No. 790,046. PATENTED MAY 16, 1905.

P. J. GILDEA.

SUBMARINE CAISSON AND TUNNEL CONSTRUCTION.

APPLICATION FILED AUG. 26, 1904.

3 SHEETS—SHEET 1.

FIG. 1.

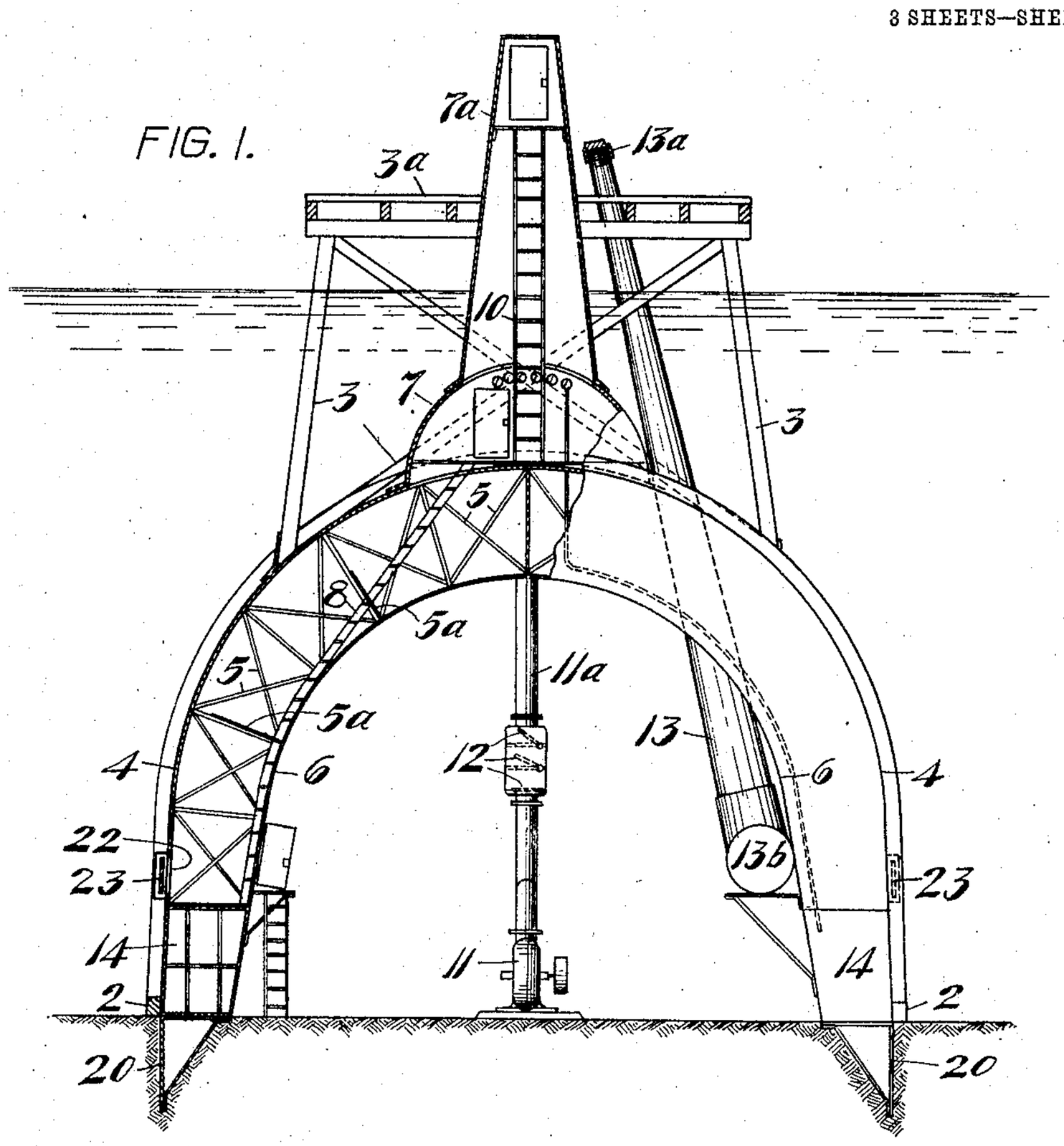

FIG. 2.

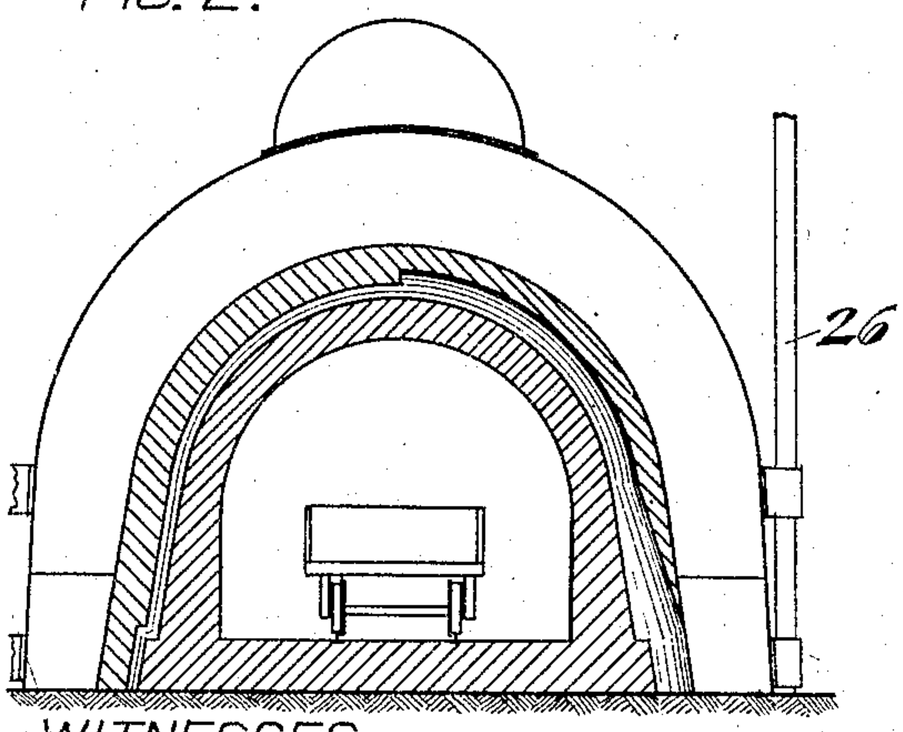

FIG. 3.

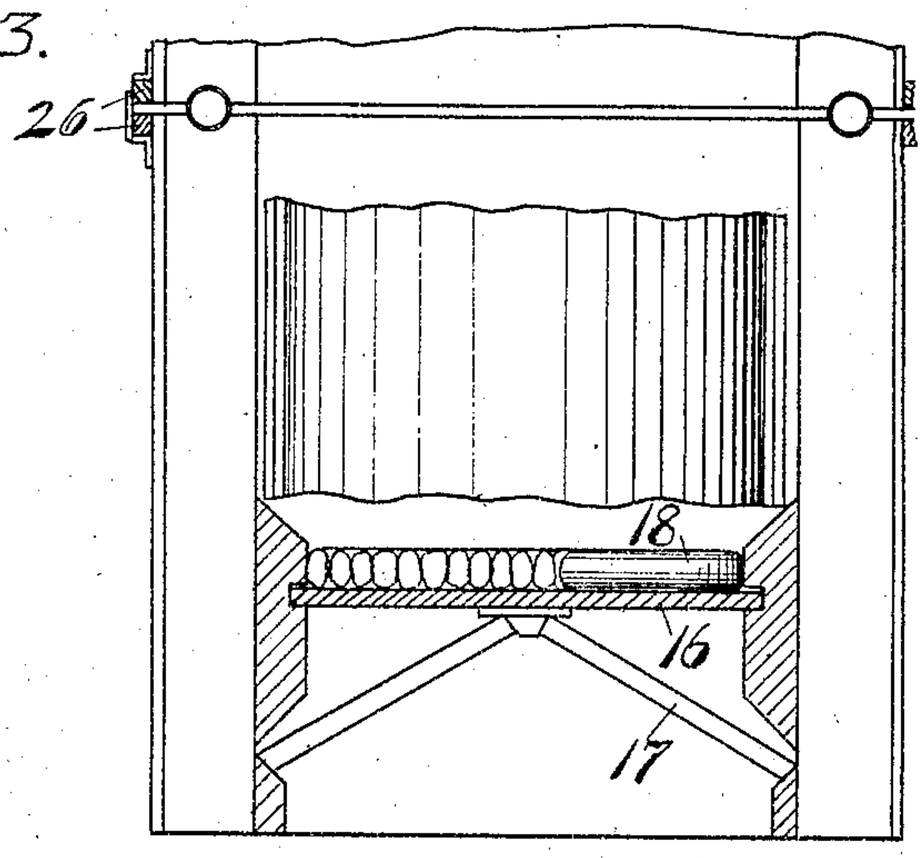

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FIG. 4.

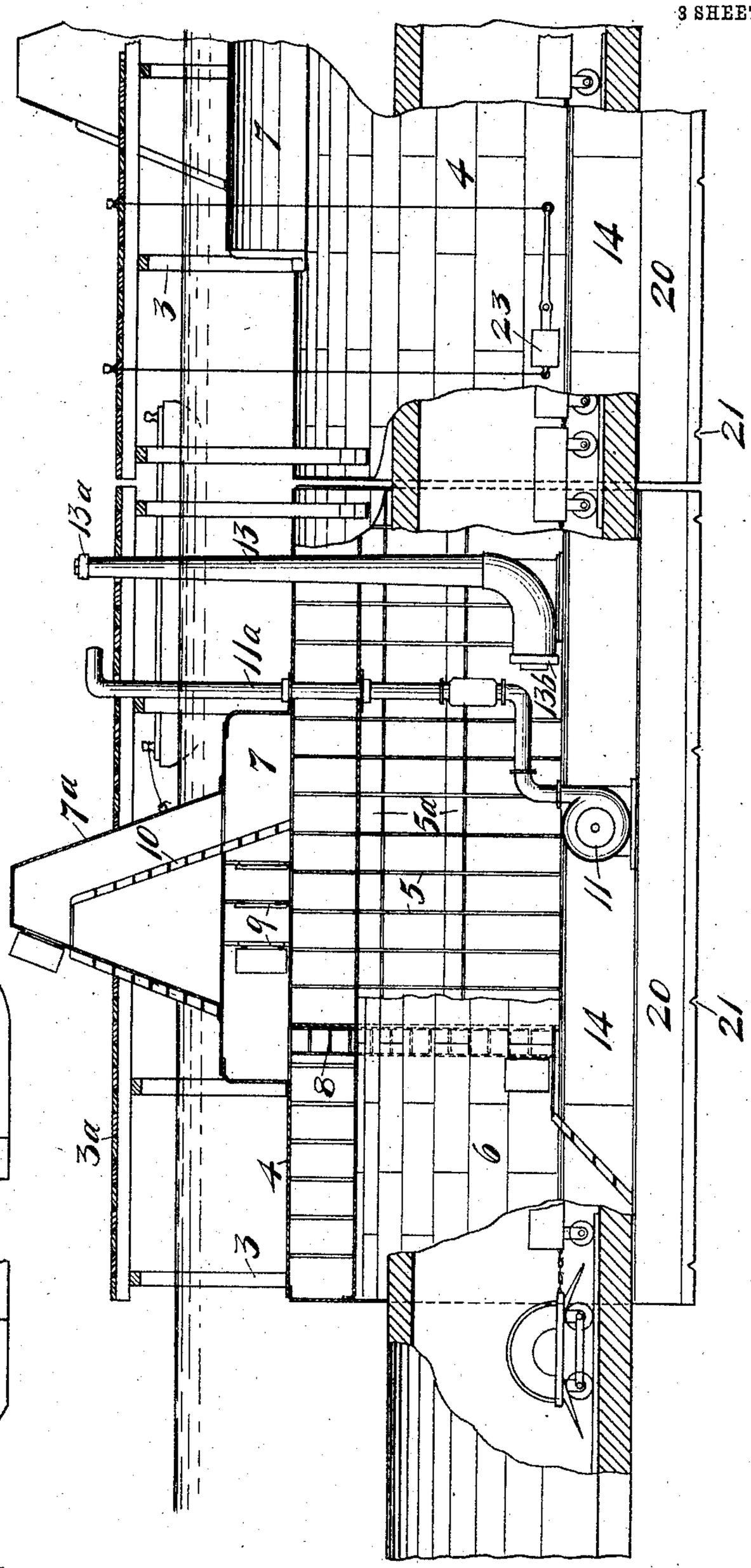
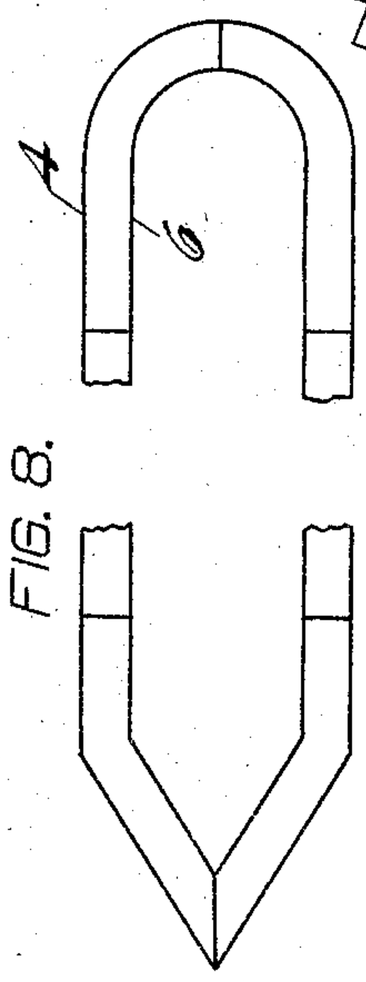


FIG. 8.



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3 SHEETS—SHEET 3.

FIG. 5.

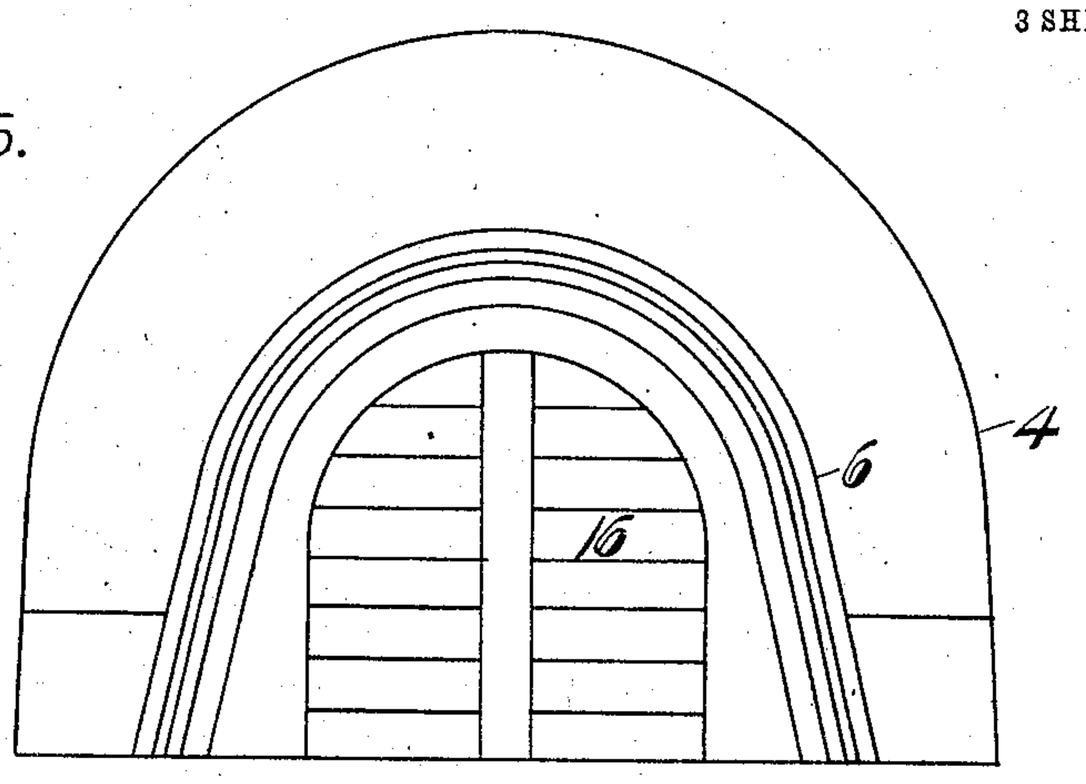


FIG. 6.

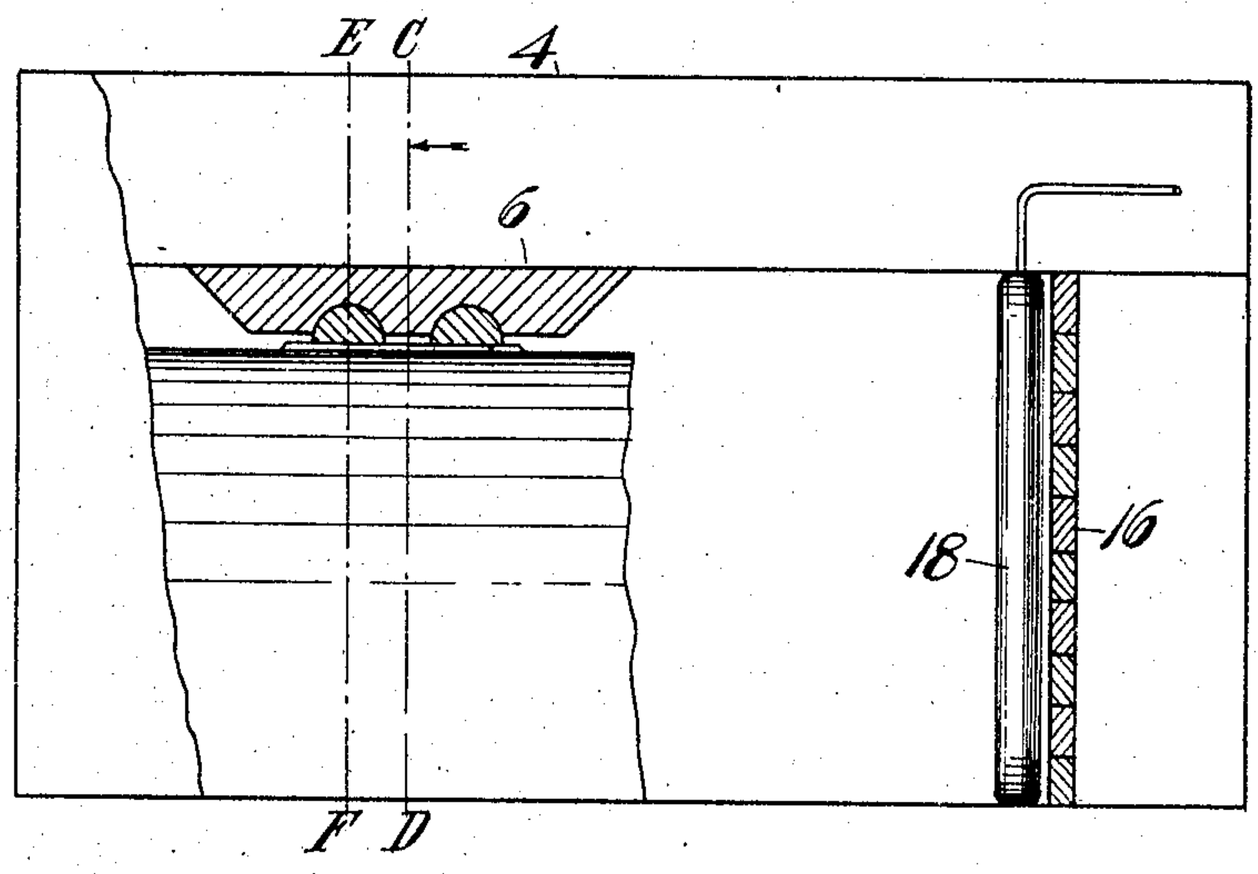
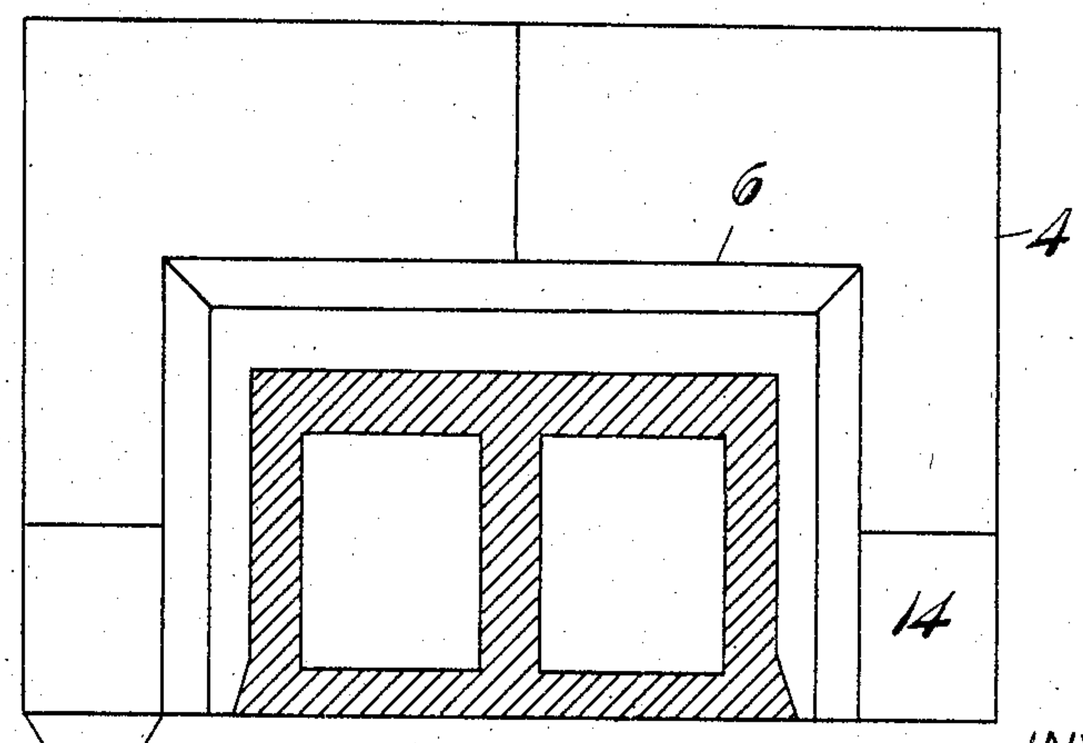


FIG. 7.



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UNITED STATES PATENT OFFICE.

PETER J. GILDEA, OF SAN FRANCISCO, CALIFORNIA.

SUBMARINE CAISSON AND TUNNEL CONSTRUCTION.

SPECIFICATION forming part of Letters Patent No. 790,046, dated May 16, 1905.

Application filed August 26, 1904. Serial No. 222,269.

To all whom it may concern:

Be it known that I, PETER J. GILDEA, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Submarine Caisson and Tunnel Constructions, of which the following is a specification.

My invention relates to an improvement in caisson and tunnel construction.

It consists in the combination of parts and in details of construction, which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is an end elevation, partly in section, of my invention. Fig. 2 is a section showing tunnel on lines C D and E F of Fig. 6. Fig. 3 is a plan view in section, showing bulkhead and means for making ends of caissons water-tight. Fig. 4 is a longitudinal section and outside view of two caissons and tunnel. Fig. 5 is an end elevation of tunnel and bulkhead. Fig. 6 is a longitudinal section of same. Fig. 7 is a modified form of caisson and tunnel. Fig. 8 is a plan view of caisson with closed ends.

The object of my invention is to provide a means by which large spaces of ground covered with water may be laid bare, so that men and machinery may be safely employed at all such work as mining excavation, building, recovering lost valuables, &c., and the structure may be of sufficient size to incase the hull of a vessel or other sunken structure. Means are provided for connecting the working interior portion directly with store-rooms and an ingress-chamber with interposed air-locks, and the whole is surmounted with a platform, with means for communicating directly between said platform and the interior of the caisson. The apparatus is provided with ballast-chambers having longitudinal partitions to prevent the ballast from shifting and independent air-chambers, with means for filling or emptying them.

As shown in the accompanying drawings, the caisson consists of outer and inner shells 4 and 6, which are made of any suitable or desired shape and size, depending upon the work to be done. If a tunnel is to be constructed, the caisson will be made in the form of an inverted arch, the outer and inner walls of which are formed of sufficiently-heavy plates so riveted as to be water-tight, and these are held together and braced by suitable stays, as shown at 5. The ends of the caisson-section may be closed by a bulkhead made of timber, as shown at 16, with suitable braces, as at 17, and close joints may be made to prevent leakage at this point by means of flexible air-bags, as shown at 18, capable of being expanded against the walls and within the bulkhead.

From the lower edge of the outside shell 4 a steel or other plate extends downward, as shown at 20. These plates located on each side extend the length of each caisson-section, and they have openings or ports made through them, as shown at 21, near the lower edges, so that when the apparatus is in position and ready to sink air introduced under sufficient pressure will expel the water through these openings or channels, leaving the interior substantially clear of water. The upper portion between the shells 4 and 6 is adapted to receive ballast of any description, which being introduced will cause the caisson to sink, and the plates 20, being forced into the material forming the bottom, will when they reach a sufficient depth assist to exclude the water and to prevent the air from escaping.

5[a] represents the longitudinal partitions.

The lower portion of the inverted arches, which form the caisson sides, are subdivided into a number of air-chambers, as shown at 14. These air-chambers in conjunction with the ballast serve to balance the caisson and cause it to float in the proper position to the point where it is to be sunk. The lower edges of the metal-work are here shown as protected by stout timbers, as shown at 2.

Through the sides of the caisson are made openings, as shown at 22, and these are controlled by gates, as 23. Through these openings, which are located above the air-chambers 14, ballast may be discharged from the upper portion of the caisson.

Upon the top of the caisson is a framework

or structure 3, which supports a platform 3ª, this platform being located above the surface of the water when the caisson is in place.

Upon the top of the caisson is a superstructure 7, which in the present case is shown in the form of an arch and having a vertical tubular shaft 7ª extending upward through the deck or platform 3ª, so that easy access may be had to this upper portion by means of a ladder, as at 10.

9 represents air-locks leading from the outer room into the inner portion of the compartment 7, and from this compartment a ladder or stairs of any description lead down into the inner portion of the caisson, as shown at 8.

13 represents a tube or pipe of any suitable dimensions extending from the deck 3ª down through the caisson and into the interior. This passage has suitable caps adapted to close and hermetically seal the top and bottom. The lower end of the tube 13 is here shown as being turned into a substantially horizontal position, and it forms a receiver into which articles needed within the caisson may be lowered when the upper cap 13ª has been removed. The lower cap 13ᵇ remaining in place prevents any escape of air from the caisson during the operation, and when the articles required have been lowered into the tube the upper cap is replaced, and the cap 13ᵇ may be removed and the articles taken out, this device serving as an air-lock for the purpose required.

In order to dispose of material which is excavated from within the tunnel, I have shown a pump, as at 11, with pipes leading to a discharge-pipe, as at 11ª, and intermediate outwardly-opening valves 12. The discharge-pipe is of sufficient height so that the column of water within this pipe will have a greater pressure than the pressure within the caisson, and by this apparatus the excavated material, being made sufficiently thin by the addition of water, can be discharged at will.

If a tunnel is to be built by the aid of this apparatus, it may be constructed as shown in the drawings, approaching in shape the interior surface of the caisson, and the space between it and the caisson may be made tight by means of bags made of heavy canvas, ducking, or rubber-coated and expanded by means of a fluid pumped into them, so as to completely fill the space between the interior of the caisson and the exterior of the tunnel. In this manner any leakage between the two may be entirely prevented.

The apparatus may be provided with guide-poles, as shown at 26, these poles serving to indicate the position of the caisson when sunk, and they serve to help steady each succeeding section while being lowered or set in place.

While the tunnel is being built it may be provided with air-locks similar to those previously described. These locks may be at any part of the tunnel, provided the tunnel is strong enough to resist the air-pressure. If not, the locks must be kept within that part of the tunnel which is located within the caisson. 7c

It will be understood that the steel aprons or extensions should be of such shape and strength that they may be forced into the ground by letting a part or all of the weight of the caisson rest upon them. This may be done by allowing the water to rise in the caisson, so as to increase the weight of the latter. When the extension is forced down into such material that the water will not find free way to escape where interior air-pressure is applied, the outlets or port-holes 21 become serviceable for the purpose, and if the bottom is of such a character as will admit the ports may be closed when the water is low enough, and the interior air-pressure may be reduced as much as the density and imperviousness of the bottom will allow. The extension or apron may be made in sections removable and interchangeable to suit the conditions of the bottom and may be packed in any suitable manner if required.

The air chambers or tanks 14, which are intended to steady the caisson in lowering or raising, may be of any size, shape, or number and so made that water can be pumped out or forced out by air-pressure. They may be built into and with the caisson, or they may be built separate and put in place at any time and may be changed to suit conditions, and in case of injury any of them may thus be removed or replaced at will. They may be of such depth as to extend to the top of the caisson or the surface of the water, and the proportions of air and ballast varied as may be found necessary.

The structure as heretofore described is particularly adapted for line or continuous work; but it is equally well adapted for working in inclosed spaces, in which case the caisson should be made of a length and width sufficient to inclose the space or object where work is to be done, and the ends of the caisson may be permanently closed and of any required or desired shape, as shown in Fig. 8.

If employed in a rapid current or in a tide or seaway, the end presented to the current or rush of water may be made narrow like the bow of a ship.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a caisson, an inner and an outer shell with intermediate arched truss-frame and ballast-compartments, said caisson having extension-plates below the lower edges of its sides.

2. A caisson comprising a truss-frame, inside and outside sheathing, ballast-chambers located within the structure, and independent air-chambers, said caisson having plates extending below the lower edges of its sides.

3. In a caisson, an arched truss or frame, inner and outer sheathing-plates forming an inclosed space, partitions extending fore and aft within the inclosed outer space forming ballast-chambers and preventing the shifting of said ballast, air-chambers located in the lower part and pipes whereby said chambers may be independently filled or emptied.

4. A caisson comprising an inner and outer sheathing, an intermediate truss-frame, longitudinally-separated ballast-chambers and independent air-chambers located in the lower part of the caisson sides and extension-plates below the lower edges of the sides.

5. A caisson comprising inner and outer shells, truss-frames between said shells with air-chambers in the lower parts of the caisson and superposed longitudinally-separated ballast-chambers, extension-plates projecting below the lower edges of the caisson, said plates having openings made through the sides as described.

6. A caisson comprising outer and inner shells with intermediate truss-frames and plates extending below the edges of the sides, a superstructure located upon the top of the caisson having chambers at opposite ends, one of said chambers having open communication with the interior of the caisson, the other having communication above the surface of the water, and air-locks and interspaces interposed between said chambers.

7. A caisson consisting of an inverted double-walled shell with intermediate truss-frames, a superstructure fixed upon the top of the caisson having chambers at opposite ends and having interposed air-locks, means connecting one of said chambers with the interior of the caisson, means connecting the other chamber with a point above the surface of the water, a platform and a framework whereby said platform is supported from the caisson above the surface of the water.

8. A caisson comprising inner and outer shells with intermediate air and ballast compartments, a superstructure and platform carried upon the caisson above the surface of the water, a tubular passage leading from the platform to the interior of the caisson for the transmission of articles, said passage having air-tight caps at either end as described.

9. A caisson comprising inner and outer shells with intermediate air and ballast compartments, a superstructure and a platform located above the surface of the water, with means for entering and leaving the caisson, a supplemental tube leading from the platform to the interior of the caisson, said tube having the lower end turned into a horizontal position serving for the introduction and reception of articles, and air-tight caps fitted upon the top and the inner end of the tube as described.

10. A caisson comprising a double-walled inverted arch with means whereby its lower edges are made tight with the bottom, the interior of said caisson being closed at the ends and capable of receiving air under pressure whereby the water is expelled therefrom, a centrifugal pump located within the caisson, a discharge-pipe leading therefrom for the delivery of material, outwardly-opening valves located in the discharge-pipe, said valves being normally closed by pressure within the pipe greater than the pressure within the casing.

11. A caisson comprising exterior and interior shells with air and ballast compartments, means for closing the ends of the caisson to form an interior chamber capable of receiving air under pressure whereby water is expelled therefrom, a tunnel-section built within the caisson, means for making tight joints between said tunnel and the interior of the caisson and at the closed ends of the caisson, said means consisting of flexible bags adapted to be expanded so as to form tight joints.

12. A caisson consisting of concentric arches with interposed air and ballast compartments, means for filling and discharging said compartments, edge plates projecting downward from the sides of the caisson to form close joints with the bottom, end gates fitted across the caisson, means for hermetically sealing the joints thereof, said means comprising flexible bags adapted to receive a fluid under pressure whereby they are expanded against the joints, and the caisson made capable of receiving air under pressure whereby the water is expelled.

13. A submerged structure consisting of a plurality of sections, said sections comprising inverted concentric arches with air and ballast chambers between and open interior working chambers, downwardly-projecting plates forming close joints between the caisson and the bottom upon which it rests, pipes whereby the air-chambers may be filled and the caisson floated to position, doors for the introduction of ballast when the air is expelled whereby the sections may be sunk in line with each other, means comprising flexible, expansible, fluid-containing bags adapted to form tight joints at the section ends whereby the caisson is adapted to receive air under pressure and a tunnel structure constructed therein, means for forming tight joints between the interior of the caisson and the exterior of the tunnel, so that the tunnel may be extended from time to time, said means consisting of flexible, expansible bags located between the tunnel and the caisson.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

PETER J. GILDEA.

Witnesses:
S. H. NOURSE,
GEORGE PATTERSON.