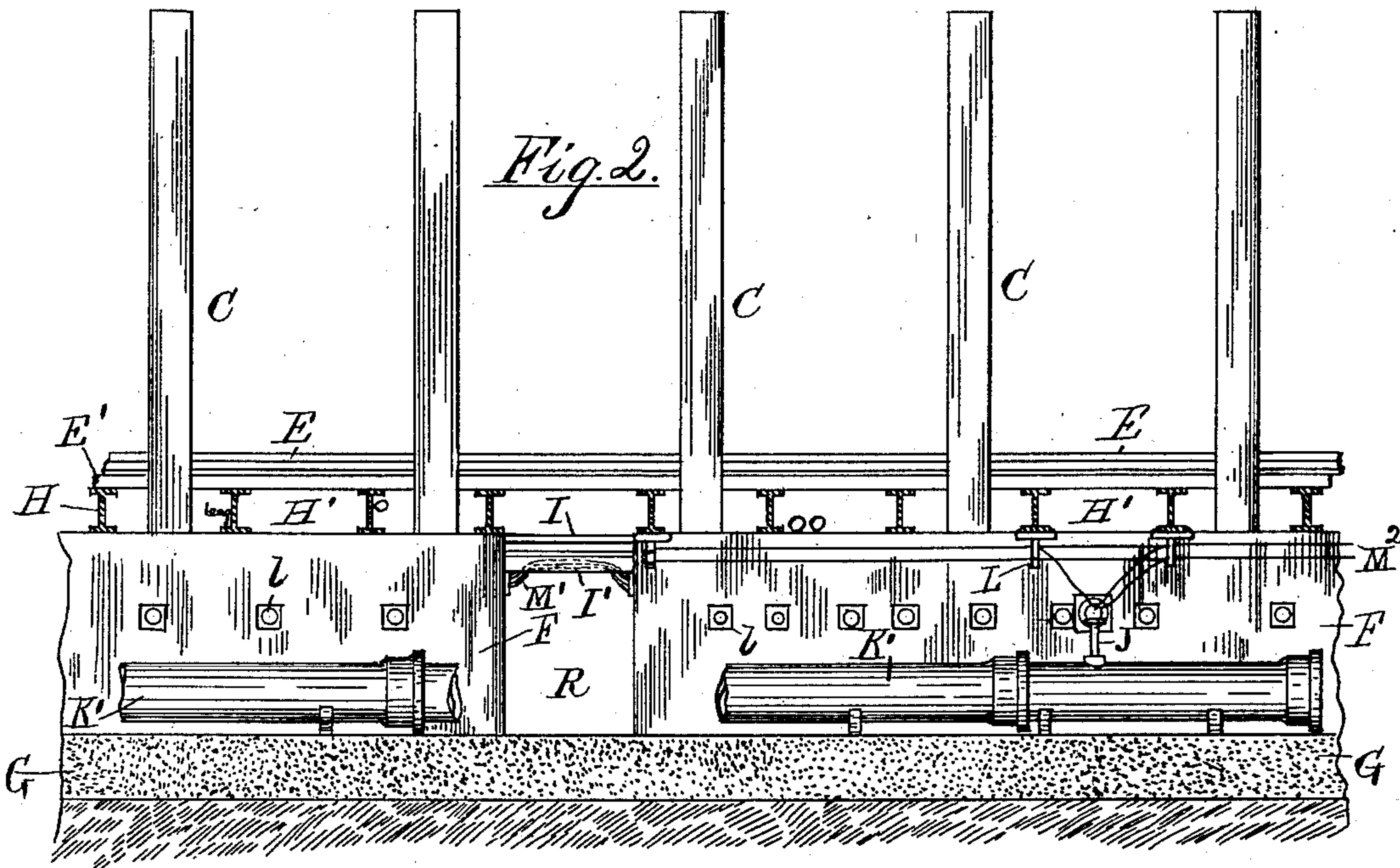


B. F. CARPENTER.

UNDERGROUND RAILWAY AND PIPE SUBWAY.

No. 360,655.

Patented Apr. 5, 1887.



Attest:

*Ly. Lee*  
*Henry P. Heath*

Inventor.

*Benj. F. Carpenter*  
*per Crane & Miller, attys*



# UNITED STATES PATENT OFFICE.

BENJAMIN F. CARPENTER, OF ROSELLE, NEW JERSEY.

## UNDERGROUND RAILWAY AND PIPE-SUBWAY.

SPECIFICATION forming part of Letters Patent No. 360,655, dated April 5, 1887.

Application filed December 18, 1886. Serial No. 221,957. (No model.)

*To all whom it may concern:*

Be it known that I, BENJAMIN F. CARPENTER, a citizen of the United States, residing at Roselle, Union county, New Jersey, have  
5 invented certain new and useful Improvements in Underground Railways and Pipe-Subways, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

10 The object of this invention is to provide improved underground transit facilities for passenger and freight traffic, combined with accessible subways for pipes, wires, and tubes for distribution and communication, all  
15 adapted to the requirements of a populous city. To effect these objects with economy of expense and space, both vertical and lateral, and to thereby reduce the depth and width of excavation and consequent danger or interference  
20 with buildings, and to secure rigidity and durability of the structure, and to adapt the whole to the existing limits of the streets occupied, and the buildings, vaults, structures, and systems of sewers and pipes and tubes of  
25 distribution occupying or adjacent to such streets, I have devised a particular arrangement of separate tracks for through and local traffic, so as to locate the through-tracks upon the solid ground, and to obtain accessible pipe-  
30 subways below the local tracks.

To supply the wants of a large city, which would be connected with lines of railway leading to great distances, and would require local passenger-trains within its own limits, I have  
35 provided for the requirements of two systems of traffic—the one for rapid express-trains and trains of freight or general traffic, with stations at longer distances, and the other local and special, with frequent stations. The system  
40 designated as “general,” with stations at long intervals, need not follow a grade-line conforming to the street-surface, except for stations and at other special places, while the system designated as “local” needs to conform to  
45 the street-surface to be adapted to frequent stations; and, as the platform of such stations by which passengers reach local cars should occupy a level above the established sewers, it becomes necessary to elevate the local tracks  
50 to a grade suited to place station-platforms above such sewers, and thereby at the same

time shorten the distance of such platforms from the street.

As cars adapted to local traffic may be made of special form, they should occupy a vertical  
55 space less than that necessary for the cars of the general traffic which would be brought from railroad-lines in any part of the country.

A majority of the streets of cities are so narrow that all the space available between curbs  
60 is required for such a double system of railways with four tracks side by side, and all the requirements of water and gas pipes and conduits for wires and tubes must necessarily be placed beneath certain of such tracks if the  
65 railways are brought near the surface of the street, for the purposes above stated. The subways for such pipes and conduits should be placed as close to the sides of the street and as near to the surface as possible, while avoiding  
70 interference with the local passenger-trains, which must, of course, be made accessible. I therefore dispose the tracks and subways in the manner shown in the annexed drawings to reconcile these different requirements, and  
75 to provide perfectly accessible subways of such magnitude that they may accommodate large water-mains and other heavy pipes and afford sufficient room to conveniently introduce and  
80 remove them, and to furnish space for a tramway as a means of conveying such pipes or removing them or other heavy materials.

As sewers should be placed on a line to connect with existing inlets and outlets, they  
85 should occupy a space either in the side walls of the structure or attached to the outside thereof at such datum line. The walls of the pipe-subways should also be located so as to serve as a part of the supports required for  
90 the street and for the railway-bridges to secure the utmost economy.

The arrangement I have devised will be understood by reference to the annexed drawings, in which—

Figure 1 is a transverse section of a street  
95 and the entire substructure. Fig. 2 is a longitudinal section of the same on line  $xx$  in Fig. 1, looking toward the posts C; and Fig. 3 is a longitudinal section on line  $yy$  in Fig. 1, looking toward the wall A.

100 A are continuous side walls, distanced about forty-four feet apart, or sufficient to accom-



moderate four lines of railway-tracks. These tracks are all contained in an open continuous space, excepting that columns C C are located at the side of the general tracks I, and serve, in connection with the walls A, to support the street-bridge B upon beams B' and B<sup>2</sup>. The tracks I for through traffic are located beneath the center of the street at a suitable distance below the bridge-beam B', to permit the passage of a locomotive or a car of any pattern used in general traffic, a freight-car, I', being indicated upon one of the tracks.

No subway or continuous excavation is made beneath these tracks, which therefore rest directly upon the ground to secure the utmost solidity and durability in the road-bed.

Between the walls and the columns C, at the sides of the general tracks, are located the special tracks E, and, as the cars used on such tracks may be made of uniform size to merely accommodate the local traffic, the rails of this track are set at a higher grade than those of the general track I.

By the elevation given to these tracks a subway, D, with ample head-room is easily obtained adjacent to the side walls, A, and therefore conveniently accessible to the buildings at the sides of the street.

To save the utmost degree of excavation and to utilize the space between the track-stringers E', the latter are supported upon transverse beams H, of metal or wood, having spaces H' between them, in which pipes and conductors of various kinds may be accommodated, as shown at the left side of Fig. 1.

At each side of the general tracks I is located a wall, F, supported upon a foundation, G, extended from the walls A, such walls F thus serving the triple purpose of inclosing the subway D, sustaining the columns C, and retaining the foundation beneath the tracks I.

Tramways N are provided upon the foundation G in the bottom of the subway, and a water-main, P, gas-mains K', and steam-pipes Q are also conveniently arranged within the same to furnish service-pipes to adjacent buildings.

The structure also affords abundant opportunity to accommodate electric wires conveying currents of different intensities in such relations that injurious induction may not be produced. Thus telegraph-wires M may be laid in the floor of the subway, electric-light wires M' may be laid between the general traffic rails, and telephone-wires M<sup>2</sup> may be sustained by brackets L upon the beams H of the subway.

In some cases a single subway at one side of the street may suffice to contain all the pipes, tubes, and wires required for distribution and communication; but where two subways are used they should be frequently connected by transverse tubes J', to convey smaller pipes, wires, &c., from one main to another, or to buildings upon the opposite side of the street. Thus in Fig. 1 a pipe, J, is shown extended

from one of the gas-mains K' through such a pipe, J', extended from one subway to the other beneath the foundation of the tracks I, the pipe being thence extended upward between the beams H and out through the wall A, from which it could be conducted to any desired point. In like manner the electric wire M<sup>2</sup> is shown carried through the pipe J' between the beams H and through the wall A, to be carried to the adjacent building.

The tubes J' may be formed of metal, terracotta, concrete, or other compositions, and hollow bricks (shown in Figs. 2 and 3) would be inserted in the walls F and A when built to furnish outlets thereto. Besides the frequent communication thus afforded for smaller pipes, wires, &c., culverts R (shown in Fig. 2) would be formed beneath the general tracks to connect the subways at longer intervals, and such culvert would permit the passage of operatives from one subway to another and the connecting of the mains by large transverse pipes whenever desired. Thus, in case of a break in a gas or water main in one subway, a large connection could be speedily formed through such culvert with a similar main in the opposite subway, to maintain a supply until the break could be repaired.

In Fig. 2 a gas-main, K', is shown laid upon the floor of the subway, and electric wires are shown suspended upon the beams H, and branches from the main and from the wires are shown extended through a transverse pipe, J', in the wall F.

In Fig. 3 are shown the rails E, for the local traffic, with a passage, S, through the wall A to a platform, T, at a local station adapted for such traffic, and the sewer T' beneath the platform.

It will be noticed that the depth of excavation required for the subways by locating them beneath the local tracks E is materially less than if they were situated beneath the general tracks I, the arrangement of the local tracks at the sides of the structure affording an opportunity to elevate the rails for such local traffic in the utmost degree, and making the platforms for such traffic and the subways for pipes and wires most accessible to the street above and the adjacent buildings.

The location of the tramways at the bottom of the structure adapts them to be used in the transportation of much of the material required for the foundations, walls, and superstructure. By laying such tramways at the commencement of the work they may be advantageously used in the later construction and in the laying of the railways and various pipe systems.

It will be noticed in Fig. 3 that where the wall A is pierced for the passage S to the platform T posts S' are inserted to widen such passage, and to sustain the street-bridge above; and it is obvious that such posts may be used with equal effect at any point in the wall.

The function of the wall A, referred to here-



in, is chiefly to operate with the wall F to inclose the subway D, and the method of construction employed for the wall A above the beams H, which support the special tracks, is entirely immaterial to my invention.

The most essential feature of my improvement is the formation of the tunnel-excavation deeper at the side than at the middle, in combination with transverse beams H, extended across such deeper parts of the excavation to form a subway containing pipes of distribution and communication beneath, and to accommodate in the spaces between such beams the service-pipes and wires, which must be extended from the mains in such subway through the outside wall of the tunnel to enter the adjacent buildings.

My improvement also includes the elevation of the beams H above the grade of the general tracks in the center of the tunnel to bring the special traffic platforms above the level of the sewers, and to diminish in the utmost degree the excavation required for the subways D. Although I have specifically claimed such elevation of the special tracks, it must be understood that in connection with such elevation all the tracks in the tunnel would at necessary intervals be brought to the same level at switches and crossings as may be required to permit communication between structures upon the opposite sides of the tunnel.

In Fig. 2 the main pipe K' is shown broken away to expose the culvert R more clearly, and the tracks I are shown at such point supported upon stringers I', to bridge the culvert within the smallest vertical space.

The conduit for the wires M' is also intersected by the culvert at such point, and the wires carried up between the stringers in the same manner as in the spaces H', between the beams H.

I disclaim the mere perforation of walls to insert conductors or pipes, as my invention avoids the formation of any kind of opening between the several parts or materials of which the wall is constructed, by the insertion in the body of the wall while building the same of hollow bricks, which form an integral part of the wall, and also provide the desired apertures or perforations.

Having thus set forth my invention, what I claim in a system of underground communication and distribution is—

1. A structure for an underground railway and pipe-subway, consisting in a tunnel inclosed between the walls A, beneath the street, four railway-tracks occupying the entire width of the tunnel, the two lateral tracks E having continuous subways D beneath them, and the said tracks being supported over such subways upon a continuous bridge formed of transverse beams H, having open spaces H' between them, as and for the purpose set forth.

2. A structure for an underground railway and pipe-subway, consisting in the walls A and intermediate rows of columns, C, support-

ing the street-bridge, the general tracks I, laid upon the ground between the columns C, the walls F, supporting such columns at the outer sides of the general tracks, the transverse beams H, supported by the walls A and F above the grade of the tracks I and forming a continuous open bridge with spaces H' between the beams, the special track E, sustained upon such beams, and the accessible pipe-subway D beneath the beams H and between the walls A and F, the whole arranged and operated as and for the purpose set forth.

3. A structure for an underground railway and pipe-subway, consisting in the walls A and intermediate rows of columns, C, supporting the street-bridge, general tracks I, laid upon the ground between the columns C, the walls F, supporting such columns at the outer sides of the general tracks, the transverse beams H, the special track E, located thereon above the grade of the tracks I, continuous subways D, beneath one or both of the tracks E, conductors for steam, gas, water, or electricity located in such subways, and service-connections extended from the same between the beams H and through the walls A, as and for the purpose set forth.

4. A structure for an underground railway and pipe-subway, consisting in the walls A and intermediate rows of columns, C, supporting the street-bridge, general tracks I, laid upon the ground between the columns C, the walls F, supporting such columns at the outer sides of the general tracks, the transverse beams H, the special track E, located thereon above the grade of the tracks I, continuous subways D for both the tracks E, conductors for general systems of distribution located in such subways, and transverse tubes J', extended between the subways beneath the tracks I, as and for the purpose set forth.

5. A structure for an underground railway and pipe-subway, consisting in the walls A and intermediate rows of columns, C, supporting the street-bridge, general tracks I, laid upon the ground between the columns C, the walls F, supporting such columns at the outer sides of the general tracks, the transverse beams H, the special track E, located thereon above the grade of the tracks I, continuous subways D, for both the tracks E, conductors for steam, gas, water, or electricity located in both of such subways, culverts or transverse tubes extending beneath the tracks I, and means for connecting such conductors through such transverse tubes or culverts, to form a duplicate system of conductors, as and for the purpose set forth.

6. A structure for an underground railway and pipe-subway, consisting in the walls A and intermediate rows of columns, C, supporting the street-bridge, general tracks I, laid upon the ground between the columns C, the walls F, supporting such columns at the outer sides of the general tracks, the transverse beams H, the special track E, located thereon,

a continuous pipe-subway beneath the beams  
H, conductors for steam, gas, water, or elec-  
tricity located in such subway, and a tram-  
way, N, upon the floor of the subway, the whole  
5 arranged and operated as and for the purpose  
set forth.

In testimony whereof I have hereunto set

my hand in the presence of two subscribing  
witnesses.

BENJAMIN F. CARPENTER.

Witnesses:

THOS. S. CRANE,  
L. LEE.