June 4, 1929. S. M. SAVAGE 1,716,190

UNDERWATER CONSTRUCTION

Original Filed Feb. 16, 1925 5 Sheets-Sheet 1

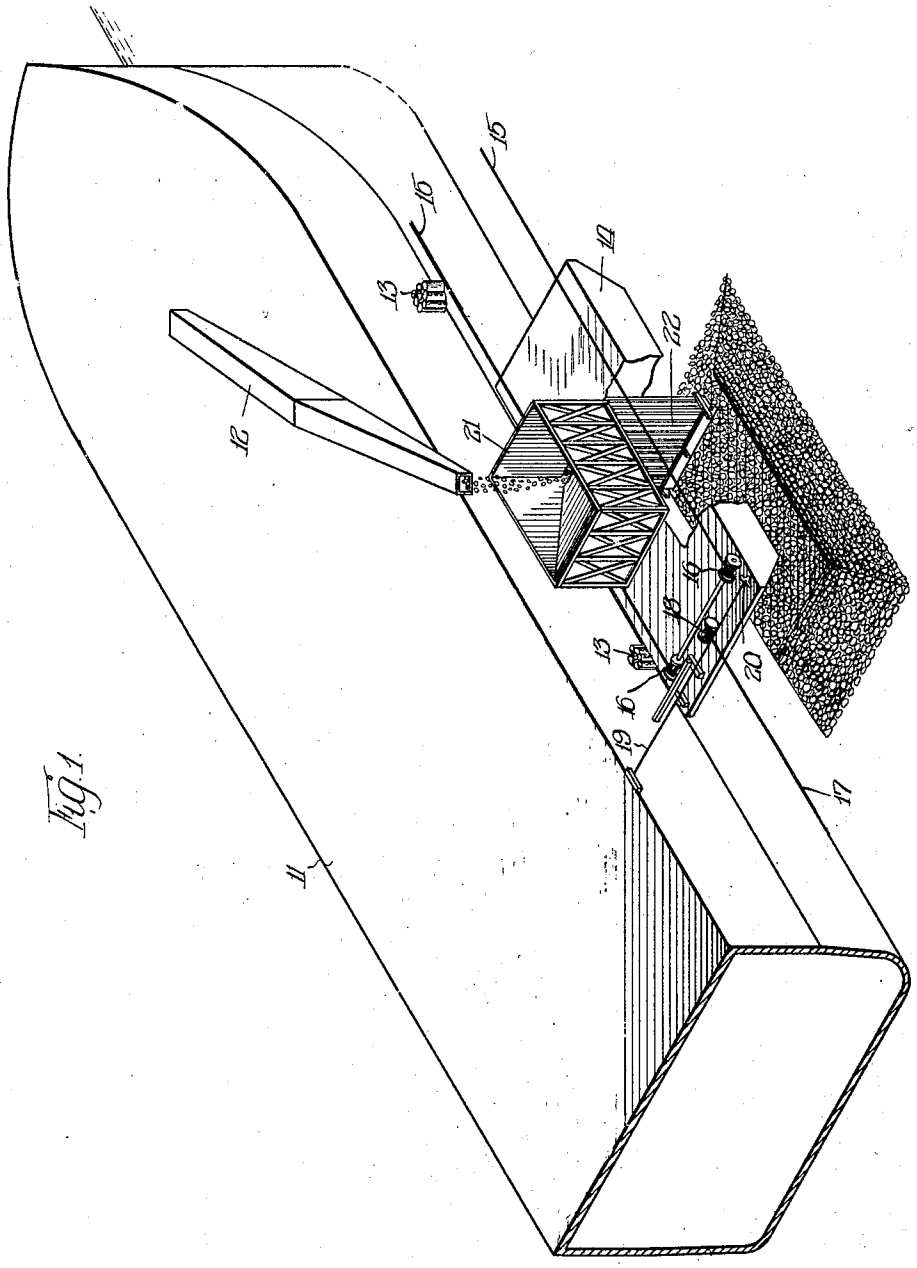


Fig. 1.

Inventor:
Seward M. Savage,
By L. Anthony Norris
Atty

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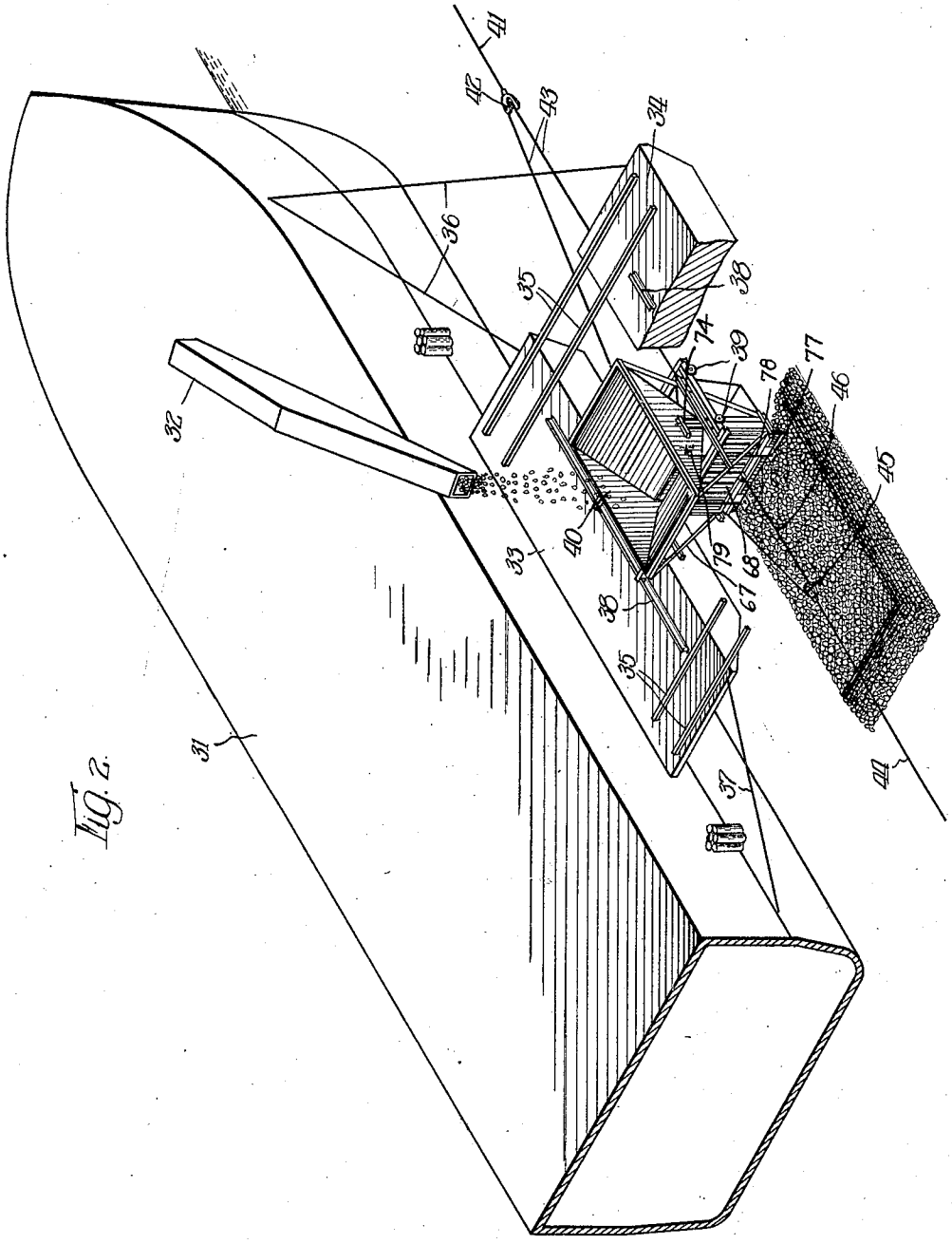


Fig. 2.

Inventor:
Seward M. Savage,
By L. Anthony Marin
Atty

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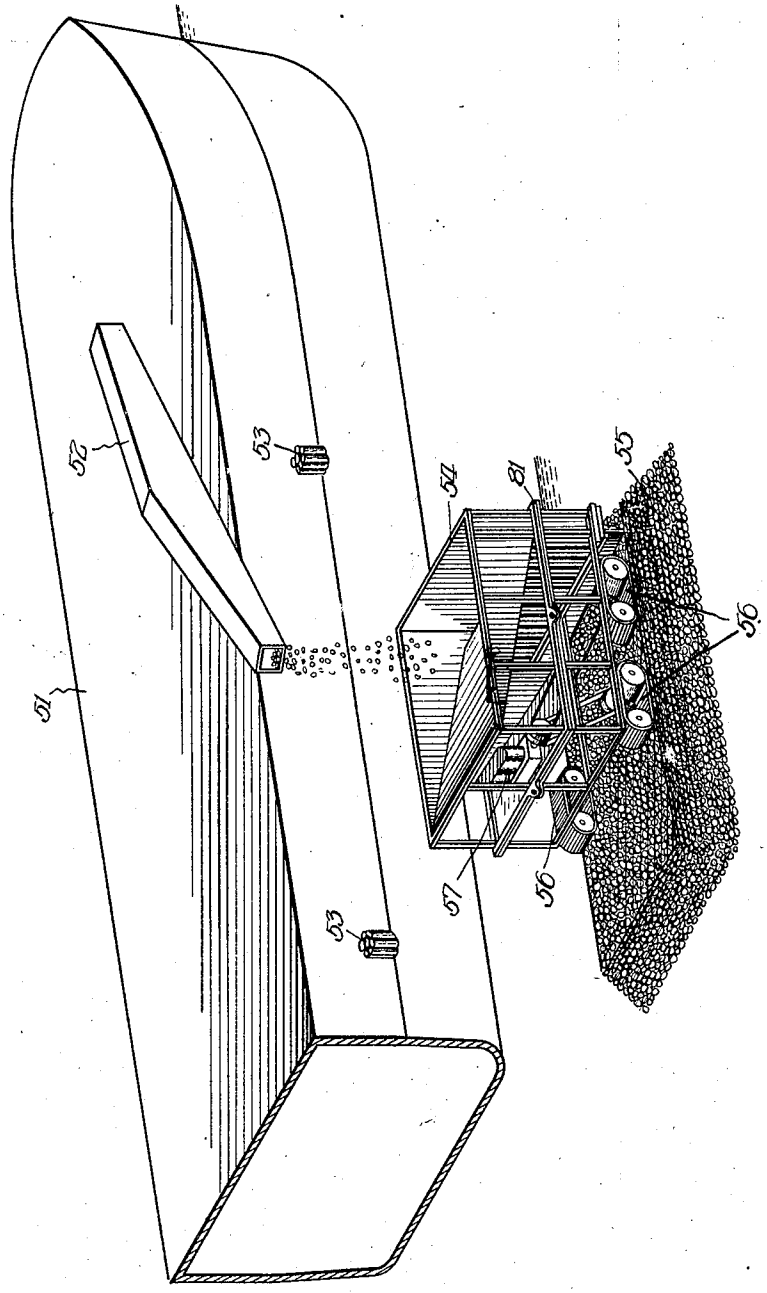


Fig. 3.

Inventor:
Seward M. Savage,
By L. Anthony Name
Atty

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Fig. 4.

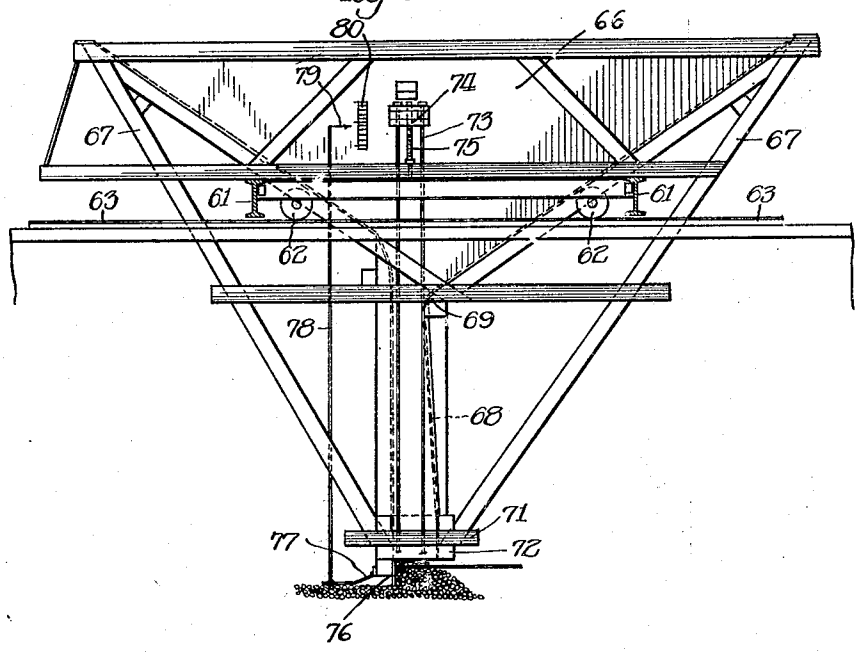
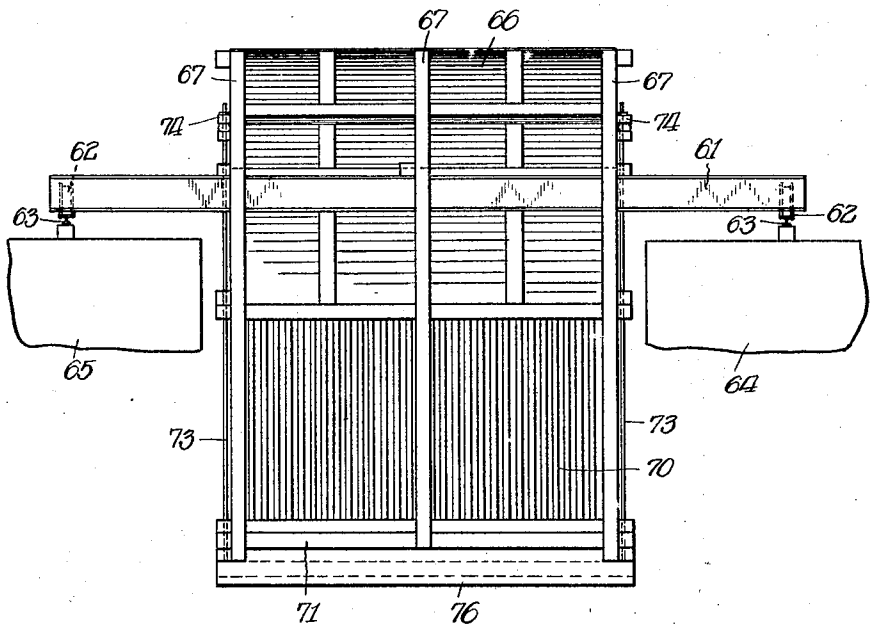


Fig. 5.



Inventor:
Seward M. Savage,
By A. Anthony Usina
Atty.

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Fig. 6.

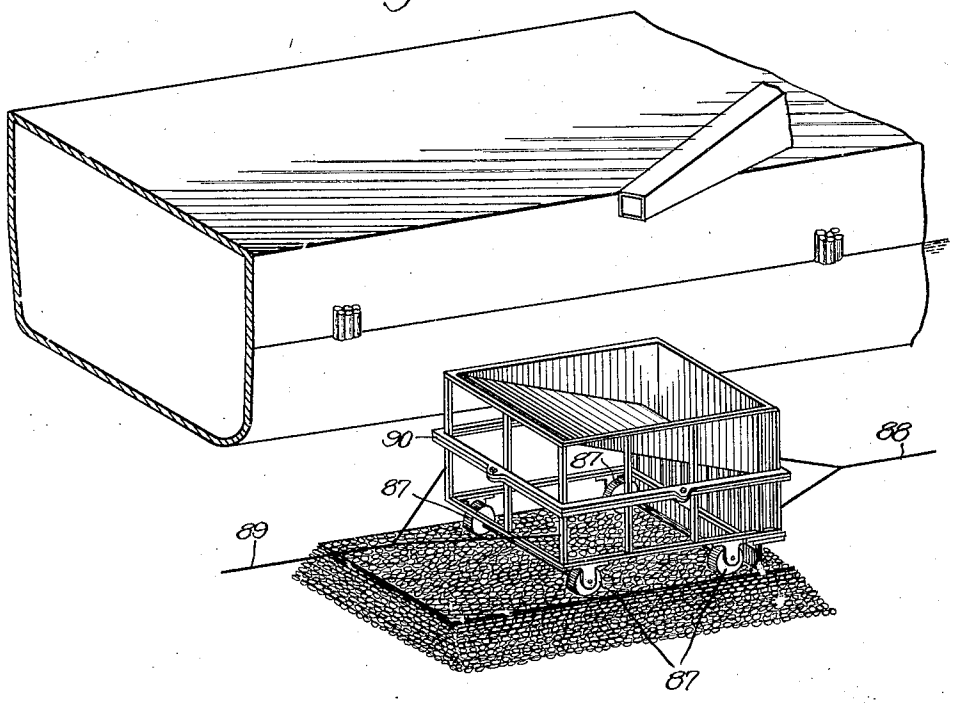


Fig. 7.

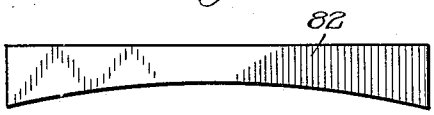


Fig. 8.

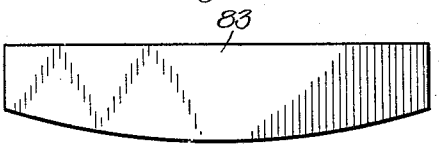


Fig. 9.

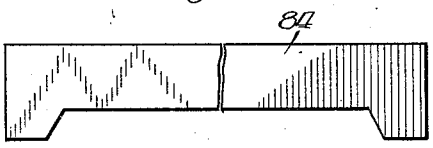
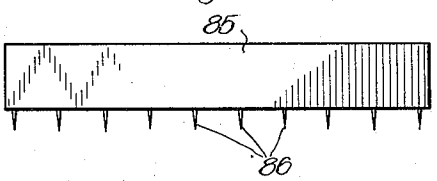


Fig. 10.



Inventor:
Seward M. Savage,
By H. Anthony Ware
Attg.

Patented June 4, 1929. 1,716,190

UNITED STATES PATENT OFFICE.

SEWARD M. SAVAGE, OF CHICAGO, ILLINOIS, ASSIGNOR TO BRADLEY TRANSPORTATION COMPANY, OF ROGERS CITY, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

UNDERWATER CONSTRUCTION.

Original application filed February 16, 1925, Serial No. 9,605. Divided and this application filed May 21, 1928. Serial No. 279,450.

This invention relates to a new and improved method and apparatus for underwater construction and more particularly, to a method and apparatus adapted for building and leveling breakwaters and the like underwater.

Numerous types of breakwaters and other structures which rest upon the bottom under water comprise as an element a lower portion or foundation consisting of broken stone in various sizes. In many such constructions it is essential that the broken stone be uniformly placed and the upper surface leveled to receive superposed structures. This construction has heretofore generally been carried out by taking the material from barges or lighters by means of power shovels and depositing it where desired. This results in a series of piles and requires considerable work by divers in leveling the work.

I am aware that it has also been proposed to make such structures by unloading the stone from a boat by means of a continuously operating conveyor extending out on a boom from the side of the boat and moving the boat along the line of the structure. In spite of continuous sounding this method forms a somewhat irregular longitudinally extending pile and even by closely placing such piles a considerable amount of underwater leveling is required.

This application is a division of my application Serial No. 9605, filed February 16, 1925.

It is an object of the present invention to provide an apparatus and method whereby loose material may be continuously deposited under water and leveled or otherwise desirably shaped mechanically simultaneously with the deposit.

It is a further object to provide apparatus which is relatively simple in design, construction and operation, and adapted for efficiently and rapidly carrying out my method.

Other and further objects will appear as the description proceeds.

I have illustrated certain preferred embodiments of my invention in the accompanying drawings, in which

Figure 1 is a perspective view showing the apparatus carried by a single barge;

Figure 2 is somewhat similar to Figure 1, showing the apparatus carried between two barges;

Figure 3 is a perspective view showing the apparatus supported on the bottom;

Figure 4 is an enlarged side view of one form of apparatus;

Figure 5 is a view of Figure 4 as seen from the right;

Figure 6 is a view similar to Figure 3 showing a further modification; and

Figures 7 to 10 are views showing forms of finishing templates or strike boards.

Referring first to Figure 1, the material carrying vessel has been indicated diagrammatically at 11 and is provided with the conveyor 12 adapted to continuously discharge the material. The vessel is moored beside the pile clusters 13, which are located in a line parallel to that of the breakwater to be constructed. The barge 14 is moored by lines 15 to anchors set up well ahead on the line of the breakwater. These lines 15 are handled by winches 16. A stern-holding line 17 connects to a stern anchor and is handled by winch 18. A rope 19 is secured to the vessel and to a cleat 20 carried by the barge. The barge carries, secured thereto, the material receiving hopper 21 having the material depositing chute 22 extending downwardly through the bars. The construction of this material handling hopper and chute will be described more in detail in connection with Figures 4 and 5.

Referring now to the form of construction shown in Figure 2, the vessel 31 is provided with the continuous discharge boom 32. The pair of barges 33 and 34 are connected by cross beams 35, or otherwise, so as to maintain them in spaced parallel position. These barges may be secured to the vessel by cables 36 and 37. The barges are provided with the longitudinally extending rails 38 upon which rest the wheels 39 which are a part of the distributing hopper assembly 40. The forward line 41 is secured to an anchor set up ahead on the line of the breakwater and carries the pulley 42. The drag line 43 is connected to the forward end of the distributing apparatus 40 and passes through the pulley 42 and back to a winch on the distributing mechanism. The rear holding line 44 leads to an anchor set astern and the pulley 45 carried by the line 44 has the cable 46 extend-

ing through it. One end of this cable is connected to the rear of the distributor and the other end goes to a winch carried by the distributor.

In the form of construction shown in Figure 3, the vessel 51 is provided with the continuous discharge boom 52 and is moored against the pile clusters 53 along the line of the breakwater. The distributing apparatus 54 rests on the top of the pile of deposited material 55. This apparatus 54 is provided with the caterpillar type of treads 56, which are driven by the internal combustion engine 57, carried by the apparatus. The apparatus is preferably divided on the plane 81, slightly above the normal water line so that during breaks in the period of operation the upper portion may be removed and not left subject to wave action. It will be understood that the drive belt will be disconnected at this time and that the apparatus may carry ballast if desirable to give it added stability.

One preferred form of hopper and distributor construction is shown in detail in Figures 4 and 5. The frame 61 is provided with the wheels 62 resting on the tracks 63 carried by the barges 64 and 65. It will be understood, of course, that instead of two barges, this construction may be supported on a single barge and extend through a central well in the barge. The hopper 66 is supported by the framing 67 from the frame 61. This hopper discharges into the chute 68 and it will be noted that the upper portion 69 of the chute is narrower than the lower portion, so that there will be no tendency for material to clog in the chute. As shown in Figure 5, the chute 68 is formed of a plurality of vertically extending parallel bars 70. This serves to minimize the effect of current or wave action upon the chute.

The lower end of the fixed portion of the chute is supported in the frame 71, which is carried by the framework 67. The adjustable lower end frame 72 of the chute is carried by the vertically extending support members 73 which terminate in the connector block 74. This block is supported by the screw 75 from the framework 67. The frame 72 may be adjusted vertically by the screws 75, one of which is on each side of the hopper.

The frame 72 carries the plate 76 extending from its rear lower edge and this plate determines the elevation and contour of the top of the deposited material. The indicating plate 77 swings to the rear of the frame 72 and is connected to the indicator rod 78, which extends up beside the hopper and carries a pointer 79 cooperating with a scale 80 to indicate the height of the material. The form of hopper shown in Figure 2 is similar in all respects to that just described. The hopper shown in Figure 1 and that shown in Figure 3 are similar in detail, but differ in that the discharge chute of the hopper is located at the forward face of the hopper rather than at an intermediate portion.

Instead of the level straight edge plate 76, members of the form shown in Figures 7 to 10 may be used or those of any desired form. The member 82 of Figure 7 provides a convex top while the member 83 of Figure 8 will form a concave surface. The member 84 of Figure 9 forms a shouldered level surface. The member 85 of Figure 10 is provided with downwardly extending spikes 86 which tend to work and consolidate the upper portion of the material as well as leveling it.

The form of construction shown in Figure 6 differs from that of Figure 3 in that it is provided with broad wheels 87 instead of the belt treads and is adapted to be moved by external power through cables 88 and 89, rather than by its own power. This structure is separable along the plane 90 above the water level.

In the use of the form of apparatus shown in Figure 1, the barge is moored so as to extend along the line of break-water to be constructed with the lower end of the chute extending the width of the top of the pile or foundation desired. The frame 72 at the lower end of the chute, shown in detail in Figures 4 and 5, is adjusted vertically so that the edge of the plate 76 is at the proper level.

Material is now dumped into the hopper from the conveyor and passes down through the chute. When the material ceases to flow down the chute and remains in the hopper, the barge is drawn forwardly, the plate 76 defining the top edge of the pile and the plate 77, by its connection with the pointer 79, indicates the level in the rear of the plate as the barge and hopper move forward. The forward movement of the barge may be substantially continuous, the flow of material being so related to the movement that the hopper is maintained partly full.

It will be seen that the movement of the barge is independent of that of the steamer or source of material supply, it merely being necessary that they be relatively positioned so that the discharge point be above some part of the hopper. The size of the hopper may be made such as to permit considerable relative displacement of the two units without interruption of the operation.

In the form of construction shown in Figure 2, the operation is similar to that described. Here the hopper structure may be moved independently of the movement of the supporting barge, the hopper being moved on the tracks carried by the barges. The barges may be moved with the vessel, or all three units may be moved independently if desired.

In the form of construction shown in Figure 3, sufficient of the breakwater will be constructed to serve as an original support for the apparatus, this construction being carried

out in any usual manner. The apparatus will then be put in place on this part of the structure and the operation will be carried out in the same manner as has been described above. Here the apparatus rests firmly on a fixed support and is moved forward under its own power as the work progresses. The vessel or other source of material is moved forward, this movement being either continuous or in such increments as to keep the end of the discharge boom over some part of the hopper. The construction of Figure 6 is operated in a similar manner, the motive power being externally supplied.

The apparatus has been described as having a discharge chute of the width of the top of the desired placed material, but it will be obvious that in wide structures the work may be carried out by placing a series of parallel strips of material.

While I have shown certain preferred embodiments of my invention, these are to be understood to be illustrative only, and I contemplate such changes and modifications to meet various conditions, as may come within the spirit and scope of the appended claims.

I claim:

1. In apparatus of the character described, the combination of a floating support adapted to be definitely positioned over an area to be leveled; a traveling carriage movable horizontally on said support; and leveling means beneath said support and suspended from and movable with said traveling carriage in a direction substantially parallel thereto whereby the area directly beneath the support may be leveled.

2. In apparatus of the character described, the combination of a floating support adapted to be definitely positioned over an area to be leveled; a traveling carriage movable horizontally on said support; leveling means beneath said support and suspended from and movable with said traveling carriage in a direction substantially parallel thereto whereby the area directly beneath the support may be leveled; and means for raising and lowering said leveling means relative to the support.

3. Apparatus for forming crib seats on the sea bottom comprising a floating support adapted to be definitely positioned over an area to be leveled and provided with openings positioned in accordance with the disposition of crib seats desired and through which discrete material may be dropped to form the seats; a traveling carriage movable horizontally on said support; and means below said support suspended from and movable with said carriage in a direction substantially parallel thereto for leveling said discrete material.

4. Apparatus for forming crib seats on the sea bottom comprising a floating support adapted to be definitely positioned over an area to be leveled and provided with openings positioned in accordance with the disposition of crib seats desired and through which discrete material may be dropped to form the seats; a traveling carriage movable horizontally on said support; means below said support suspended from and movable with said carriage in a direction substantially parallel thereto for leveling said discrete material; and means for raising and lowering said leveling means.

Signed at Chicago, Illinois, this 17th day of May, 1928.

SEWARD M. SAVAGE.