No. 835,238. PATENTED NOV. 6, 1906.

A. J. DUCELLIER.

APPARATUS FOR CONSTRUCTING SUBAQUEOUS WALLS AND THE LIKE.

APPLICATION FILED DEC. 29, 1904.

4 SHEETS—SHEET 1.

Fig. 1.

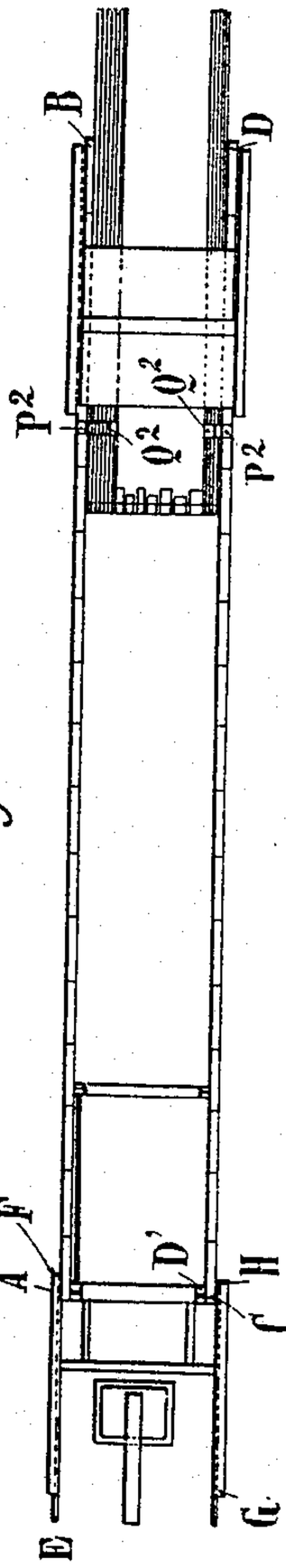

Fig. 2.

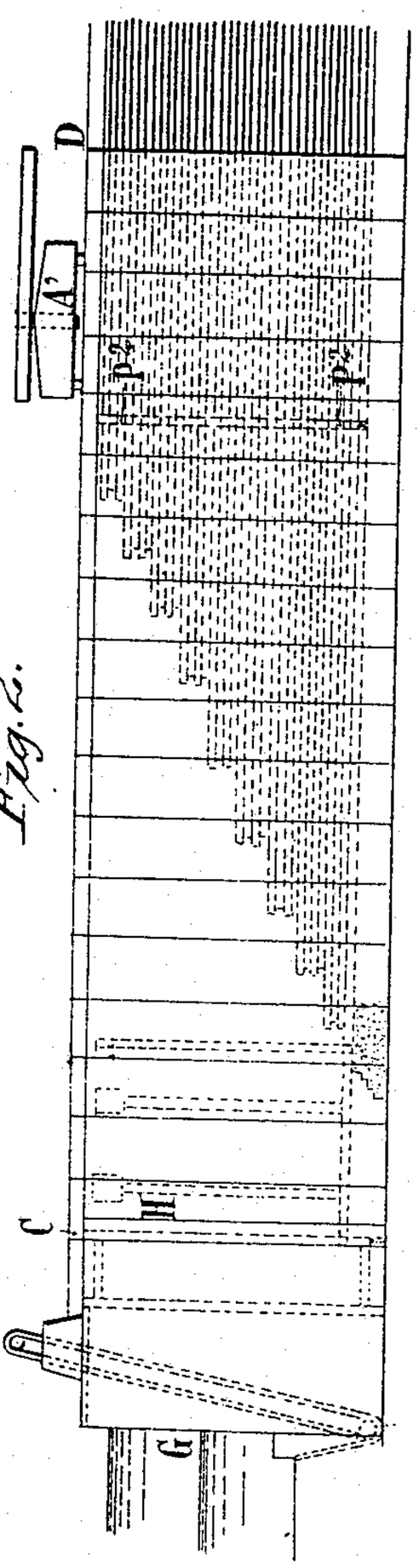

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Fig. 4.

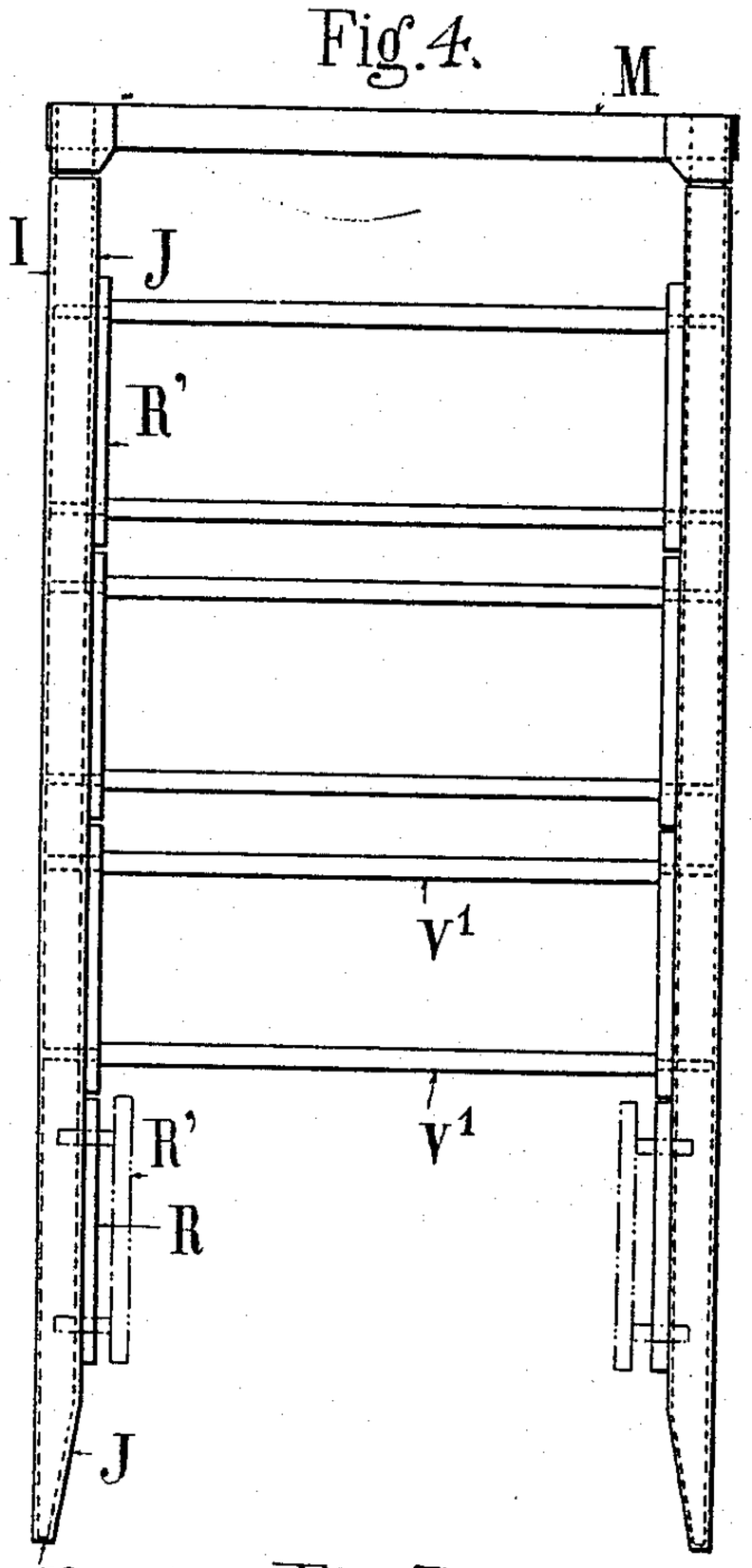


Fig. 3.

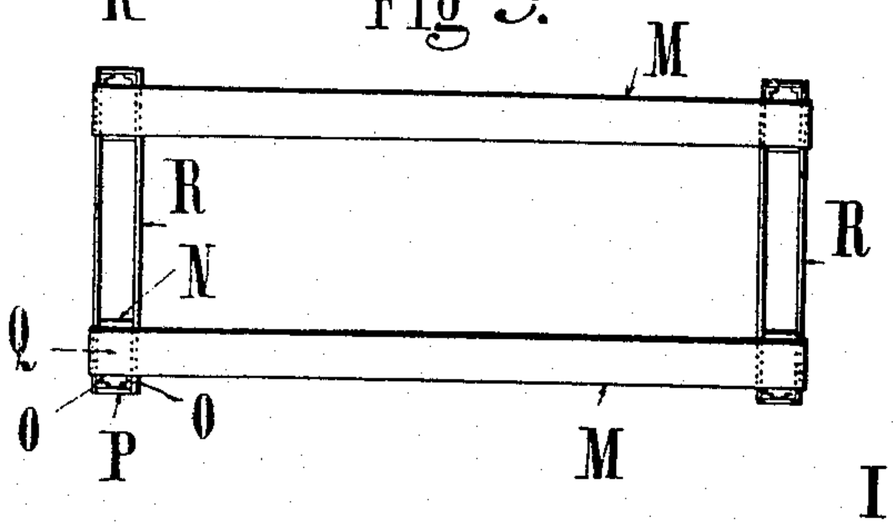


Fig. 9.

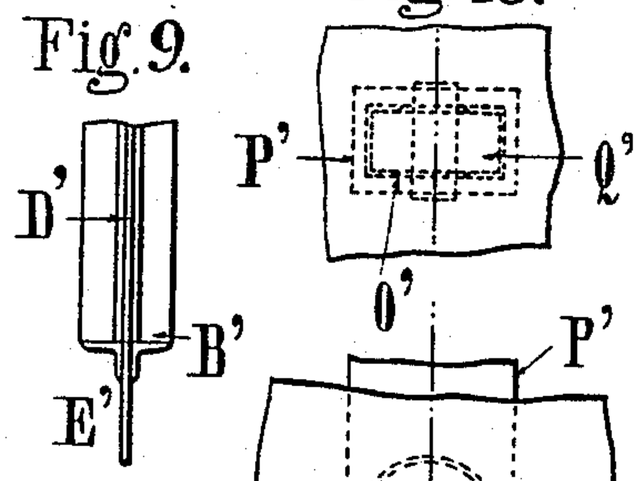


Fig. 13.

Fig. 12.

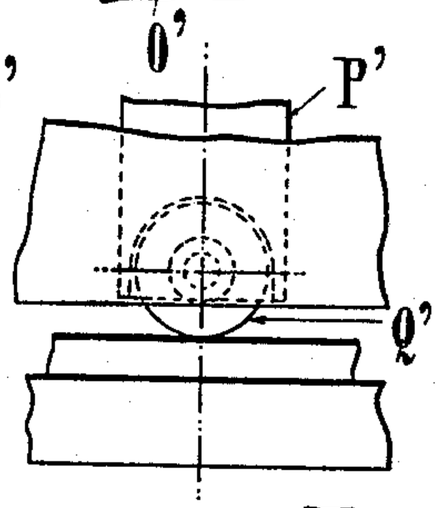


Fig. 8.

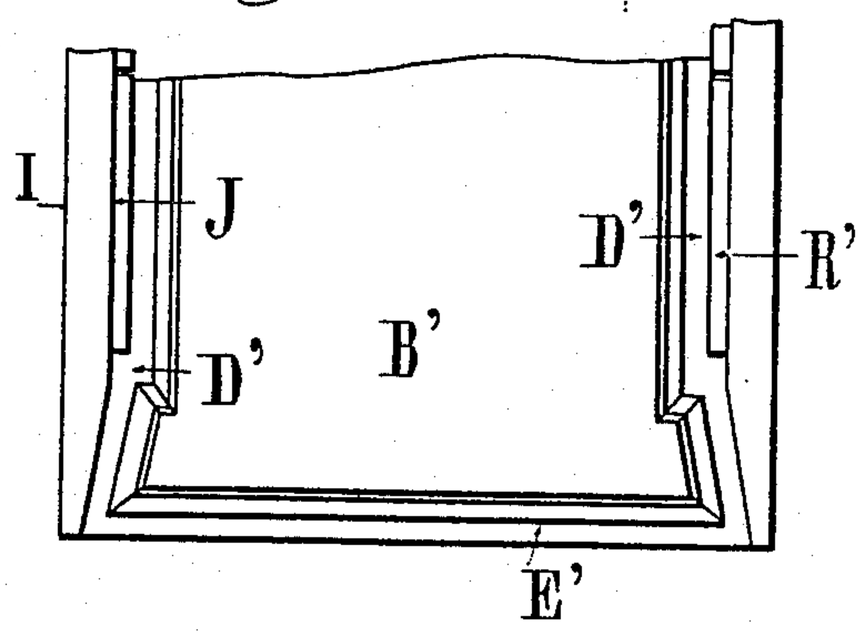


Fig. 10.

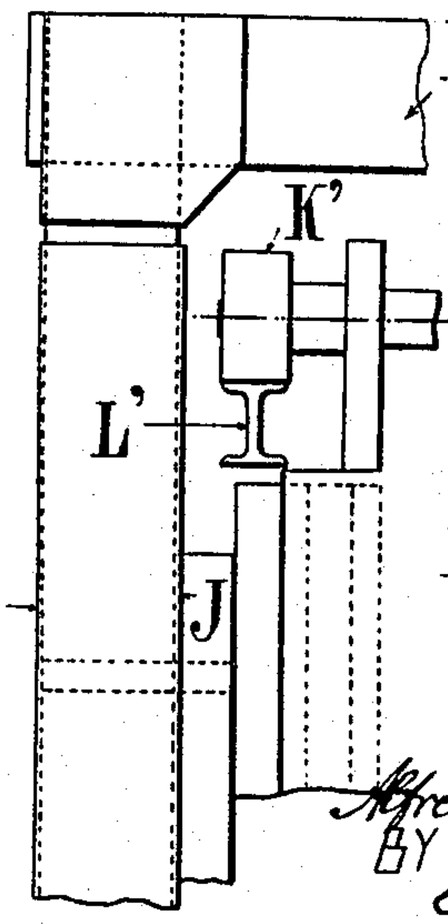
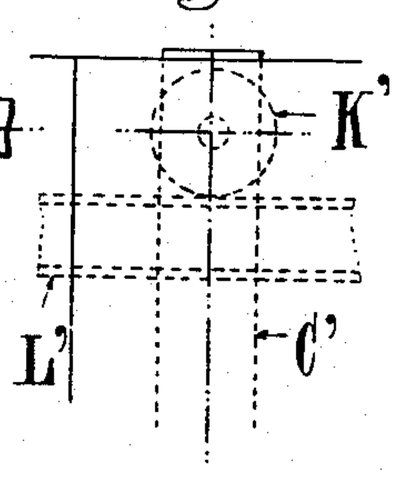


Fig. 11.



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No. 835,238. PATENTED NOV. 6, 1906.

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4 SHEETS—SHEET 3.

Fig. 5.

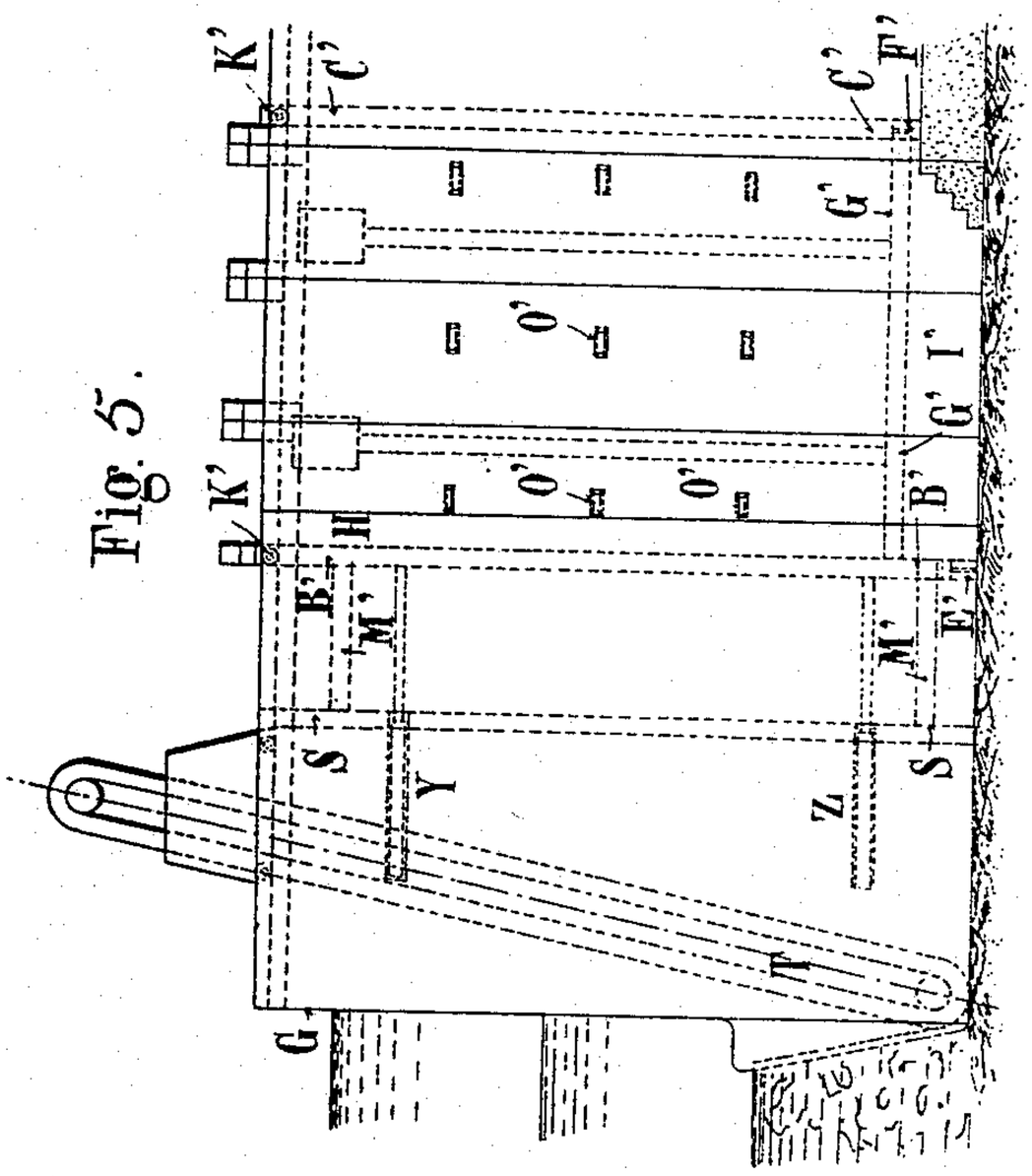
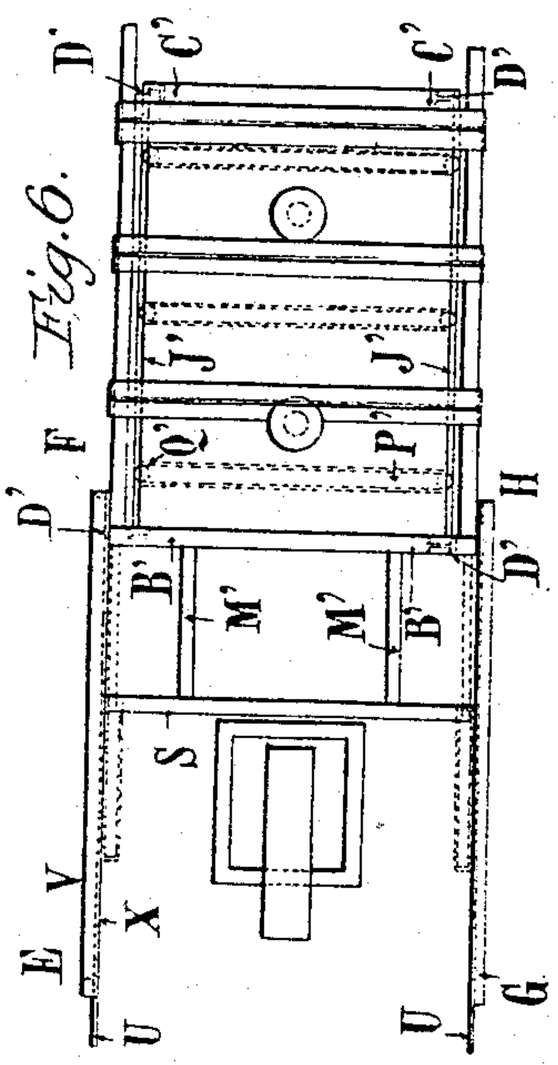


Fig. 6.



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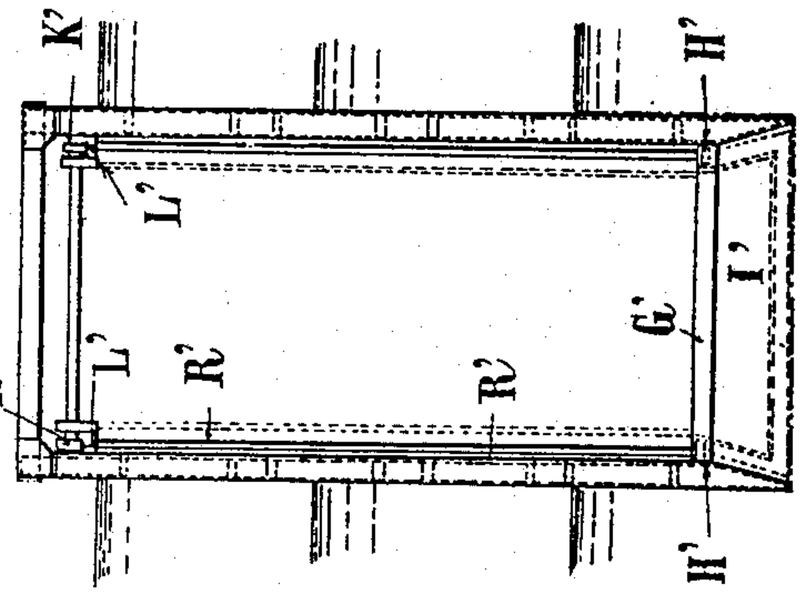
4 SHEETS—SHEET 4.

Fig. 7.



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UNITED STATES PATENT OFFICE.

ALFRED JULIEN DUCELLIER, OF VINEUIL, NEAR CHANTILLY, FRANCE.

APPARATUS FOR CONSTRUCTING SUBAQUEOUS WALLS AND THE LIKE.

No. 835,238. Specification of Letters Patent. Patented Nov. 6, 1906.

Application filed December 29, 1904. Serial No. 238,814.

To all whom it may concern:

Be it known that I, ALFRED JULIEN DUCELLIER, a citizen of the Republic of France, residing at Vineuil, near Chantilly, France, have invented certain new and useful Improvements in Apparatus for Constructing Subaqueous Walls and the Like, of which the following is a specification.

This invention relates to apparatus for erecting subaqueous or partially-subaqueous walls, such as dams, docks, locks, quays, jetties, and the like.

Among the objects of the invention is to provide apparatus by means of which this purpose may be rapidly and efficiently carried out.

Other objects of the invention will appear as the same is better understood.

The novel features of the invention will be hereinafter described, and finally pointed out in the claims.

In the accompanying drawings, in which corresponding parts are designated by the same reference characters throughout, Figure 1 is a plan view of the improved apparatus. Fig. 2 is a side elevation of the same. Fig. 3 is a plan view of one of the panels constituting the running inclosure or caisson. Fig. 4 is an end elevation of one of said panels. Fig. 5 is a detail side elevation of the special part or nose-section of the apparatus and of the compressed-air chamber. Fig. 6 is a plan view of Fig. 5. Fig. 7 is an end elevation showing the guiding means for the panels forming the compressed-air chamber. Fig. 8 is a detail view of the lower part of the caisson, showing the arrangement of the packing. Fig. 9 is a detail edge view of the packing. Fig. 10 is a detail end view showing the means by which the panels are rolled along the caisson. Fig. 11 is a side view of the parts shown in Fig. 10. Fig. 12 is a detail top plan view showing the mounting of the horizontal panel of the air-chamber with respect to the walls of the caisson, and Fig. 13 is a detail side view of the parts shown in Fig. 12.

The improved apparatus comprises a running inclosure formed by two parallel walls A B and C D, Figs. 1 and 2, and of a second special part E F and G H. Throughout the whole length of the structures A B and C D the inclosure is formed of similar elements connected end to end in longitudinal direction.

An element or panel of the running inclosure can be constituted, say, by two vertical parallel metal plates I J, Figs. 3 and 4, connected together and forming one side of the panel. At its lower end the inner plate is bent outward so as to join a horizontal portion K or to join the outside plate and form with it a knife-edge. The outside plate is vertical along the whole of its height or bent inward so as to reduce the resistance due to the friction of the walls in the ground at the moment of removing the panel. A similar construction constitutes the other side of the panel. The two sides of the same panel are connected together by two transverse girders M, to the ends of which are secured vertical plates N, transversely connecting along the whole of their height the two plates of one and the same side. In order to enable the panels to be connected to each other, angle-irons O are arranged inside and at the vertical ends of the longitudinal plates. Plates P are riveted to the transverse sides of these angle-irons and form with the connection-walls of the lateral sides compartments Q for the men who effect the bolting of the end of the inclosure with the panel which is to be added to the said end. The end compartments R are filled with the necessary ballast.

The special part of the inclosure is constituted by two walls E F and G H, Figs. 5 and 6, connected together by a transverse partition S. It does not form a closed inclosure and water freely enters on both sides of the partition S. The distance between the inner longitudinal walls is greater than the distance between the outer walls of the running inclosure described, so that this special part or nose-section can slide on the latter in longitudinal direction. A bucket-chain T or pumps remove the necessary earth for permitting the building up of the masonry on a solid ground or at a sufficient depth. A front projection or rib U connects the vertical end of this special part with the line slope of the excavation and penetrates into the earth in front of that line. The longitudinal walls of this part are constituted by two metal plates V X, forming between them a compartment, by means of which whenever necessary the weight of this part of the structure can be reduced as regards its buoyancy or increased by the introduction of ballast into the said compartment. This

compartment continues down to the earth, and the walls below that point are provided with strong plates added for stiffening the inner plates. When the removal of the excavated ground allows it, this part longitudinally advances under the action of screw-jacks Y Z, secured behind this part and resting on the fixed inclosure.

The panels are removed by an apparatus A′, Fig. 2, as the masonry at the back is completed and carried and put in place in front by the said apparatus which travels for the purpose on the upper portion of the caisson.

In order to put down a layer of concrete required for insuring the impermeability of the bottom of the inclosure, an apparatus is used constituted by two transverse partitions B′ and C′, Figs. 5 and 6. The length of these partitions is equal to the inner width of the inclosure with the walls of which they form a tight joint by means of packing D′, as shown in Figs. 8 and 9. The partition B′ rests on the plates covering the bottom with which it makes a tight joint by means of the packing E′. The partition C′ rests on the upper surface of the layer of concrete with which it makes tight joint by means of packing F′. A horizontal partition G′ is secured to these two transverse partitions and makes tight joint with the innner walls of the inclosure by means of packing H′, Fig. 7. A working chamber of a compressed-air caisson is thus constituted at I′. In the portion situated above the bottom partition or floor G′ of the air-chamber the transverse partitions are connected by longitudinal walls J′, Fig. 6, the bottoms of which are secured to the cover or ceiling B′ of the working chamber, and thus forms a compartment isolated from the fixed inclosure and intended to receive the required ballast. During the whole execution of one and the same work this compressed-air apparatus is never taken to pieces. It moves longitudinally as the work advances, traveling by means of rollers K′, (on the spindles of which it is suspended,) which roll on a track L′, secured to the inner walls of the fixed inclosure, as shown in Figs. 10 and 11. This apparatus is connected to the movable part of the inclosure by girders M′ and participates in the advance movement of the said part, the movement of the whole structure being regulated by the requirements of the movement of the compressed-air apparatus. At the moment when it is necessary to make an advance the pressure which is supplied or mechanically produced in order to firmly apply the packing against the surfaces at which a tight joint must be made is reduced so that the movement of the latter surfaces can take place without any tearing or jamming, the screw-jacks act and shift the whole structure to the necessary extent, and the packing is again applied, and so on. The packings D′ E′ F′ are composed of strips of rubber or similar material, generally doubled, temporarily fixed by means of bolts or angle-irons, such as shown in Fig. 9, to the supporting parts in such a manner that the air or water under pressure will make them adhere closely against the surfaces against which they abut, whereby said packings form air and water tight joints. The upper compartment of this apparatus is provided with openings O′, Figs. 5, 6, 12, and 13, which enable transverse girders P′ to be arranged, to the ends of which are secured horizontal rollers Q′, Figs. 12 and 13, which when the compressed-air apparatus moves travel on the inner walls of the inclosure. These girders constitute movable struts in case it should be necessary to connect the walls together for resisting outside pressure to which they are subjected. This apparatus closes one of the ends of the inclosure, and the partition P^2, Figs. 1 and 2, of a shape adapted to the cross-section of the wall to be built in order that it may make proper joint with the face of that wall by means of packing Q^2, closes the other end.

The height of the working chamber depends on the thickness of the layer of concrete to be made by means of compressed air for insuring the impermeability of the bottom of the inclosure, and its length must be such as to enable the quantity of concrete to be used necessary for attaining the desired rapidity of execution, also to enable the preparatory work that must be executed before the putting in place of the concrete, cleaning the bottom of the excavation, &c., to be effected. When the layer of concrete is made at one point of the necessary thickness in this manner, it will not be necessary to leave this portion under the action of compressed air until it is properly set, since impermeability can be attained by making a lower layer of the said concrete with quickly-setting cement and increasing the proportion of the cement according to circumstances or placing on the bottom of the excavation a thin metal or other sheet, which being covered with concrete will insure impermeability of the bottom of the inclosure.

The building up of masonry above the layer produced by means of compressed air is carried out in the open air along the length that is necessary for carrying on the work with the required speed. The present apparatus enables the whole work to be executed in concrete or in masonry, or, if desired, up to a certain height in concrete and the rest in masonry. Along the length of the inclosure corresponding to the space occupied by the compressed-air apparatus the outside pressure acting on the walls of the inclosure is neutralized by the girder-struts already referred to, which follow the movements of this apparatus. It might also be necessary to stiffen or to stay the next portion—that is

to say, the walls between them along the length of the inclosure where the body of the dam is carried out in the open air. This condition could be complied with by using girders strengthening the two walls between them and placed at a suitable level and length and successively replaced before their removal—necessitated by the erection of masonry— by other supports resting, on the one hand, on one wall of the inclosure and, on the other, on supports or plates applied to the face of the masonry walls. It is, however, preferable to effect this consolidation by a process which would at the same time facilitate the execution of the concrete or of the masonry work. To that end, the inner walls of the inclosure are provided, over the whole of their height situated above the concrete made with the assistance of compressed air, with movable panels R′, Figs. 4, 7, and 8, each of which can be of the same length as that of the inclosure-panels, but of less height than that of the inclosure. All these panels, intended to be arranged in the plane of the surface of the work, rest against the inner walls of the inclosure. At the moment when each panel is connected to the end of the inclosure, in order to extend it, they remain in that position until, owing to the advance of the compressed-air apparatus, the back partition of that compartment has entirely passed it. This panel is then situated at the place where the masonry is being built in open air. As the back partition moves along the length of this panel, stays or struts B′ are placed between the panels facing each other, except between the two bottom panels. The bottom panels are arranged so that their inner faces are in the same plane as the surface of the structure to be built, and they serve as coffers for the concrete or as alinements for the masonry, the surface of which rests against the face of the panels in order that they should constitute a support or stay for that portion. The supports or stays of the second panel are then removed, and these panels, like the preceding ones, are brought into alinement with the work, and so on. As shown in Fig. 4 of the annexed drawings, the panels R′ are placed in vertical series. The upper panels abut absolutely against the panels of the inclosure, while the bottom panels are spaced slightly backward from the inclosing panels. They constitute, as stated, a coffer-dam, in which the concrete is filled, which serves as an alinement for the brickwork, according to the method of construction used. When the brickwork has been brought up to the height of the top of the bottom panels, the panels next above are shifted in such a way to lengthen the bottom panels, and the upper panels then do the same service for the woodwork and the concrete that the bottom panels formerly did, and so on. The movement of the movable panels, which must be placed against the fixed partitions and in alinement, can be effected by means of screw-threaded rods passing through the inner wall of the inclosure into screw-threaded parts secured to the said wall. The rods are rotated from the interior of the compartment.

I claim—

1. The combination, with a caisson constituted by parallel upright walls, of a nose-section having side walls slidable along said first-named walls and open at its front portion to the passage of water, excavating mechanism mounted in said nose-section, and a compressed-air chamber in said caisson at the rear of said nose-section.

2. The combination, with a caisson constituted by parallel upright walls, of a nose-section embodying walls slidable along the outer faces of said first-named walls and open to the passage of water, and means for longitudinally shifting said nose-section.

3. The combination, with a caisson, of a nose-section at the front end of the caisson, means for advancing said section as the work progresses, interconnected partitions in the caisson at the rear of the nose-section forming a compressed-air cement-setting chamber, and means for connecting one of said partitions with said nose-section.

4. The combination, with a caisson, of a nose-section at the front of the same, an excavating mechanism mounted in said section, means for advancing said section as the work progresses, vertical and horizontal partitions in the caisson at the rear of the nose-section forming a hermetically-sealed compressed-air concrete-setting chamber, said partitions being interconnected and slidable in said caisson, and beams or girders connecting the front partition or wall of the chamber thus formed with a part of said nose-section.

5. The combination, with the caisson, of the nose-section at the front of the same, the excavating mechanism mounted in said section, the means for advancing said nose-section, the upright and horizontal panels or partitions forming the compressed-air chamber in the caisson at the rear of said nose-section and the chamber above said air-chamber; said partitions being interconnected substantially as described, the means for suspending said panels from and guiding the same along the upper edges of the caisson-walls, and the means connecting the forward upright panel or partition with said nose-section.

6. The combination, with the caisson embodying parallel upright walls, of a compressed-air chamber formed therein at the base thereof by upright partitions and a horizontal partition disposed intermediately of the height of said walls, and struts extending between said walls above said last-named partition.

7. The combination, with the caisson embodying parallel walls, of a compressed-air chamber formed therein by upright partitions and a horizontal partition disposed intermediately of the height of said walls, and transversely-extending struts provided with terminal rollers engaging the inner faces of said walls exteriorly of the air-chamber.

8. A caisson embodying parallel upright walls, partitions disposed between said walls and forming an air-chamber, and means for shifting said partitions longitudinally of the caisson.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALFRED JULIEN DUCELLIER.

Witnesses:

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JOHN BAKER.