G. W. JACKSON.

MARINE AERIAL TRAMWAY.

APPLICATION FILED MAY 5, 1908.

916,158.

Patented Mar. 23, 1909.

3 SHEETS—SHEET 1.

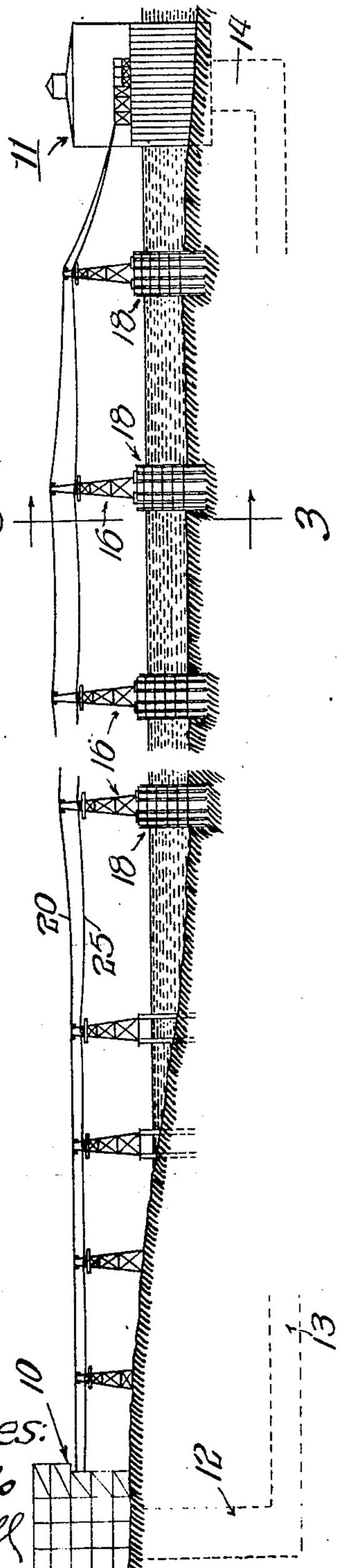


Fig. 1.

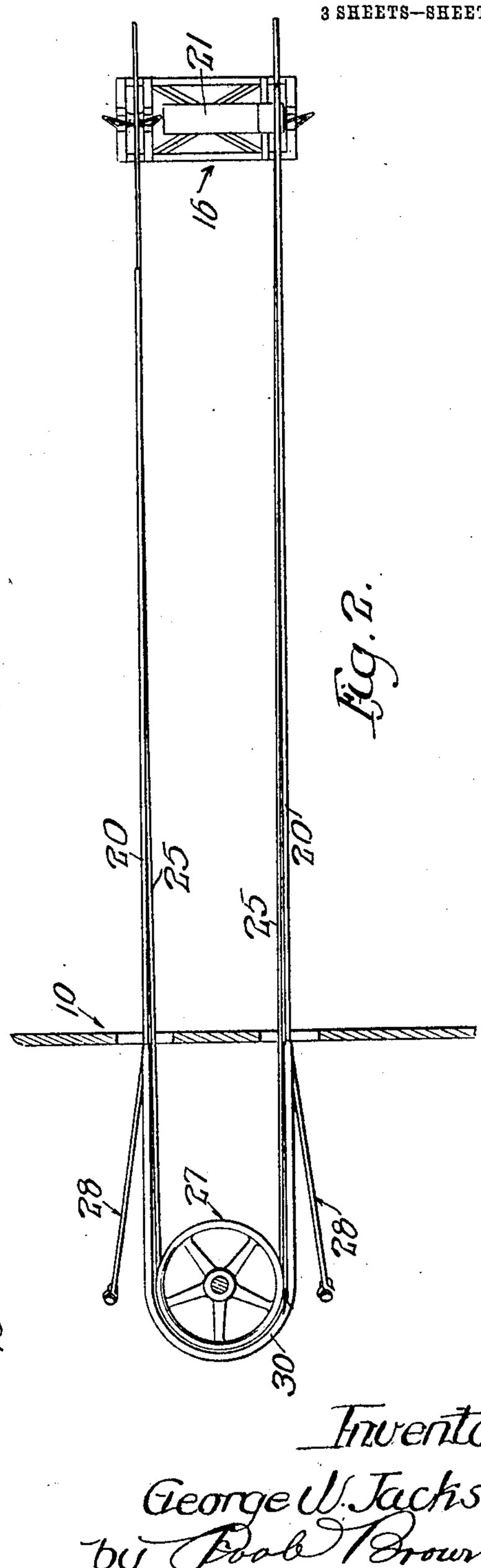


Fig. 2.

Witnesses:
F. H. Alfredo
W. B. Hall

Inventor:
George W. Jackson
by Poole & Brown
Attys

G. W. JACKSON.

MARINE AERIAL TRAMWAY.

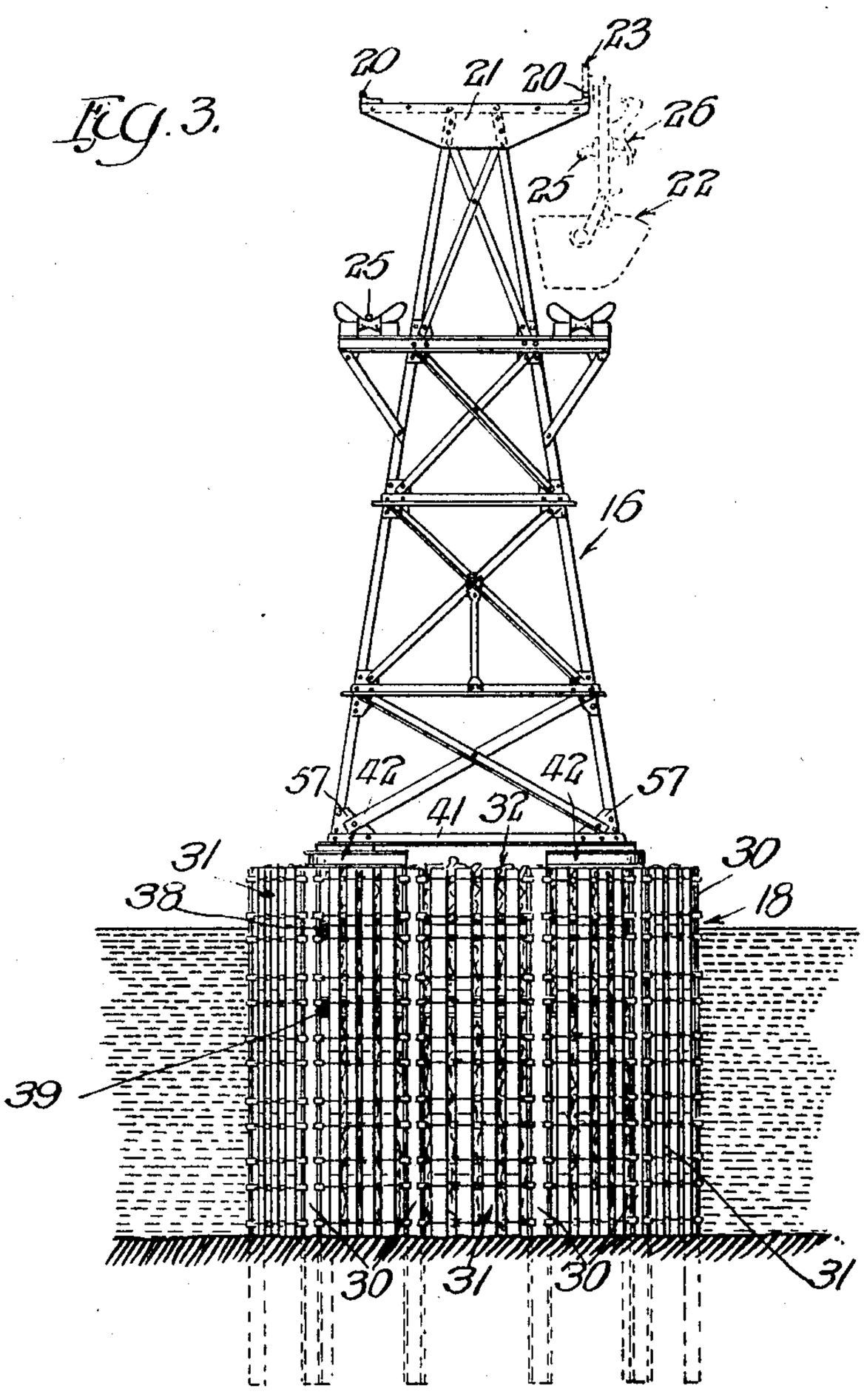
APPLICATION FILED MAY 5, 1908.

916,158.

Patented Mar. 23, 1909.

3 SHEETS—SHEET 2.

Fig. 3.



Witnesses:
F. H. Alfred
M. Stall

Inventor:
George W. Jackson
by Reed & Brown
Attys

G. W. JACKSON.

MARINE AERIAL TRAMWAY.

APPLICATION FILED MAY 5, 1908.

916,158.

Patented Mar. 23, 1909.

3 SHEETS—SHEET 3.

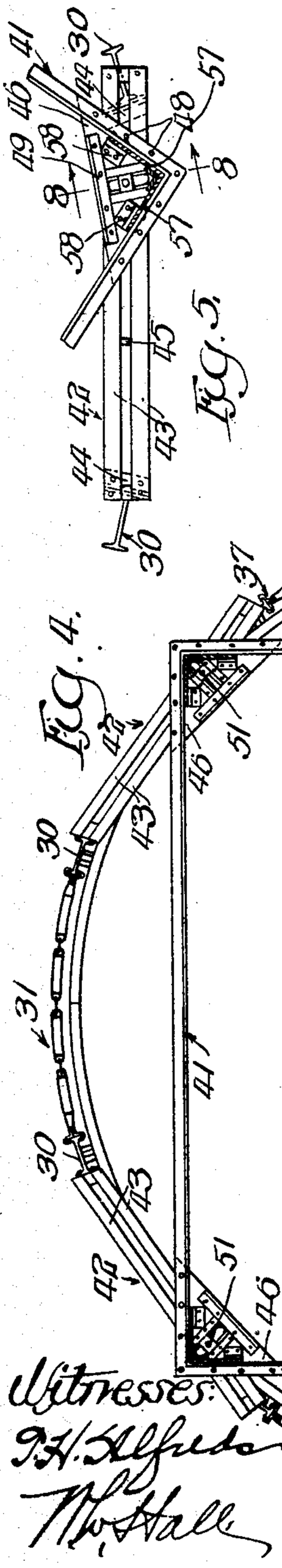


Fig. 5.

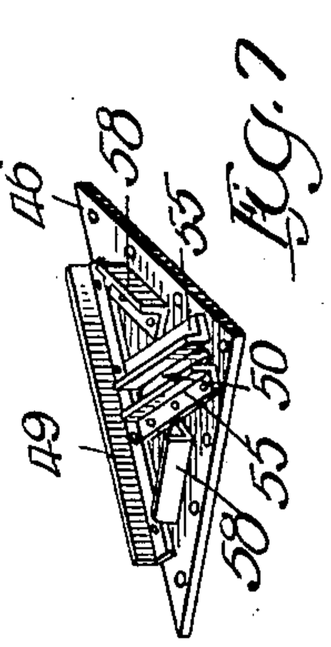


Fig. 7.

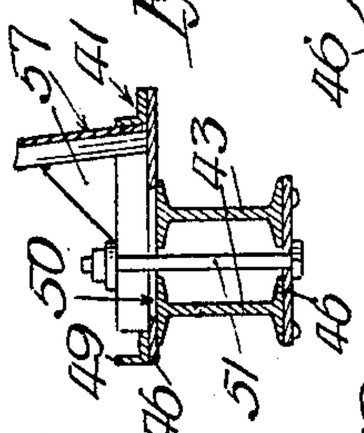


Fig. 8

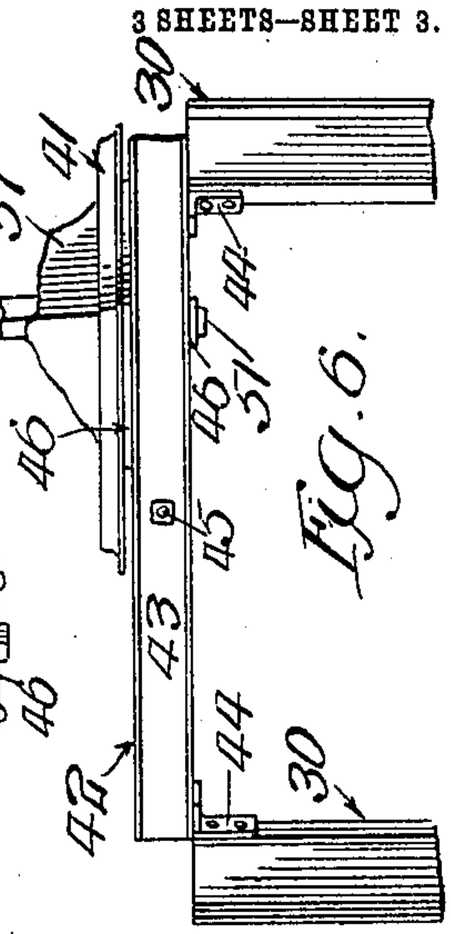


Fig. 6.

Fig. 4.

Witnesses:
W. Alfred Hall
W. D. Hall

Inventor:
George W. Jackson
by Poole & Brown
Attys

UNITED STATES PATENT OFFICE.

GEORGE W. JACKSON, OF CHICAGO, ILLINOIS.

MARINE AERIAL TRAMWAY.

No. 916,158. Specification of Letters Patent. Patented March 23, 1909.

Application filed May 5, 1908. Serial No. 430,981.

To all whom it may concern:

Be it known that I, GEORGE W. JACKSON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Marine Aerial Tramways; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the numerals of reference marked thereon, which form a part of this specification.

This invention relates to a marine aerial tramway designed to transport articles from one point to another over a body of water, as from a point on the shore to seaward, or vice versa.

The invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

In the drawings:—Figure 1 is a diagrammatic side elevation of a marine aerial tramway embodying my invention. Fig. 2 is a top plan view of one end of the tramway, showing one of the supporting towers and a wheel at the power house for operating the traveling cable of the tramway. Fig. 3 illustrates one of the towers and its supporting piers as viewed from section on line 3—3 of Fig. 1. Fig. 4 is a top plan view of the shell of the pier and the tower supporting frame. Fig. 5 is a detail illustrating the means for connecting the load supporting frame with the shell of the pier. Fig. 6 is a side elevation of the parts shown in Fig. 5. Fig. 7 is a detail illustrating a part connecting said load supporting frame and the pier. Fig. 8 is a section taken on line 8—8 of Fig. 5.

A tramway embodying my invention may be used for a variety of purposes where it is desired to transfer articles from the shore to a distant point in a lake or other body of water, or from a seaward location to the shore or to other points. A concrete adaptation of my tramway is herein illustrated, wherein it is shown as designed to be employed as part of an equipment or appliance used in the construction of a tunnel beneath a lake or body of water, which extends inwardly from the shore beneath the lake or to a point distant in the lake or like body of water. The tramway extends, in this adaptation thereof, from a shaft house on the shore to a crib located a distance in the lake or other body of water. The crib and shaft house, in this use of the tramway, are located above the line of the proposed tunnel, and shafts are sunk downwardly therefrom to the tunnel level, whereby the work of constructing the tunnel may be carried on from both ends thereof. The material removed from the seaward end of the tunnel is transported over the tramway to the shore, and material used in the construction of the tunnel is transported from the shore over said tramway to the seaward end of the tunnel. Likewise, the tunnel operatives or construction gang may be transported toward and from the seaward end of the tunnel on the tramway. The shaft leading downwardly from the crib to the tunnel level may be located at the end of the proposed tunnel or midway between its ends, in which latter event the work of excavating the tunnel and building the walls thereof will be carried on in both directions from the crib shaft. Said illustrated and proposed use of the tramway for conveying the excavated material from, and conveying the tunnel constructing material to, the crib, as well as conveying the operatives to and from the crib greatly simplifies and reduces the cost of handling the material and the operatives, inasmuch as it avoids the use of tugs and scows for this purpose.

Inasmuch as the tramway herein shown is adapted for use in connection with tunnel construction, it is hereinafter specifically described in connection with this use. It will be understood, however, that the tramway may be adapted to other uses as, for instance, it may be used for loading and unloading vessels from and to the shore, which are of such draft as to make it impracticable to unload such vessels on wharves located near the shore.

As shown in said drawings, 10 designates a shaft house located on the shore, and 11 a crib located a distance from the shore. Said shaft house is designed to contain machinery for operating the tramway and it is located over a vertical shaft 12 that extends to the level of the proposed tunnel 13 at the shore end thereof. A shaft 14 likewise extends downwardly from the crib to the level of the seaward end of the tunnel.

The tramway embraces a plurality of towers 16 which are arranged in a row between the shaft house and the crib and are located at suitable distances apart. The towers which are located over the deeper

part of the body of water are supported on piers 18, 18 which are sunk into and supported on the bottom beneath said body of water and extend at their upper ends to above the level of the water. The said piers 18, 18 are herein shown as made like the piers described and claimed in my copending application for U. S. Letters Patent filed of even date herewith, Serial No. 430,982. The towers carry two parallel tram cables 20, extending from the shaft house to the crib, which are supported on the outer ends of cross arms 21, 21 on the upper ends of said towers. Said tram cables constitute tracks for skips or cars 22 of any suitable or preferred construction which are suspended from, and are provided with wheels 23 which travel on, said tram cables. The towers also support an endless traveling cable 25, the side members of which lie on opposite sides of the towers, and which are adapted for connection with suitable gripping devices 26 carried by the cars or skips, whereby the latter are conveyed along the tram cable from one end of the tramway to the other. The cars or skips connected with one side of the traveling cable travel seaward, while those connected with the side of said cable on the other side of the towers travel shoreward. The endless traveling cable 25 is trained at the ends of the tramway about suitable guiding and driving sheaves, the driving sheave 27 at the shore end of the tramway being located in the shaft house 10. The ends 28 of the tram cables are anchored in any suitable manner at the shaft house and crib so as to hold said cables relatively taut. The said skips or cars are transferred from one tram cable to the other around the driving sheave 27 over a curved track 30, the ends of which lie in line with the tram cables.

The piers 18 each embrace a plurality of metal sheet piles 30 of I-beam cross section, as herein shown, which are driven into the bottom beneath the lake or other body of water over which the tramway is located, and are arranged to surround an area which the pier is to occupy. The said piles afford support for a plurality of sections or panels 31 which extend between and are interlocked at their ends with said piles to constitute, with said piles, a cage-like shell or wall which incloses the area occupied by the pier. The space within said shell or wall is filled with a body 32 of stone or other filling material which gives body or permanence to the pier to resist lateral stress brought thereon. Said filling material may be of such material, as concrete or the like, as to harden after it has been placed in the pier shell or wall to constitute a solid filling body. The said piles 30 are driven a distance into the bottom of the lake or other body of water and extend at their upper ends a distance above the level of the water. The panels or sections which constitute the principal part of the wall or shell of the piers are arranged in a plurality of horizontal rows, superposed one on the other, the lowermost row resting on the bottom of the lake or other body of water and the top row thereof extending to or near the top of the piles. The panels or sections, as herein shown, each comprise a plurality of vertical, laterally spaced bars 35, 35 made of heavy planks or the like which are supported on upper and lower rows of chains or flexible strands 36, 36 that are provided at their ends with hook-shaped clips 37 which interlock with and are adapted for sliding connection on the flanged margins of the piles. The upper ends of said piles are bound or tied together by means of a ring 38 which is located within the circular row of piles and is rigidly attached thereto. The said shell is further strengthened or braced by an interior bracing ring 39 which is designed to be suspended from the upper tying or binding ring. The foregoing construction corresponds with the construction of the pier described in my aforesaid application and need not be more specifically described here. Moreover, so far as is concerned certain features of the invention the construction of the pier may be varied. The said towers 16 are supported on and connected with the piers through the medium of tower or load supporting frames 41 which are made and attached to the pier structures as follows: Said frame is rectangular and is made of angle bars, as herein shown, which are attached to each other at the corners of the frame. The frame is of such dimension that the four corners thereof extend slightly beyond the curved line of the cage-like shell or wall of the pier. The corners of said frame are supported on tangentially arranged, horizontal supports 42, each of which extends between the upper ends of two adjacent piles 30 of the pier and are attached thereto. Said supports 42 each consists, as herein shown, of two parallel I-beams 43, 43, the upper flanges of which are arranged horizontally and in the same plane to constitute broad supporting surfaces for the load supporting frame. Each pair of I-beams constituting a support 42 are attached to two adjacent piles 30 by angle brackets 44, the vertical members of which are attached to the webs of said I-beam piles and the horizontal members of which fit beneath and are attached to the lower flanges of said supporting beams. Said brackets thus constitute means at the ends of said beams for rigidly joining or connecting the same. The beams of each support may be further connected or tied together by bolts 45 extending transversely through the webs thereof, and plates 46 attached to the lower flanges of the beams. The load supporting frame 40 is connected with said supports 42

by means made as follows: Attached to the under side of said frame at the corners thereof are flat triangular plates 46, 46 which rest on the upper flanged sides of the supports 42. The said triangular plates are attached to the members of the frame 41 by bolts or rivets 48 which extend through the margins of said plates and through the horizontal flanges of said angle bar frame members. The inner margins of said plates are stiffened by reinforcing angle bars 49 which are riveted thereto. The said triangular frame plates are provided with slots 50 arranged diagonally with respect to the frame 40, downwardly through which extend bolts 51 which fastens the load supporting frame to the supports 42 of the pier. The said attaching bolts extend downwardly through the spaces or slots between the I-beam members of the supports 42 and through openings in the plates 46 attached to and extending between the members of said supports, as aforesaid. Arranged at the opposite sides of said slots 50 are two parallel angle bars 55 which are riveted to the plates 46 and stiffen the same, and against the vertical flanges of which the nuts of said attaching bolts 51 bear.

The arrangement of the slots 50 through which the fastening bolts extend, transversely with respect to the spaces or slots between the members of the supports 42 affords means for angularly shifting the tower supporting frame relatively to the pier, such adjustment being effected at a time when the nuts of the attaching bolts 51 are loosened, after which the nuts are tightened to rigidly fix or clamp said frame to the pier structure. Such angular adjustment of the tower supporting frame may likewise be effected by making the slots of the load supporting frame or the supports 42 curved concentrically to the vertical axis of the pier. The provision of means for adjusting the towers on the piers is advantageous inasmuch as it permits the tram cable supporting arms of the towers to be adjusted accurately at right angles to the line of the towers and thereby maintain the tram and overlying cables in proper adjustment with the parts on the towers which support the same.

The lower ends of the upright members of the tower extend into and are fastened at the corners of the frame by means of gusset plates 57 which are riveted to the lower ends of the members of the tower and are fastened to the plates 46 of the supporting frame by means of angle pieces 58, the horizontal members of which are riveted to the plates and the vertical members of which are riveted to said gusset plates and to the vertical webs of the angle bar members of the tower supporting frame, as best shown in Fig. 5.

I claim as my invention:—

1. A marine aerial tramway comprising a plurality of massive, stationary piers arranged in a row and resting on and anchored to the bottom beneath a body of water, a plurality of separate and disconnected metallic skeleton towers supported on and anchored to said towers and provided with means for supporting a tramway, a flexible tramway carried by said supporting means and means carried by said towers for moving a skip along the tramway.

2. A marine aerial tramway comprising a plurality of piers arranged in a row and resting on the bottom beneath a body of water, a plurality of towers supported on said piers above the body of water and having cross arms which carry a tram cable, means carried by the towers for moving a skip along said tram cable, and means for angularly adjusting said towers on said piers.

3. A marine aerial tramway comprising a plurality of piers arranged in a row and resting on the bottom beneath a body of water, a plurality of towers supported on said piers above the body of water, and carrying a tram cable and means for moving a skip along said cable, tower supporting frames supported on said piers on which the towers rest and to which they are attached, and means for adjusting said frames on said piers.

4. A marine aerial tramway comprising a plurality of piers arranged in a row and resting on the bottom beneath a body of water, a plurality of towers supported on said piers above the body of water and carrying a tram cable, tower carrying frames to which the towers are attached and means for attaching said frames to said piers, arranged to permit angular adjustment of the frames relatively to the central axes of the piers.

5. A marine tramway comprising a plurality of piers arranged in a row, each consisting of piles driven into the bottom beneath the body of water, and a shell or casing attached to said piles and surrounding the area which the pier occupies and filled with a mass of filling material, and towers supported on said piers above the water level and carrying a tram cable and means for moving a skip along said cable.

6. A marine tramway comprising a plurality of piers arranged in a row, each consisting of piles driven into the bottom beneath the body of water, and a supporting shell or casing attached to said piles and surrounding the area which the pier occupies, and filled with a mass of filling material, tower supporting frames supported on and carried by the upper ends of the piles of said piers, and towers supported on and attached to said frame above the water level and carrying a tram cable and means for moving a skip along said cable.

7. A marine aerial tramway comprising a plurality of piers arranged in a row, each

consisting of a plurality of piles which are driven into the bottom beneath the body of water, panels having interlocking and guiding connection at their ends with said piles and arranged to constitute a shell surrounding the area occupied by the pier, and a mass of filling material filling the said shell, and towers supported on said piers above the water level and carrying a tram cable and means for moving a skip along said cable.

8. A marine aerial tramway comprising a plurality of piers arranged in a row, each consisting of piles driven into the bottom beneath the body of water around an area occupied by the pier, panels or sections extending between and adapted for interlocking and sliding connection at their ends with said piles to constitute an inclosed shell or wall, and a mass of filling material filling the space inclosed by said shell or wall, tower supporting frames supported on the piles of said piers, and towers resting on and attached to said frames and carrying a tram cable and means for conveying a skip along said cable.

9. The combination with a pier comprising piles driven into the bottom beneath a body of water surrounding the area occupied by the pier, panels of sections extending between and adapted for interlocking and sliding connection at their ends with said piles to constitute an inclosing wall or shell, and a mass of filling material filling the space inclosed by said wall or shell, and a load supporting frame supported on the upper ends of the piles of the pier and attached thereto by means permitting angular adjustment of the frame relatively to the central axis of the pier.

10. The combination with a pier comprising piles driven into the bottom beneath a body of water around the area occupied by the pier, a shell or wall supported on the piles to inclose said area and a mass of filling material filling the space inclosed by said shell or wall, and a tower supporting frame attached to and having slotted connection with the upper ends of said piles of the pier, whereby said frame may be angularly adjusted relatively to the central axis of the pier.

11. Means for removing material from and conveying material to the seaward end of a tunnel built under a body of water, comprising a crib located in the body of water above the line of the tunnel and associated with a vertical shaft which extends to the tunnel level, and a tramway extending from said crib to the shore comprising a plurality of piers arranged in a row and resting on the bottom beneath the body of water, and towers supported on said piers and carrying a tram cable and means for operating a skip on the tram cable.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of witnesses, this 29th day of April A. D. 1908.

GEORGE W. JACKSON.

Witnesses:
J. C. MOORE,
R. V. MEGARY,
G. R. FEHR.