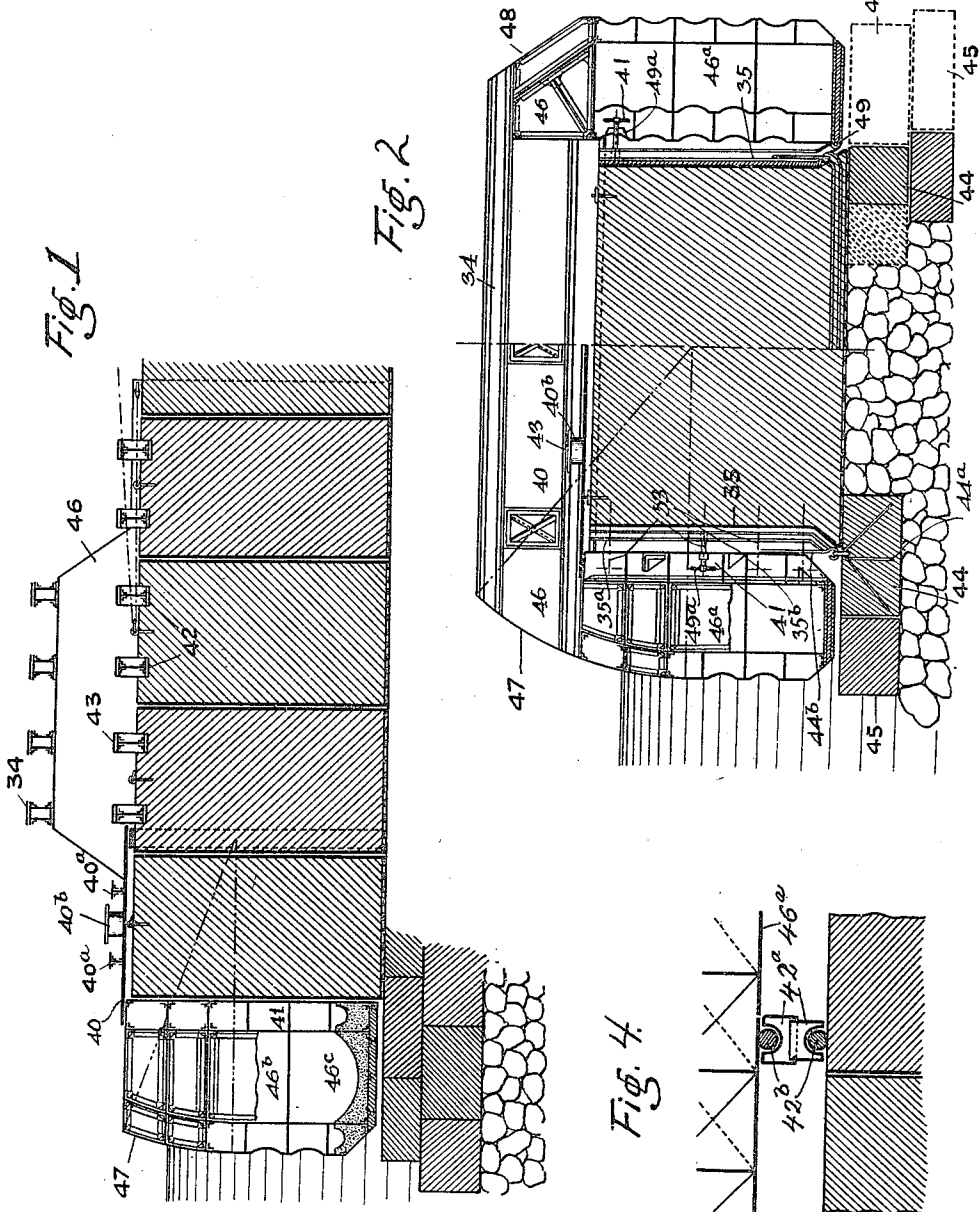


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 APPLICATION FILED APR. 15, 1913.

1,137,601.

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2 SHEETS—SHEET 1.



WITNESSES:

W. Roche
Ben R. Newcomb.

INVENTOR:

Ezio Gallo
 BY *B. Singer*
 ATTORNEY

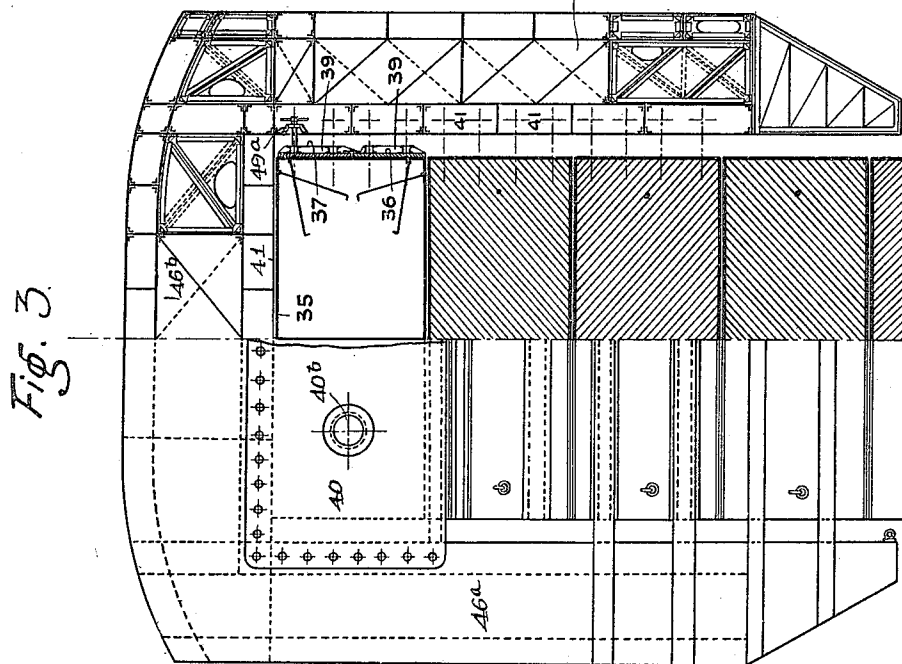
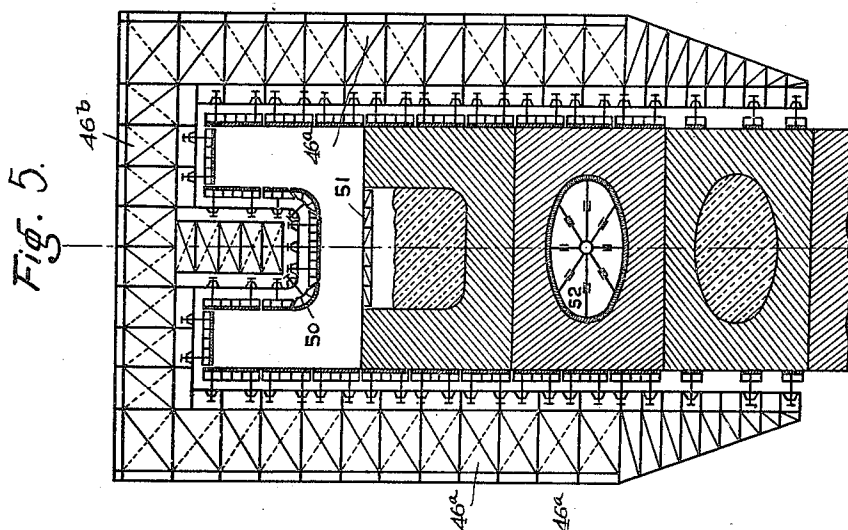
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UNITED STATES PATENT OFFICE.

EZIO GALLO, OF GENOA, ITALY.

PROCESS AND APPARATUS FOR HAVING ARTIFICIAL BLOCKS CAST OR SETTLED ON SPOT TO BUILD PIERS, QUAYS, AND LIKE STRUCTURES.

1,137,601.

Specification of Letters Patent.

Patented Apr. 27, 1915.

Application filed April 15, 1913. Serial No. 761,316.

To all whom it may concern:

Be it known that I, EZIO GALLO, engineer, subject of the King of Italy, residing at Genoa, Italy, have invented certain new and useful Improvements in Processes and Apparatus for Having Artificial Blocks Cast or Settled on Spot to Build Piers, Quays, and like Structures, of which the following is a specification.

10 This invention refers to a novel apparatus for building breakwaters, piers and the like by turning out on the spot artificial blocks, the concrete mixture being filled in under water. Such casting on the spot is carried out in either an iron caisson or a caisson of any other suitable material, with no bottom, made up of three walls, viz. two side walls arranged along the axis of the pier and a cross wall, which are connected together
20 either by hinge-joints or, what is better, in a stiff manner. The two side walls are fitted with a device allowing of the caisson being by means of said walls strongly secured to such portion of the work as has been previously built in the usual way. The hollow space where the monolith is built up is made up of the three walls of the caisson, the fourth wall and the face of the last built block or of the pier to be lengthened. The
30 bottom is formed by the foundation reef or by the duly smoothed sea bottom. Said side walls are upwardly connected together by means of strong girders, which are made capable of being lengthened in the case of a hinge-joint caisson and are stiff in the other alternative. Some of said girders rest on the previously built blocks and are capable of supporting the caisson even though the block molding part of it be at an angle with the rest. For the easy management of the caisson the side walls and the cross wall can be made buoyant. By letting in inside them water ballast by means of flooding valves and by ejecting it by means of pumps or, better still, by means of a compressed air arrangement, their buoyancy and therefore the buoyancy of the caisson can be changed as required. To provide against the action of heavy seas, the caisson can be made of such a size as to secure for the caisson through the employment of stable ballast and the shifting ballast together with the block's weight an efficient weight per square unit of battered surface equal to the one calculated for the blocks of the finished pier,
55

the caisson being thereby made as stable as the finished pier even before any block being cast. To allow of the contrivance being easily applied even though the blocks to which the caisson is to be fastened were to give way or shift sidewise, its side walls are wholly or partly provided with further shifting walls, arranged inside of them, which are fastened or connected with the former by hinge-joints or otherwise, and are cut up into several panels, such panels being capable through a screw arrangement or some other suitable gear of being moved toward or away from the previously built block or blocks and being easily taken away from the last cast block on dismantling. The caisson besides its being fastened through a part of the two side walls, can be secured to the bottom by means either of ties fastened to rings secured to the bottom, whereon the caisson can rest if the bottom be made up of usual artificial blocks, or in any other way that circumstances might suggest.

The inside shifting walls, above referred to, can be built semi-buoyant in order to make their weight counteract the upward thrust due to immersion so as to impose the least strain on the controlling jacks and the joints fastening the shifting walls to the caisson walls. The foundation whereon the caisson itself rests can be made up either of a number of beams set in place beforehand as the work is progressing, such beams being made use of to secure the caisson mooring rings, or of a number of usual artificial blocks, such blocks, if duly arranged, being capable of being partly weighed, after the monolith has been built, so as to allow of a greater available depth than the one which the foundation of the caisson itself reaches. Lastly there can be fitted inside of the caisson's walls suitable appendages allowing, when required, of the building of hollow blocks, to be afterward filled in with cheaper mixtures or stuffing materials. Such portions of the walls as are going to mold the block in the casting process can be lined with sheet iron, netting or any other suitable material to prevent the concrete from sticking to the shifting walls. The side walls as well as the cross walls or either of them can be placed at a slope. With a sloping cross wall the blocks are made steadier against any overturning action along the

axis of the pier. This is all the more useful at the head or near the head of the pier. As to the caissons for small blocks it is unnecessary to impart them any buoyancy as they can be controlled by a crane traveling along the finished part of the pier. Lastly the caisson can be easily made available for compressed air castings. To such a purpose it is sufficient that it should be provided above with a fourth air-tight wall and that an air-tight fit be made between the side walls and the blocks already built, *e. g.* by applying india-rubber pipes, leather fittings or by any suitable means.

On the annexed plates several ways of carrying out the invention are shown by way of illustration. On them: Figure 1 is a length section of a pier portion built up of vertical-face blocks showing the caisson with floating walls; Fig. 2 is a sectional as well as a perspective view of the caisson and pier as shown in Fig. 6; Fig. 3 is a sectional as well as a front plan of the caisson as shown in Figs. 3 & 4 fitted with the 4th. wall to be operated as an air chamber. Fig. 4 shows the details of the arrangement to insure an air-tight fitting between the caisson walls and the block faces; Fig. 5 is a plan of a caisson fitted with an appendage for building hollow blocks showing diagrammatically an arrangement whereby hollow blocks can be turned out whatever the shape of the caisson.

The caisson shown in Figs. 1, 2, 3 and 5 is made buoyant, 46^a representing the buoyant side walls thereof and 46^b the buoyant cross wall which if desired may be provided with suitable ballast 46^c. This form of caisson may, as shown in Figs. 1 and 2, be stiffened or rigidly joined together by means of cross beams 34 mounted on lateral longitudinally extending super-structures 46 and along its interior sides the caisson is provided with movable semi-buoyant walls adapted for movement toward and away from said sides, for the purpose of securing the caisson to the old pier or new structure already formed, for easily dismantling same from the last block built and to allow of the caisson being kept level even though the blocks to which the caisson is secured should incline laterally to some extent. Below the upper stiffening beams 34, there are also shown arranged lower cross beams 43 and the latter may be at such a level, that the blocks are cast about part of them so that they enter hollow channels 42 across the upper parts of the blocks, this arrangement tending to reduce longitudinal stresses in the caisson and to obviate displacement of the caisson in the direction of the axis of the pier. The lower beams 43 are also strong enough to resist moments of flexion and the shearing action arising when the caisson rests on the settled blocks through said beams only. It is there-

fore advisable to have a very long caisson in order to obtain a greater number of bearing points above the settled blocks. The beams 34 and 43 will not interfere with the casting of the concrete blocks if suitable height or distance is allowed between them for example, two meters, since sufficient space would then be allowed for the wagons, carrying the concrete mixture. Figs. 1 and 2 also show a fourth or upper wall 40 in the form of a covering plate for use when operating with compressed air, a chamber equivalent to a fire walled caisson being thus produced. This wall is strengthened by means of beams 40^a and is shown as provided with an inlet or coupling 40^b through which the compressed air may be passed to the caisson chamber. When using compressed air it is necessary to provide an air-tight joint between the side walls 46^a and the blocks and Fig. 4 shows means for this purpose comprising spring boxes 42^a and rubber or like packing 42^b.

In Fig. 2 the movable semi-buoyant walls 35 are shown as hinged at 49 to the lower parts of the buoyant side walls 46^a and are shown as operated by means of screw jacks 49^a extending through the inner surfaces of said walls and the manually operative parts thereof, inclosed within water-tight chambers 41 contained within the side walls and accessible to the workmen, so that they may adjust the walls 35 to and from the buoyant walls 46^a. These walls may be provided with a larchwood lining 35^a and with a metallic sheet 35^b of wire netting or the like for the same purpose as described with reference to the sheet 29 above referred to, or if this sheet is dispensed with the wall may be smeared with tallow. In this figure, shows foundation blocks previously placed in position and 44 others of said blocks to which the caisson may be moored by means of ring ties 44^a and hooks or tension cables 44^b, the latter secured to the walls 46^a.

In Fig. 3, movable walls 36 are shown in the settling block section, only two of said walls being shown at one side consisting of strong iron plates without wood lining, braced by ribs 37 and provided with angle iron channels 39 in which engage parts of the screw jacks 49^a operated from the chambers 41 in such a manner that the walls 36 may be moved away from and toward the side walls 46^a by said screw jacks. These walls 36 can also be provided with a metallic covering similar to those 29 and 35^b above described. This figure also shows movable walls 35 to the cross wall 46^b, the construction and operation of said walls 36 having already been described with reference to Fig. 2. The caisson's plates can have a bent form to allow of increased strength and considerable saving in cost.

The interior movable walls might be dis-

5 pensed with from the parts of the side walls
 surrounding the monolith already built, as
 the controlling jacks or the compressors
 conveniently provided with limited surfaces
 might be sufficient. Interior movable walls
 10 might be totally dispensed with from the
 cross wall of the caisson. The block mold-
 ing portion of the caisson even if at an
 angle maintains the required stability, which
 15 may be further increased where the caisson's
 upper compartments or super-structures 46
 are flooded with water, as mentioned above.
 Near the sea surface and along the belt more
 exposed to wave action the caisson's walls
 20 instead of being made straight or sloping
 as shown at 48 can be wholly or partly out-
 wardly bent as at 47 or otherwise suitably
 shaped to increase the resistance to wave ac-
 tion.

20 It is of advantage to cast the blocks with
 their cross faces inclined landward or to-
 ward the existing pier or new blocks cast to
 prevent said blocks being overthrown sea-
 ward, the resultant of their weight being
 25 thus directed landward from their bases.
 Instead of the hollow blocks being cast by
 means of the cores 50 of the caisson (Fig.
 5) and the further interposition of a wall
 30 51, there can be arranged in the hollow
 space bounded by the three caisson walls
 and the last block built a frame 52 of suit-
 able shape, the casting being then carried
 out in the remaining hollow space.

35 Having now particularly described and
 ascertained the nature of my said inven-
 tion and in what manner the same is to be
 performed, I declare that what I claim is:

1. Apparatus of the character described,

comprising in combination, a block mold-
 ing caisson, wholly or partly buoyant, 40
 means for sinking or floating said caisson,
 beams fitted on the upper part of the side
 walls of said caisson rigidly connecting the
 same so as to offer a resistance to the waves,
 and means for increasing the resistance of 45
 the caisson to wave action upon the part of
 the caisson above said beams, substantially
 as described.

2. Apparatus of the character described,
 comprising in combination, a block mold- 50
 ing caisson, wholly or partly buoyant, bal-
 last for sinking or floating said caisson,
 beams fitted on the upper part of the side
 walls of said caisson rigidly connecting the
 same so as to offer a resistance to the waves, 55
 means for increasing the resistance of the
 caisson to wave action upon the part of
 the caisson above said beams and cores
 within said caisson for the formation of
 hollow blocks. 60

3. Apparatus of the character described,
 comprising in combination, a caisson having
 an air tight door on its upper face, side walls
 and cross-walls, and packings provided along 65
 the sides of the caisson coacting with a por-
 tion of a wall already completed for pro-
 ducing an air-tight chamber for construc-
 tion by the use of compressed air, substan-
 tially as described.

In testimony whereof I affix my signa- 70
 ture in presence of two witnesses.

EZIO GALLO.

Witnesses:

PIO RIMHLING,
 ANGELO BONAGUIA.

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