C. E. RICHARDSON.

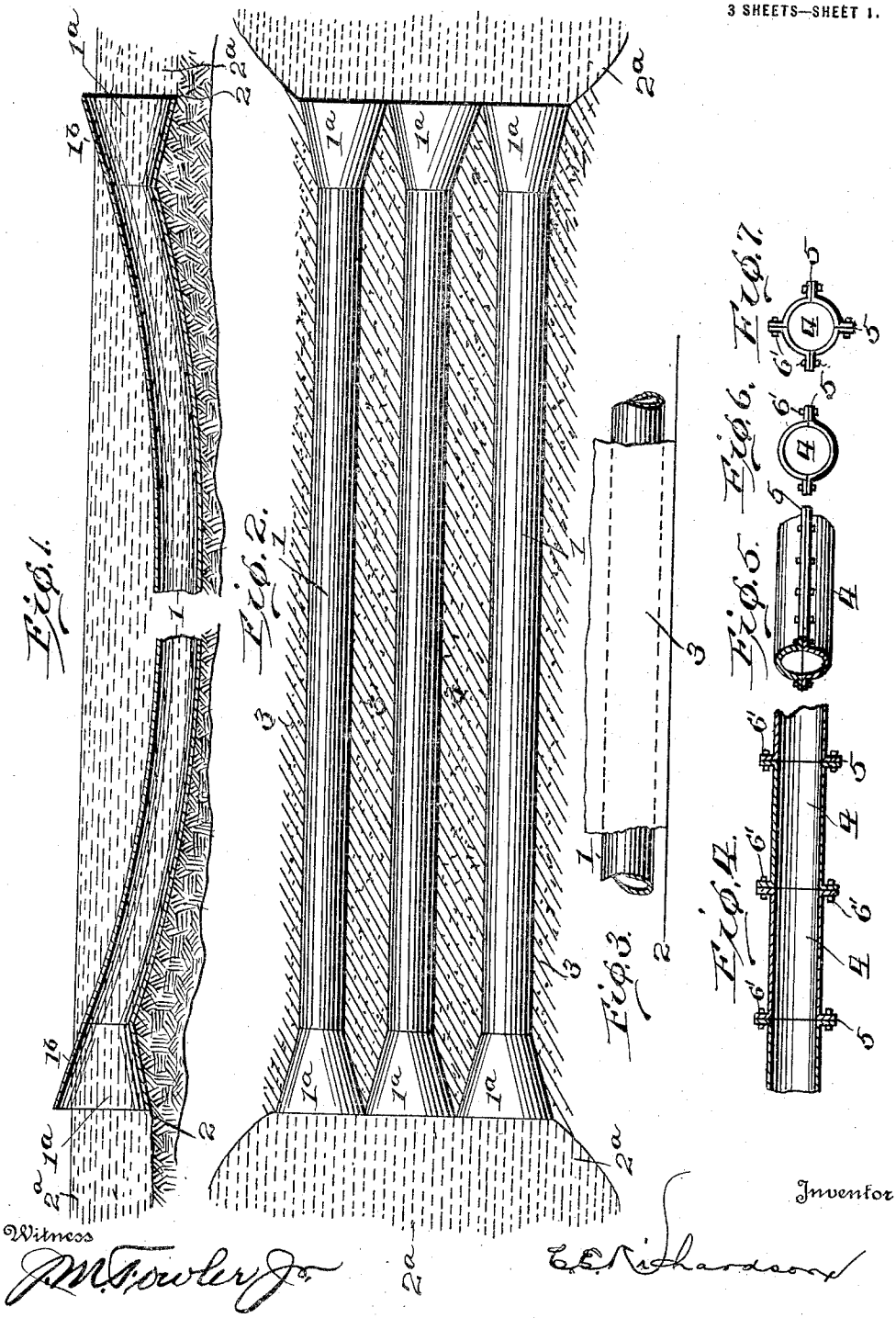
SYSTEM OF TRANSPORTATION.

APPLICATION FILED NOV. 2, 1917.

1,276,115.

Patented Aug. 20, 1918.

3 SHEETS—SHEET 1.



Witness

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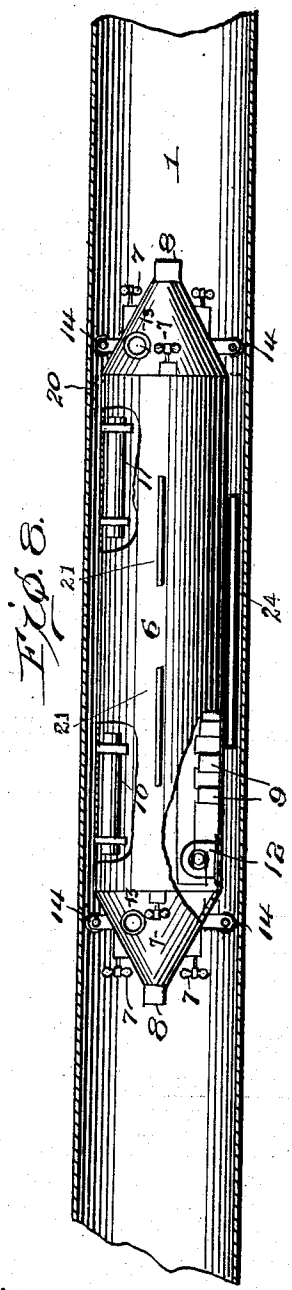

Fig. 8.

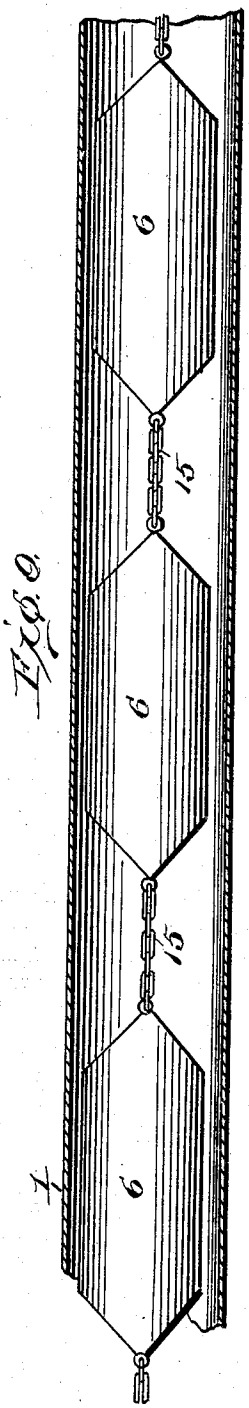

Fig. 9.

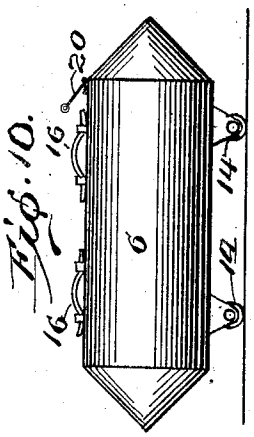

Fig. 10.

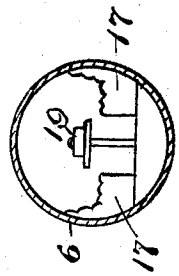

Fig. 12.

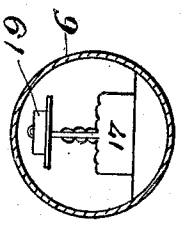

Fig. 11.

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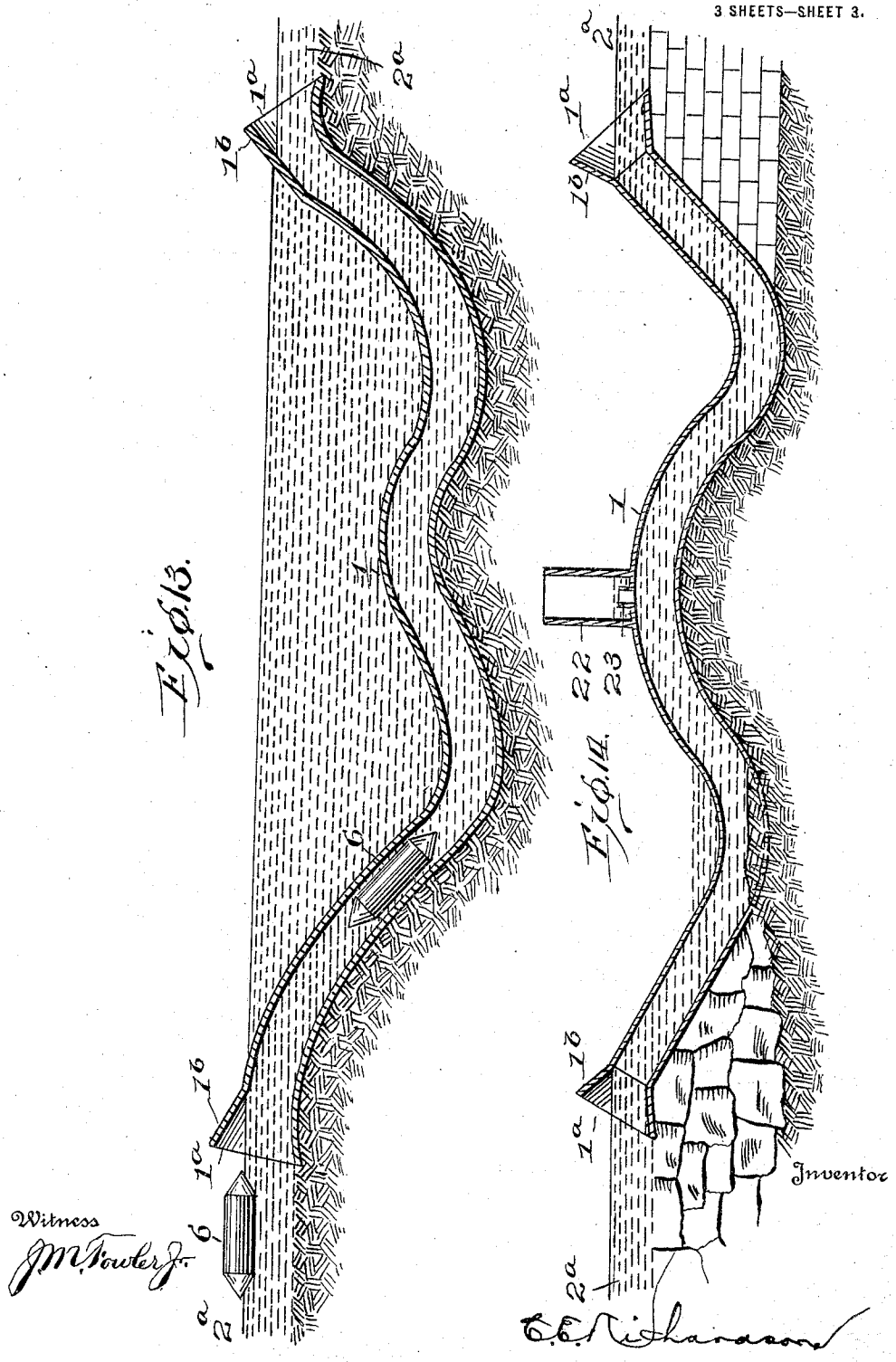
3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

CHAUNCEY E. RICHARDSON, OF CHEVY CHASE, MARYLAND.

SYSTEM OF TRANSPORTATION.

1,276,115. Specification of Letters Patent. Patented Aug. 20, 1918.

Application filed November 2, 1917. Serial No. 199,946.

To all whom it may concern:

Be it known that I, CHAUNCEY E. RICHARDSON, a citizen of the United States, residing at Chevy Chase, in the county of Montgomery and State of Maryland, have invented certain new and useful Improvements in Systems of Transportation, of which the following is a specification.

This invention relates to an improved method for traversing waterways and land over which surface travel is inconvenient, expensive, slow or hazardous; and it involves an entirely new system of transportation. The invention consists of the matters hereinafter described and more particularly pointed out in the annexed claims.

One object of the invention is to provide a safe means of navigating waters that are otherwise difficult to cross and to obviate the delay and expense of dry-tunneling. Another is to provide means of water communication that is safe for submarine boats under certain conditions. A further object is to provide a subaqueous tunnel which need not be dry or waterproof. A still further object is to provide means for transporting bulk freight in large quantities without the usual traffic blockades. It is also designed to afford means for general transportation between distant points separated by land and water without the necessity for removing the natural obstructions to ordinary communication.

To these ends it is proposed to utilize tunnels and to operate through said tunnels submarine boats of suitable types and equipment.

A tunnel such as is contemplated by this invention may be created by boring, but it is preferably formed of pipes, which can be made at factories anywhere and bolted or otherwise assembled when and where permanently laid, wherther on or in the bed of a waterway or other place of utilization. It may be used on land, either above or below the surface, or on trestles or aqueducts, or wholly submerged. Such a tunnel is intended preferably to accommodate traffic in one direction only, and they may be constructed in pairs or in groups, and as many such pipes, pairs or groups may be employed as the traffic requires, some for passengers and others for freight, according to the volume of business.

The tunnel, when consisting of a pipe, may be of any required diameter, but it should be large enough to permit the passage of boats of practical utility, as, for instance, a ten-foot pipe which would pass therethrough a boat approximately eight feet in diameter. This tunnel may be cheaply constructed from iron, steel or any suitable material, and formed by the combination of such sections as may be most convenient to assemble in place. It may be the ordinary cylindrical tube or of any other desired form, and it may be either straight or curved. It is important, however, that the tube be strong enough to avoid buckling when suspended, as it may be in places, from natural or artificial supports.

It is obvious that the joints of the pipe tunnel for subaqueous use need not be watertight, because there its principal object is to serve as a guide for the passage of submarine boats, much as the torpedo-tube guides its projectile; and it might as well be a skeleton frame if that could exclude all possible obstructions. Such a pipe tunnel, when used in the ordinary waterway, may be laid in a trench, or merely on the bottom, as it is very apt to become buried by reason of its weight and by the aid of marine currents. Where further reinforcement of the tunnel is desired, this object may be attained by raising a mound of rock, concrete riprap, sand or other material over the same for portions of or for its entire length.

The submarine boats contemplated by this invention may be of any desired form, but preferably of a cross-section the same as the cross-section of the conduit which they are to traverse, as, for instance, the fore-and-aft projectile-like vehicle shown in the accompanying drawings, which permits the use of a plurality of screw-propellers at each end without the danger of their damage by colliding.

Boats may be propelled by their own power, on the screw, siphon, trolley, traction or other method, or directed by wireless electricity, operated by gravity, by hydraulic or pneumatic pressure, by siphoning of the tubes, or by any one or combination of methods that may be found most suitable for the purpose; and they may be operated singly or in trains, and either pushed or drawn. For illustrative purposes I have shown such a boat equipped with storage batteries and electric motors, as one of the abovementioned means. An endless chain

or cable passing through one tunnel and back through another would afford almost unlimited opportunity for the movement of freight over limited distances between relay stations. A siphon system, under certain circumstances, might be profitably employed, and the same water could be returned through the twin conduit. Boats may be provided with friction-pulleys, spring fenders, or other means to facilitate their alinement with the tunnel-sides and to equalize the resistance.

In the drawings, Figure 1 is the longitudinal section of a pipe tunnel laid on the bottom or bed of a waterway, with its accompanying entrance and exit; Fig. 2 is the perspective of a plurality of such tunnels protected by a dike, and having their termini in a common basin or harbor at water-level at either end; Fig. 3 is the side view of one tunnel with a protecting dike reinforcement; Figs. 4 and 5 illustrate possible methods of pipe construction; Figs. 6 and 7 are cross-sections in detail of 4 and 5; Fig. 8 is a broken side view of a submarine boat in a tunnel; Fig. 9 is the longitudinal section of such a tunnel and a train of boats being towed therethrough; Fig. 10 is the side view of a boat equipped with friction-pulleys, spring-fenders and a signal trolley; Figs. 11 and 12 are detail cross-sections showing passenger and luggage disposal in a submarine boat; Fig. 13 is the longitudinal section of a subaqueous tunnel following the natural contour of a water-bed; and Fig. 14 is the longitudinal section of an overland tunnel, with means for maintaining the water-balance therein by a water tower and vent thereto connected, and with a basin-terminus erected to the required elevation and supported by masonry.

The numeral 1 represents a pipe-tunnel; 1^a its flaring termini, 1^b the water-surface level, 2 the bed of a waterway, 2^a the basin or harbor, 3 the reinforcing dike, 4 sections of pipe, 5 and 6' pipe-fastenings, 6 a submarine boat, 7 screw-propellers, 8 buffers, 9 storage batteries, 10 compressed-air tank, 11 oxygen tank, 12 electric motors, 13 port holes, 14 friction-pulleys, 15 towing-chains, 16 spring-fenders, 17 seats, 18 luggage racks, 19 luggage, 20 spring signal-trolley, 21 hydroplanes, 22 water-pressure tower, 23 feed-and-vent pipe, and 24 a keel.

By the improved method herein outlined, it is possible to construct a system of transportation in a fraction of the time and for a small portion of the expense required in boring and waterproofing a tunnel below water-level; and, compared with a railroad or open canal, this method presents marked advantages over either, in points of utility and economy. Its operation and maintenance are inexpensive compared with other systems of transportation, and the possibilities for rapid transit by this means are great.

Each boat may be equipped with one or more motors and propellers, and as many of these may be operated as occasion dictates—varying according to whether running submerged or on the surface, and in proportion to the speed required. Obviously, one boat may propel others, and boats may be constructed without motive power therein, to be pushed, drawn or otherwise operated. Boats may be propelled as closely together as cars in a train, for each is provided at bow and stern with buffers, 8, which may be hydraulic, pneumatic, spring or of any other type, and no severe impact is possible from contact. These buffers may also be provided with interiorly-operated coupling devices. The water-cushion between the boat and the tunnel walls is equalized by the friction-pulleys or other similar equipment, so that the resistance is balanced on all sides and the boat's direction is constantly centered while it is in the conduit.

In operation, boats of the type indicated can be loaded at any convenient point having water communication with a tunnel entrance; and it is entirely feasible to construct such a tunnel overland for any distance and to maintain a water-level at any required elevation whereby grades are surmounted and other transportation obstacles are overcome. In this way lines could be operated between London and Paris, without the necessity for changing at Dover and Calais. Similarly, tunnel and open-water communication between Washington and New York can be made by the shortest geographical distance. Whenever such boats are operated in open water, they are of course susceptible of surface navigation, and need not be closed until reaching the basin 2^a. In entering the month of a tunnel 1^a, the boat is automatically guided therewithin by the gradually tapering sides thereof, and it becomes submerged without other mechanical process. Upon emerging from a tunnel, boats will naturally rise to the surface, and this is announced interiorly by a signal given by the spring-trolley 20 as it is released by the emergence of the boat from the tube. It is then possible to remove portions of the decking and to proceed as a surface boat.

The electric lights with which a passenger boat is equipped, the facilities for maintaining the quality of the air-supply, together with the smoothness of travel, comfortable accommodations and great speed possible, render this means free from the ordinary discomforts of travel. Any rolling motion that might be objectionable is prevented by the hydroplanes 21, the keel 24, and by the disposition of ballast.

Boats may be as long as the curves of the

tunnel will permit; and, because little space is required for machinery and crew, much capacity is available for passengers and freight. As the batteries with which boats may be equipped are recharged from the shore at terminal points, boats are not required to carry motive power for this purpose. In an emergency, a boat may be propelled by the next; and as telephone communication may be constant between boats and with the termini, coöperation is always possible. Frequent inspection of the tunnel's interior is possible from smaller submarine boats equipped and illuminated for that purpose, and sand or other substances may be removed by sweeping, dragging or other suitable means.

As a means for continental transportation, this method affords freedom from many of the engineering difficulties ordinarily encountered in railroad and open canal construction. As the soil-surface is restored after the laying of a tunnel, the cost of right-of-way is materially lessened; no roadbed has to be graded, no crossings guarded, no snow-fences built, no bridges constructed, no expensive terminals maintained, and few men employed, much of the loss and damage of railroading is avoided. Converging lines can be accommodated at convenient points, where a basin or water-front of moderate dimensions will bear much traffic, and this can be despatched with little or no interruption, continually and continuously. In the transportation of grain, ore, cotton, coal, and other bulk commodities, more than the ordinary speed is possible; for the discharging of such cargo with the aid of mechanical or magnetic hoists by which a boat is dumped, is the work of minutes.

Wherever natural waterways are available for the purpose, it is of course feasible to employ them in conjunction with the tunnels herein described; and, wherever open canals may properly serve a purpose in this connection, their use is also contemplated. The use of interval relay stations is obviously necessary for local traffic, but express tunnels may be longer if desired. Upper levels are necessary in transcontinental traffic, and may be maintained by locks at suitable stations, in the usual way. The despatching of boats, by directing them into their respective tubes, like the chuting of logs in a mill-pond, affords much economy of time and labor, as well as of money.

Further details and other safety measures suggest themselves, and it is obvious that various modifications may be made in the construction shown and described, without departing from the spirit and scope of my invention.

I claim:

1. In a system of transportation, the combination with a conduit containing a liquid, of a submarine boat in said conduit, and arranged to be propelled therethrough between distant points.

2. In a system of transportation, the combination with a liquid-filled conduit submerged in a body of water, of a submarine boat in said conduit and arranged to be propelled therethrough between distant points.

3. In a system of transportation, the combination with a liquid-filled conduit submerged in a body of water and having entrance and exit openings adjacent to the surface of the said water, with its intermediate portions submerged at a greater depth than its entrance and exit portions, of a submarine boat in said conduit and arranged to be propelled therethrough between distant points.

4. In a system of transportation, the combination with a liquid-filled conduit, of a submarine boat of cross-section substantially the same as the cross-section of the conduit and arranged to fit loosely therein, and means for propelling said boat therethrough between distant points.

5. In a system of transportation, the combination with a liquid-filled conduit having means for maintaining a water-balance in said conduit when it extends over varied elevations, of a submarine boat in said conduit and arranged to be propelled therethrough between distant points.

6. In a system of transportation, the combination with a liquid-filled conduit submerged in a body of water, or laid upon, or buried under or supported by the dry land, of a submarine boat in said conduit, and arranged to be propelled therethrough between distant points.

In testimony whereof I have affixed my signature.

CHAUNCEY E. RICHARDSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."