Jan. 10, 1933. L. R. TALBOT 1,894,206

CAISSON WORK

Filed Oct. 11, 1930

Fig. 1.

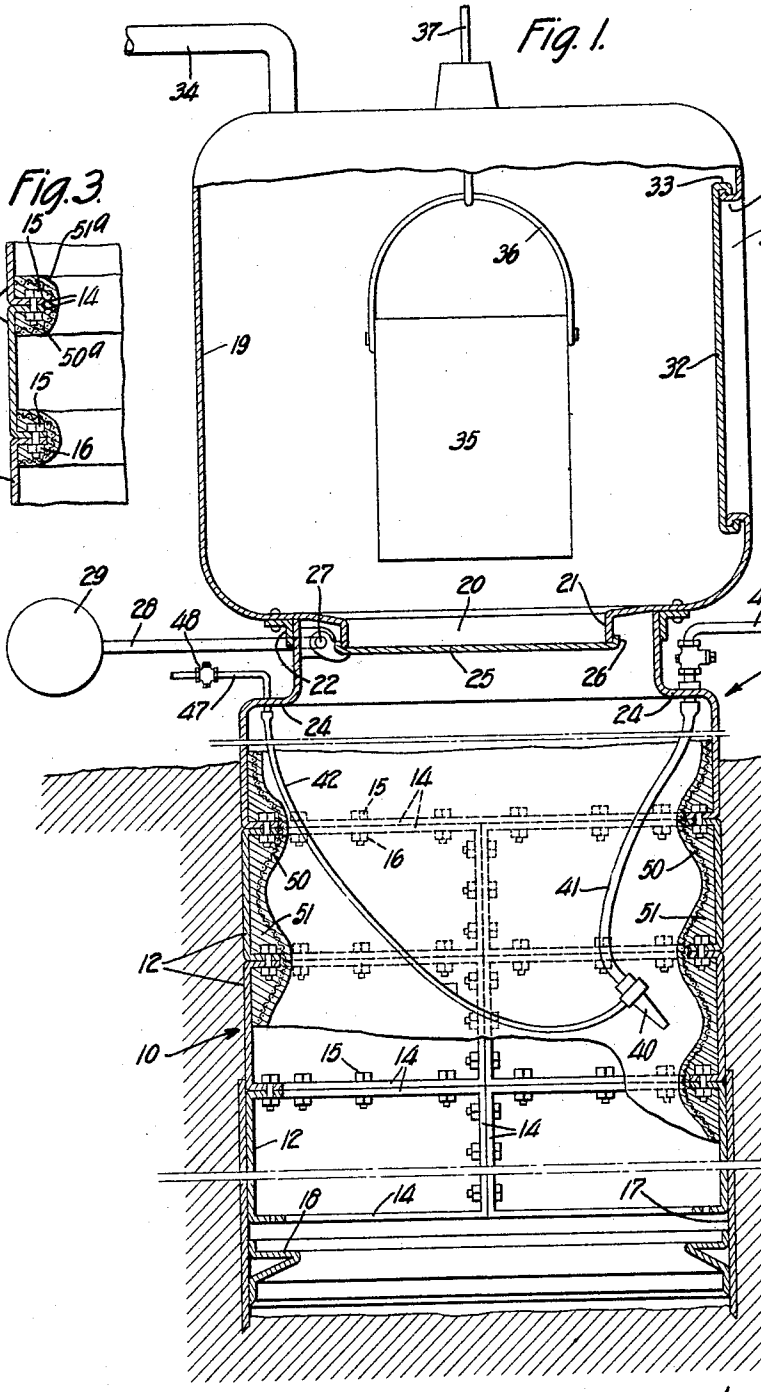
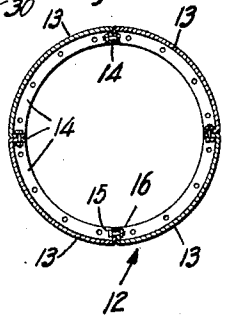


Fig. 3.

Fig. 2.



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Patented Jan. 10, 1933 1,894,206

UNITED STATES PATENT OFFICE

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CAISSON WORK

Application filed October 11, 1930. Serial No. 488,095.

This invention relates to caisson work and more particularly to work of this kind in which the caisson is carried down by adding successive rings at the bottom as soon as space is provided therefor.

The aforesaid method of adding successive rings involves the formation of said rings in sections so that they can be lowered through the previously installed portion of the caisson and then assembled and secured to the lower end of said previously installed portion.

The use of caissons built up in this way obviates many of the difficulties previously encountered, but gives rise to other difficult problems including that of sealing the joints thoroughly and expeditiously to enable maintenance of the desired air pressure with compressor equipment of substantially the usual capacity.

Heretofore, attempts have been made to seal the joints in such caissons in different ways, but none of such attempts have been satisfactory. For example, where ordinary calking material has been forced into the joints the result has been rather to increase air leakage than to decrease it. It is also impracticable to seal the caisson by use of material requiring the use of forms.

An important object of the present invention is to provide for overcoming such difficulties and preventing any substantial amount of air leakage. Further objects are to provide improved caisson structure and an improved method of sealing joints of sectional caissons to prevent leakage of air.

The objects of the invention may in general be attained by sealing the joints by the application thereto from a nozzle, as by the use of compressed air, of plastic material such as mortar hydrated either at the nozzle or before reaching the nozzle. Preferably the sealing of the joints is effected by applying "Gunite" by means of a "cement gun."

Other objects and advantages will be apparent upon consideration of the following detailed description and of the drawing, in which:

Fig. 1 is a view, principally in vertical section through the axis, illustrating a preferred embodiment of the invention as applied to a caisson with an air lock on the upper end thereof;

Fig. 2 is a transverse section of a caisson ring; and

Fig. 3 is a fragmentary section illustrating a modification.

Referring to the drawing, 10 designates a caisson extending downwardly through the ground 11 and built up of rings 12 comprising sections or segments 13. As here shown, there are four segments or quadrants to each ring and each of these segments is of plate material or the like with a main portion of appropriate shape to form part of the outer wall of the caisson and with flanges 14 extending inwardly from the edges thereof to facilitate the attachment of segments together from the inside thereof to form rings and the attachment of successive rings together to form a caisson including more than one ring. Adjacent flanges may be secured together in any suitable manner as by means of bolts 15 passing through the flanges and secured in position by nuts 16.

With this form of caisson, there is no necessity for driving or forcing the caisson down into the ground, but segments 13 for additional rings are lowered through the previously assembled upper part of the caisson and, as soon as sufficient material has been excavated at the lower end of the caisson and removed, another ring is assembled and secured to the ring which was previously the bottom ring. Although the caisson is illustrated as of circular cross section, the cross section may take other shapes.

In excavating at the lower end of the caisson use may be made of a shield 17 surrounding the caisson so as to be guided thereby. Preferably the peripheral wall of the shield is provided with a suitable cutting bottom edge and to facilitate the sinking of the shield it is provided at its inner surface with a suitable peripheral shelf or ledge 18. By striking the ledge from above or exerting downward pressure thereon, as by means of jacks, the shield may be driven downwardly as fast as the material is excavated. It will be seen that the part of the shield above the ledge is of sufficient height to enable the

assembly of a ring 12 above the ledge without disconnecting the shield from the bottom ring previously assembled and secured in position.

In general, caissons of this nature are sunk below the water level which may be above, below or at the surface of the ground, and the work must be carried on under air pressure which serves to prevent the water from entering in sufficient volume to interfere with the work.

In order to maintain the necessary pressure while permitting the admission and withdrawal of men and material, the caisson is provided at its upper end with an air lock comprising a casing 19 provided at its bottom with an opening 20 surrounded by a flange 21 which, as brought out hereinafter, serves as a door frame. Surrounding the flange 21 and spaced therefrom is a flange 22 forming part of a strip of angle iron secured to the bottom of the casing.

The flange 22 fits around the reduced upper end of a ring 23 of plate material of which the lower end rests on the upper sectional ring 12 of the caisson proper. The lower end of the ring 23 is provided with an inwardly extending flange 14 bolted to the flanges 14 at the upper edges of the ring segment 13. Connecting the lower part of the reduced upper end of the ring 23 with the upper part of the lower end is a substantially flat annular portion 24 through which connections between the inside and outside of the caisson can conveniently be made.

The opening in the door frame or flange is closed by a door 25 mounted for movement in one direction to engage the lower edge of the flange 21 to close the opening 20, and in another direction to open said opening 20. As illustrated, the door 25 is provided with a peripheral flange 26 to fit over the flange 21 and assist in sealing the opening 20, and, for opening and closing movement, the door 25 is fixedly mounted on a horizontal rod or shaft 27 pivotally mounted in the ring 23 and projecting to the outer side of the ring where it is provided with an arm 28 carrying a counterbalance or weight 29 which constantly urges the door 25 upwardly to closed position.

The casing 19 is also provided at one side with a door opening 30 surrounded by an inwardly extending flange 31. The opening 29 is provided with a door 32 which, as indicated in Fig. 1, has a peripheral flange 33 cooperating with the flange 31.

Control of the pressure in the caisson is effected through a pipe 34 connected with the upper part of the casing. To lower material into the caisson and to remove material therefrom, use is made of a bucket 35 having a bail to which is attached a flexible rope 37 passing upwardly through the top of the casing, the arrangement being such as to avoid air leakage around the rope. The air lock is utilized in the usual manner, the pressure therein being brought up to the caisson pressure before opening the door 25 and being brought to atmospheric pressure before opening the door 32.

The apparatus of which the structure and operation have just been described forms no part of the present invention which relates to sealing the joints of a caisson such as described hereinbefore. According to the preferred form of carrying out the invention, the "Gunite" is applied by means of a "cement gun" nozzle 40 to which the desired mixture of cement and sand is supplied through the material hose 41, and water is supplied through a hose 42. The material hose 41 may be connected at its other end with a nipple projecting downwardly from the flat annular portion 24 of the ring 23 and connected through portion 24 with a pipe or hose 45 connected in turn with the outlet valve of a "cement gun". Preferably a valve 46 is provided in the connection between the pipe or hose 45 and the hose 41. Similarly, the water hose 42 is connected through the flat annular portion 24 with a water supply pipe 47 provided with a valve 48. Reference has been made to a "cement gun" at the outside of the caisson, but it will be evident that the operation may be performed by use of a "cement gun" at the interior of the caisson.

Under many conditions it is not necessary to seal the joints each time a sectional ring is added at the bottom of the caisson, but after a suitable number of rings have been added a sheet of reinforcing material 50, of suitable size wire and size of mesh to meet the requirements of the work, is applied and, as indicated in Fig. 1, is bent around the flanges to some extent to bring the portions in the spaces between the flanges closer to the side wall of the caisson. The reinforcing material thus applied may be secured in this position by suitable means such as loops of wire connected with parts of the reinforcing material and extending around bolts 15 or nuts 16.

The sealing of the joints is effected by spraying the hydrated mixture into place over and around the joints, thereby forming a seal of cementitious material, such as "Gunite". It is especially advantageous to use "Gunite" in that this material is very strong and will adhere to the caisson wall when sprayed thereagainst. Preferably, reinforcing material such as metal mesh 50 is applied over the flanges at the joints and the hydrated material is blown into place to form a deposit 51 filling the space between the reinforcing material and the caisson members and covering the reinforcing material. The operation just described is repeated each time the depth of the caisson is increased to a predetermined extent, and until the caisson is completed.

Although, when the pressure maintained in the caisson is relatively low, it may be sufficient to cover the joints only (Fig. 3), it is in general found desirable to line the caisson throughout (Fig. 3) with cementitious material, such as "Gunite".

In the event that the joints only are to be covered (Fig. 3) strips 50*a* of reinforcing material are bent into position around the flanges 14 at the joints and material sprayed thereon to form the desired deposit 51. However, where the joints only are covered and the pressure is relatively high, there is danger of the seal being broken. For example, the air pressure at the outside of a portion of the caisson may, due to passage of air around the bottom of the caisson, be as great as at the inside, and if the pressure in the caisson falls suddenly the air at the outside might force its way inwardly and break the seal.

The seal shown in Fig. 1 has the advantage that the lining of the caisson is complete and, even if the air from the outside of the caisson came in between the caisson shell and the lining, it would be prevented by the lining from entering the caisson so as to reduce materially the air tight condition thereof.

As already stated, it is practically impossible to keep up the air pressure in the caisson necessary to exclude water, unless the sealing of the joints is effected more expeditiously than by methods heretofore in use. Obviously it is impracticable to attempt to seal the joints by material requiring the use of forms. However, by use of a "cement gun", cementitious material forming "Gunite" can be applied very quickly. Furthermore the "Gunite" adheres strongly to metal. "Gunite" is of especial value for this purpose in that the mixture of cement and sand blown by the "cement gun" to the nozzle is hydrated at the nozzle substantially without addition of excess water and is therefore immediately effective.

It should be understood that various changes may be made and that parts of the invention may be used without others without departing from the true spirit and scope of the invention.

Having thus described my invention, I claim:—

1. The method of sinking a caisson under high internal air pressure which includes assembling ring sections into successive rings at the bottom of the caisson as soon as sufficient soil is removed to permit the addition of a ring, securing the sections of each ring together and to the next ring above as quickly as possible, and quickly sealing, at the interior of the caisson to enable the air pressure to be maintained, the joints at each newly formed portion of the caisson by blowing cementitious material into place over the joints.

2. The method of sinking a caisson under internal air pressure which includes assembling in successive interior-pressure-sustaining rings at the bottom of the caisson ring sections having at their edges inwardly extending fastening flanges, securing together the flanges brought together in assembling ring sections into a ring engaging the lower edge of a previously formed ring, and quickly sealing the joints of newly formed portions at the bottom of the caisson by applying sheets of mesh material over said flanges at the interior of the caisson depressing the mesh material between the flanges at opposite edges of the ring sections, and blowing hydrated cementitious material into place to embed said mesh material.

In witness whereof, I affix my signature.

LYMAN R. TALBOT.