

Aug. 9, 1932.

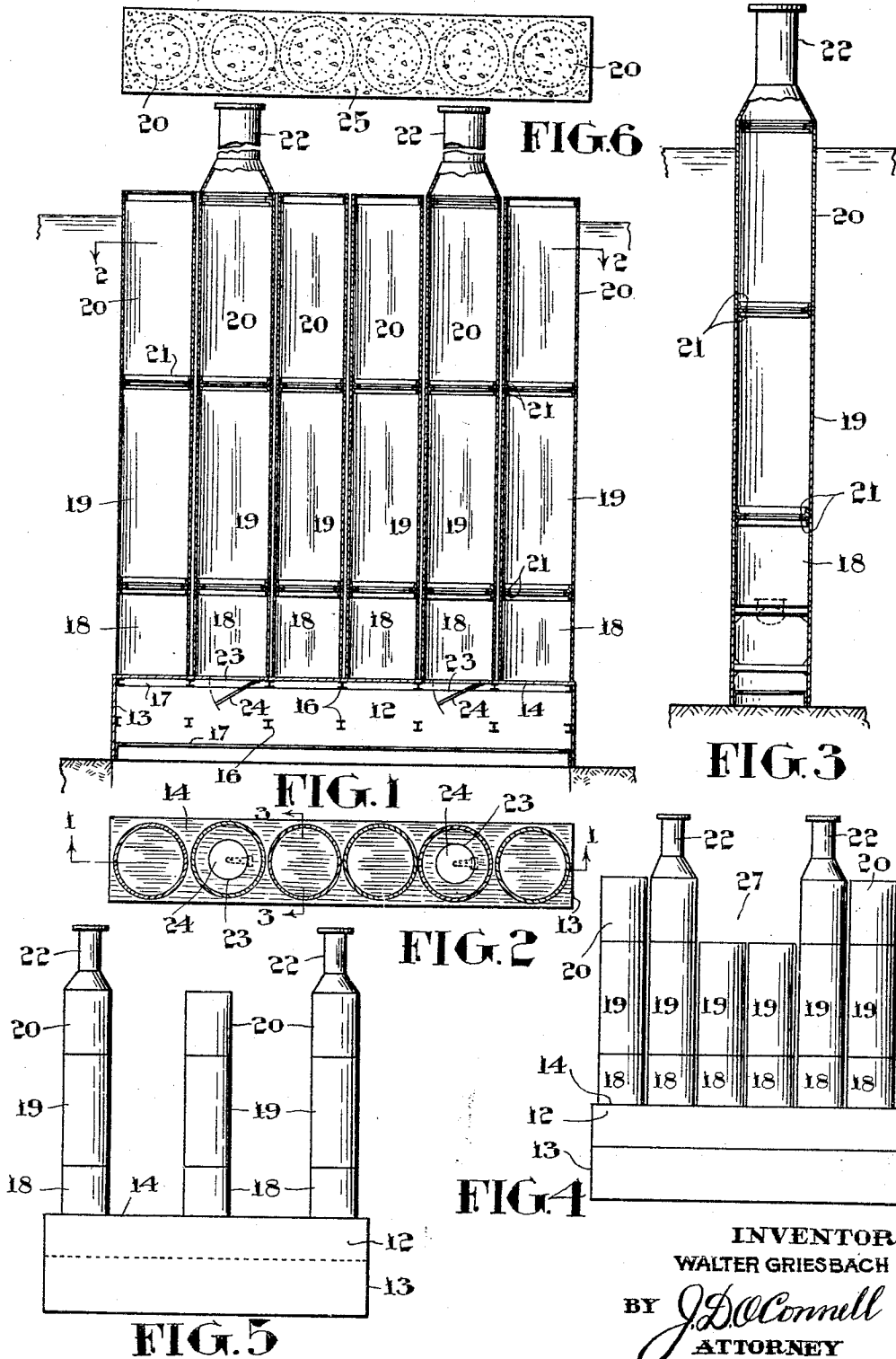
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1,870,248

METHOD AND APPARATUS FOR BUILDING RETAINING WALLS, PIERS, ETC

Filed March 2, 1931

2 Sheets-Sheet 1



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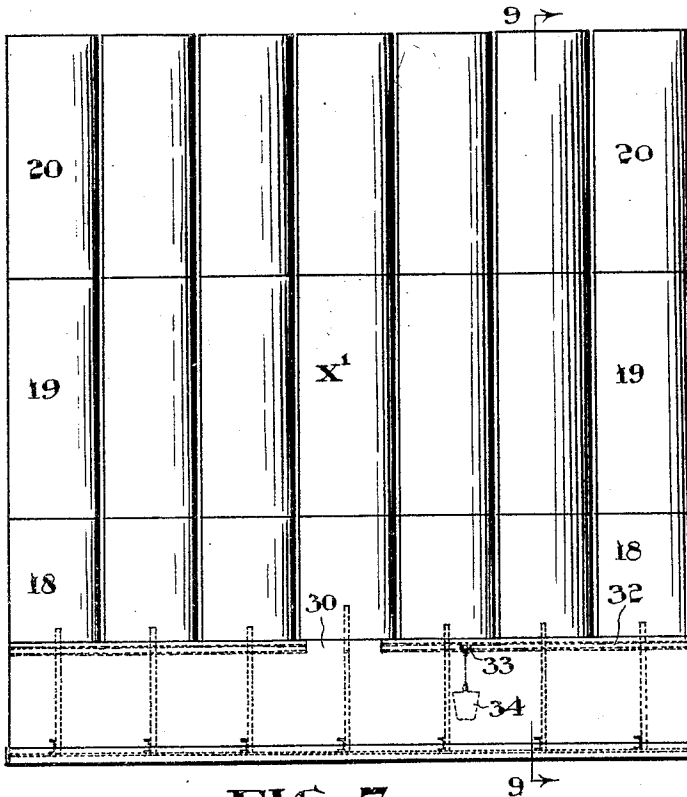


FIG. 7

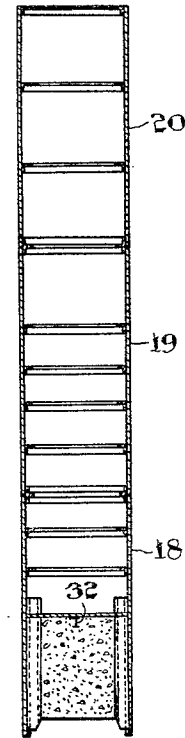


FIG. 9

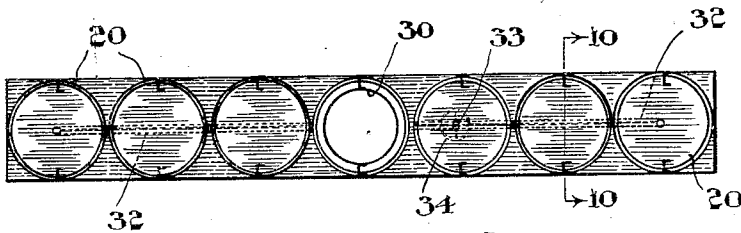


FIG. 8

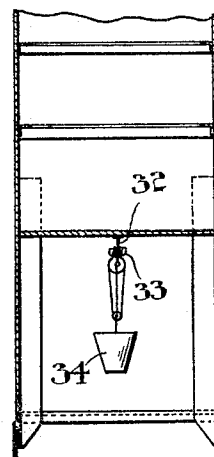


FIG. 10

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## UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR BUILDING RETAINING WALLS, PIERS, ETC.

Application filed March 2, 1931. Serial No. 519,565.

This invention relates to the building of bridge piers, retaining walls and similar structures usually erected on the bed of a river or other body of water.

5 The object of the invention is to provide an improved method and apparatus for the rapid and economical erection of such structures.

10 The invention resides, more particularly, in the construction and use of a pneumatic caisson of novel design. As is well known, the ordinary pneumatic caisson consists of a working chamber surmounted by a cofferdam having a horizontal cross section similar  
15 to that of the working chamber which is usually rectangular or circular. Shafts giving access to the working chamber for the admission of compressed air and for the lowering and removal of materials are usually erected on the roof of the working chamber within but independently of the cofferdam structure. These shafts are frequently  
20 buried in the complete structure and in addition to the loss thus entailed, usually tend to weaken the concrete filling of the cofferdam. When a cylindrical caisson structure is employed, the cofferdam portion invariably consists of a single unit rising from the working chamber and made of sections superimposed one upon the other. Whether rec-  
25 tangular or cylindrical, the sections of the cofferdam are relatively large and unwieldy and require the use of heavy and expensive construction equipment. Cofferdams of the rectangular type, as heretofore constructed, also require to be heavily braced and add  
30 materially to the cost of labor and materials.

35 The present invention eliminates these difficulties by providing a cofferdam of novel construction including a plurality of cylindrical units of relatively small diameter rising from the roof of the working chamber. The working chamber is preferably rectangular and is designed to provide for the  
40 construction of a common footing of adequate area supporting all of the cylindrical units of the cofferdam. The cylindrical shape of the units comprising the cofferdam is of particular advantage in that it renders  
45 the cofferdam sufficiently resistant to water

pressure to eliminate the need of the expensive bracing necessarily resorted to in the erection of cofferdams of the rectangular casing type. The small diameter and cylindrical shape of the cofferdam units also enables the cofferdam to be conveniently erected without the aid of the heavy and expensive construction equipment usually employed in work of this character. Moreover, the use of cylindrical units in the building of the cofferdam has a decided advantage in connection with the building of certain types of retaining walls, since the height of selected units of the complete wall may be conveniently varied to leave gaps in the wall structure for the passage of sluiceways or the like. As the cylindrical units of the cofferdam are initially formed as hollow shells rising from the roof of the working chamber, certain of these shells may be temporarily used as shafts for the admission of compressed air to the working chamber and for the lowering and removal of materials and, hence, take the place of the independent shafting ordinarily employed for this purpose, besides forming an integral part of the complete structure.

Proceeding now to a more detailed discussion of the invention, reference will be had to the accompanying drawings, where-  
in

Figure 1 is a vertical sectional view through a pneumatic caisson constructed in accordance with this invention.

Figure 2 is a plan view of the construction shown in Figure 1.

Figure 3 is a vertical transverse sectional view taken along the line 3—3 of Figure 2.

Figure 4 is a view in side elevation of a modified construction in which the height of the cylindrical units forming the cofferdam is varied to provide a gap in the complete structure.

Figure 5 is a view in side elevation of a pneumatic caisson having the cylindrical units of the cofferdam spaced apart as would occur in the building of bridge piers and in certain other classes of work.

Figure 6 is a view similar to Figure 2 but showing a slight modification.

Figure 7 is a view in side elevation of a further modification.

Figure 8 is a top plan view of the construction shown in Figure 7.

5 Figure 9 is a vertical sectional view taken along the line 9—9 of Figure 7.

Figure 10 is a transverse sectional view taken along the line 10—10 of Figure 8.

As shown to advantage in Figures 1 and 10 3, the working chamber provided in accordance with this invention is open at the bottom and is provided with side walls 12, and walls 13, and a top wall 14, arranged to form an enclosed chamber of substantially rectangular form. The walls of the working chamber may be reinforced and braced in any suitable manner to afford the necessary strength and to compensate for any variation in the bearing qualities of the soil or bed on which the footing is constructed. In the present instance, I have shown structural bracing members 16 extending transversely between the side walls 12 and these side walls, together with the end walls 13, are additionally reinforced as by means of the reinforcing members appearing at 17.

The cofferdam consists of a plurality of cylindrical units erected on the top wall or roof of the working chamber. In the present instance, each cylindrical unit is shown as consisting of three sections including a bottom section 18, an intermediate section 19, and a top section 20 fastened together in any suitable manner such as by means of the joining flanges appearing at 21. When building a structure such as a retaining wall the cylindrical units are preferably arranged in close proximity to one another over the entire length of the working chamber, as illustrated in Figs. 1 and 4. But, in building bridge piers, for example, the number of cylindrical units will ordinarily be decreased and the several units arranged in substantially spaced relation as shown to advantage in Fig. 5. Certain of the cylindrical units are equipped with air locks 22 so that these units may be temporarily employed as shafting for supplying compressed air to the working chamber and for the lowering and removal of materials in the same manner as the independent shafting usually provided for this purpose. The cylindrical units equipped with the air locks are placed in communication with the interior of the working chamber through suitable openings 23 controlled by doors 24. These doors 24 are not, however, essential and may be dispensed with if desired.

The cylindrical units of the cofferdam may be erected on the working chamber either before or during sinking of the chamber. In some instances, the working chamber, carrying thereon the lowermost sections 18 of the cylindrical units, is shipped to the site and set in position. The remaining cylindrical

sections 19 and 20 are then superimposed on the sections 18 so that the tops of the cylindrical units will be at the required elevation when the caisson is bottomed or grounded. Concrete or other suitable material is then placed in the required number of the cylindrical units to sink the caisson. Compressed air is then applied, through the air locks 22 and the cylindrical units connected therewith, in order to expel the water from the working chamber so that the work of excavation can be conveniently carried on by the workmen in order to lower the working chamber to the required depth. The working chamber is then filled with concrete or other suitable material while still maintaining sufficient pressure of air within the chamber. The cylinders which have been temporarily used for shafting purposes, together with any other unfilled cylinders, are then filled in with concrete or the like to give solidity to the complete structure.

In the case of a retaining wall structure, the tops of the upper sections of the cylindrical units forming the cofferdam may be tied together in a suitable manner such, for example, as by means of the bonding wall of concrete appearing at 25 in Fig. 6. Also, in the case of a retaining wall or the like, wherein it is necessary to leave gaps in the wall structure for the passage of sluiceways or similar structures, this may be conveniently accomplished by removing certain sections of the cylindrical units which have been previously filled with concrete or other material only to a point coinciding with the lower ends of the sections to be removed so that upon removal of such sections a gap or passageway is formed in the complete structure. Such an arrangement is shown in Figure 4 wherein it will be noted that the upper ends of the two centrally located cylindrical units are below the upper ends of the remaining units whereby a gap 27 is provided in the complete structure.

The advantages incident to the construction described in the foregoing may be briefly reviewed as follows. The cost of constructing the cofferdam portion of the caisson is materially reduced since the cylindrical shape of the units employed for this purpose renders the cofferdam self supporting against external water pressure without the aid of the heavy bracing heretofore required; the erection of independent shafting to give access to the working chamber during the course of the construction work is eliminated since certain of the cylindrical units of the cofferdam are available for this purpose; the present invention is more flexible in its application in that provision may be made for causing individual units to terminate at any desired elevation above or below the waterline by providing a field joint at the particular elevation selected, the concrete being

then poured up to the joint and the top portion of the cylinder removed to leave a gap in the upper portion of the wall structure; the working chamber may be made of any

width required to provide the necessary area to suit the bearing capacity of various soils independent of the size or spacing of the cylindrical units rising from the roof of the working chamber.

Figures 6 to 9 inclusive show a modification wherein the working chamber is equipped with a conveying apparatus for conveying dirt and other refuse from remote portions of the working chamber to a central opening 30 from whence such refuse may be conveniently removed through the cylindrical unit X'. The conveying mechanism used in this connection is illustrated as comprising a pair of I beams 32 forming supporting tracks for the trolleys 33 carrying buckets or other conveying devices generally indicated at 34. Each I beam is supported in any suitable manner from the roof of the working chamber as shown to advantage in Figure 9.

Having thus fully described what I now conceive to be the preferred embodiment of my invention, it will be understood that various minor changes in the construction and arrangement of parts may be resorted to within the scope and spirit of the appended claims.

Having thus described my invention, what I claim is:—

1. A method of erecting retaining walls, bridge piers and similar structures which consists in providing a working chamber open at the bottom, erecting a plurality of hollow cylindrical units on the roof of the working chamber to provide a cofferdam, filling certain of said units with material to sink the working chamber and the cofferdam to the required depth, temporarily utilizing certain of the remaining cylindrical units as shafting for the introduction of compressed air into the working chamber and for the introduction and removal of materials, filling in the working chamber with material to form a footing and finally filling in the previously unfilled cylindrical units so that the working chamber and the cylindrical units form the permanent shell of the complete structure.

2. A retaining wall or foundation structure comprising a casing resting on the bed of a body of water and filled in with suitable material to constitute a permanent part of the footing of said structure and a plurality of cofferdam units in the form of metal cylinders rising from the roof of said casing and also filled in with suitable material to constitute a permanent part of the upper portion of said structure.

3. A retaining wall or foundation structure as recited in claim 2 in which the height

of the filled in cylinders is varied to provide gaps in the upper portion of the complete structure.

4. A retaining wall or foundation structure comprising a casing resting on the bed of a body of water and filled in with suitable material to provide a footing including the casing as the permanent outer shell and a plurality of hollow metal cylinders rising from the roof of the casing in side by side relation, said cylinders being arranged close to one another in a row extending practically over the entire length of the casing and being filled in with suitable material to provide a permanent superstructure.

5. A retaining wall or foundation structure comprising a casing resting on the bed of a body of water and filled in to form a footing, a plurality of hollow cylindrical shells rising from the roof of the casing and arranged close together in a row extending substantially the full length of the casing, said cylindrical shells being filled in with suitable material to form a permanent superstructure and certain of said cylindrical shells being made shorter than the remaining shells to provide a gap in the upper portion of the superstructure.

6. A method of erecting retaining walls, bridge piers and similar structures which consists in providing a working chamber open at the bottom, erecting a plurality of hollow cylindrical units on the roof of the working chamber, introducing filling material into certain of said units to sink the working chamber and the cofferdam to the required depth, temporarily utilizing certain of the remaining cylindrical units as shafting for the introduction of compressed air into the working chamber and for the introduction and removal of material, filling the working chamber when grounded to the required depth with material to form a footing and effecting a further introduction of filling material into the cylindrical units to completely fill certain of the units while leaving portions of other units clear of filling material above a certain point and then removing the unfilled portions of the last mentioned units to leave gaps in the upper portion of the completed structure.

7. A retaining wall or foundation structure as recited in claim 2 in which the tops of the metal cylinders forming the cofferdam are bonded together by a concrete cap.

In witness whereof, I have hereunto set my hand.

WALTER GRIESBACH.