June 20, 1967 M. L. JACOBS 3,326,005

RETAINING WALL FOR WATERWAYS

Filed April 16, 1965 2 Sheets-Sheet 1

FIG. 1

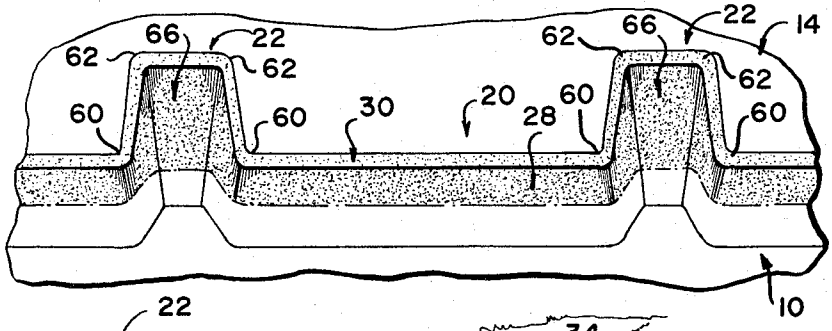


FIG. 2

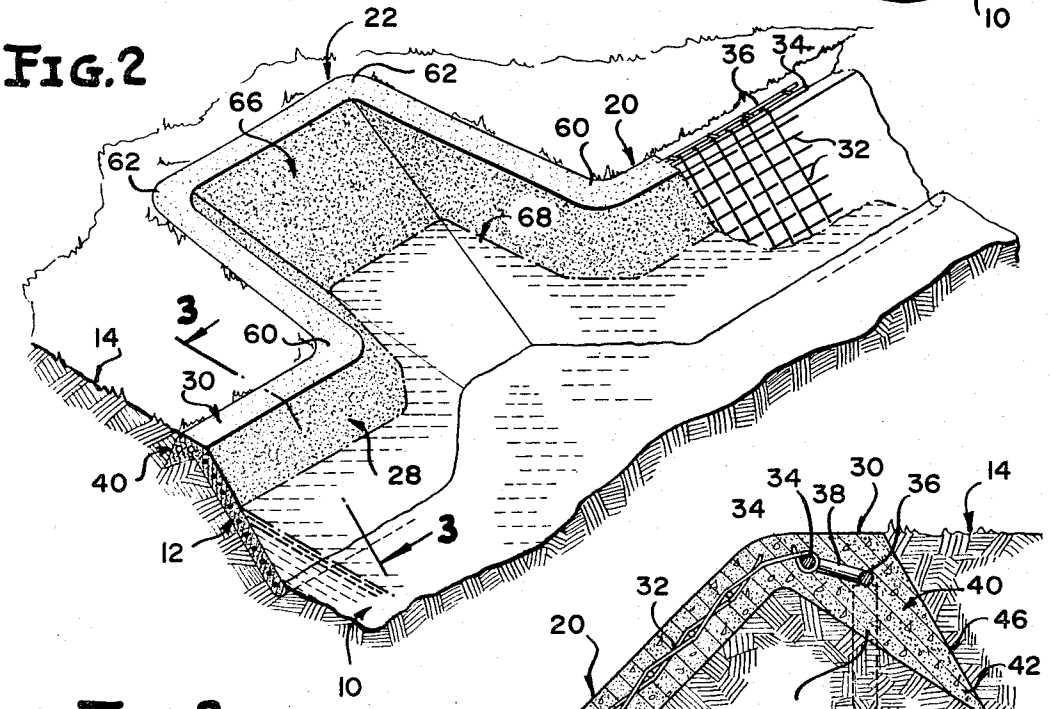
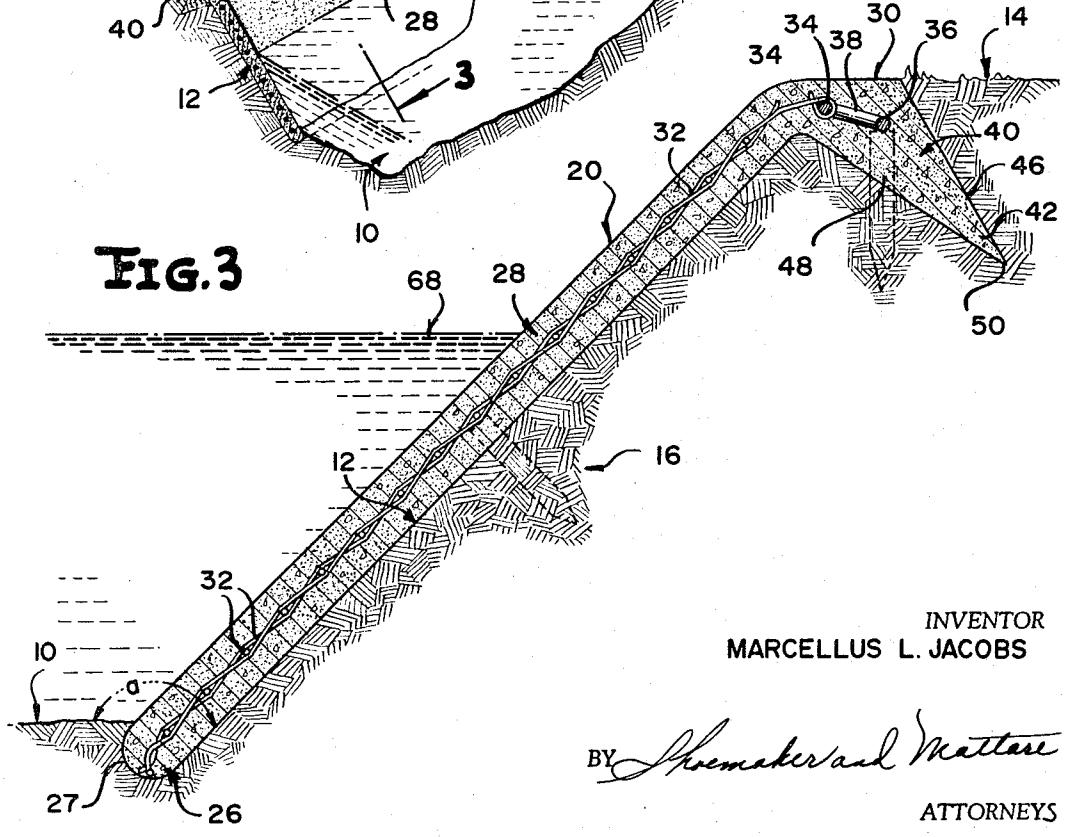


FIG. 3



INVENTOR
MARCELLUS L. JACOBS

BY Shoemaker and Mattare

ATTORNEYS

June 20, 1967 M. L. JACOBS 3,326,005

RETAINING WALL FOR WATERWAYS

Filed April 16, 1965 2 Sheets-Sheet 2

FIG. 4

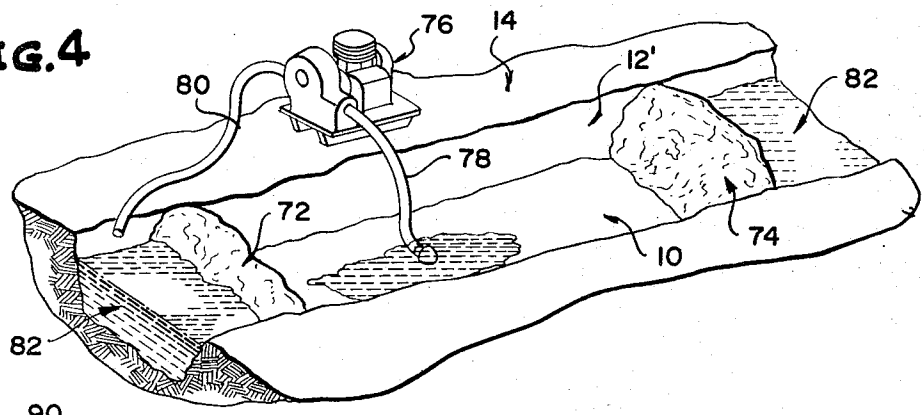


FIG. 5

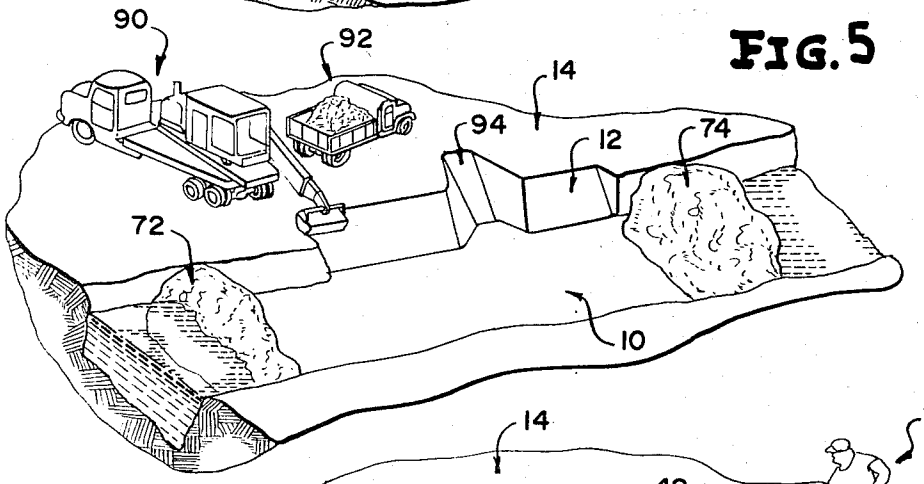


FIG. 6

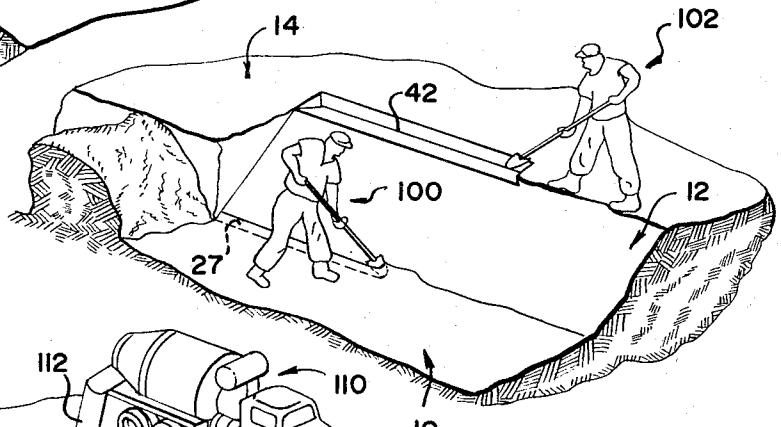
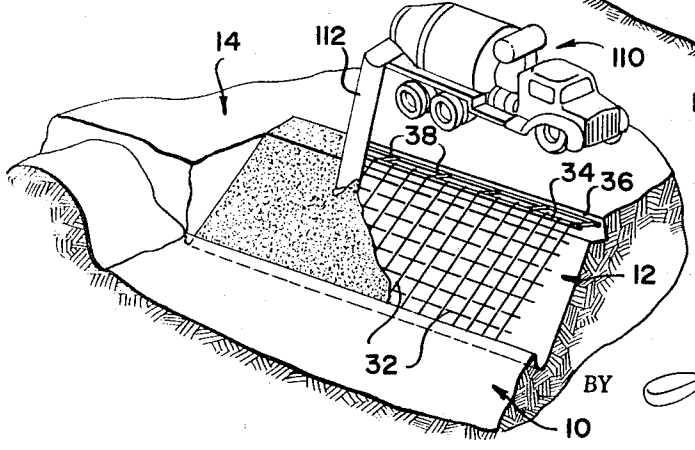


FIG. 7



INVENTOR
MARCELLUS L. JACOBS

BY Shoemaker and Mattare

ATTORNEYS

United States Patent Office

3,326,005

Patented June 20, 1967

3,326,005

RETAINING WALL FOR WATERWAYS

Marcellus L. Jacobs, Fort Myers, Fla., assignor to Jacobs Wind Electric Company, Inc., Fort Myers, Fla., a corporation of Montana

Filed Apr. 16, 1965, Ser. No. 448,661
2 Claims. (Cl. 61—37)

ABSTRACT OF THE DISCLOSURE

The sloping retaining wall for a waterway having a bed and bank is formed of reinforced concrete and extends from the bed of the waterway to the top of the bank. The bank is shaped to the desired configuration such that the side surface thereof slopes upwardly from the bed at an angle of approximately 135 degrees. The side portion of the retaining wall conforms to the slope of the bank and at the the top thereof the wall includes a laterally outwardly extending part which extends substantially normal to the side portion. This extending part has a generally wedge-shaped or V-shaped cross sectional configuration and tapers to a relatively sharp edge in a direction away from the side portion. The retaining wall further incorporates integral offset boat ramp sections which have side portions having a more gradually sloping surface than the side portions of the retaining wall. The side and top portions of the ramp section are interconnected with the side and top portions of the retainer wall by integral curved wall portions.

The present invention relates to retaining wall apparatus and method of making same, and more particularly to a retaining wall which is adapted to be used along the canals of waterfront developments and the like.

The arrangement of the present invention is particularly adapted for use along waterways such as canals employed in housing developments in certain areas of the country such as along the Florida coast. In these type of developments, it is necessary to provide some sort of retaining wall to keep the adjacent earth in place, and also preferably to provide suitable ramp means for launching boats into the waterway.

In the past, retaining walls or so-called "seawalls" have generally comprised pre-cast sectional vertical walls or formed and poured vertical walls.

These vertical walls have not proved satisfactory in actual practice for several reasons. In Florida and in many other places, the back-fill soil does not become solid and bonded sufficiently to hold an anchor system in the form of anchor cables and deadmen that are placed in the earth to hold the vertical type walls in place. In areas where there is quite a bit of sand and little clay to bond the sand, any anchor system depending only on stakes or individual deadmen with cables attached will not hold particularly during the rainy season when the soil becomes quite mushy. Various methods of anchoring a vertical or nearly vertical wall have been tried over the years and it has been found that the wall will push out even after it has been in place several years if an unusually wet season occurs due to the fact that the back-fill soil becomes too soft.

Another problem occurring with vertical type retaining walls arises from the fact that it must have earth placed against the lower portion thereof on the waterway side thereof to hold the lower end of the vertical sections in place and the prevent them from pushing out into the waterway. The earth placed against the outer portion of the vertical walls generally extends up about one-third of the height of the wall. This dirt fill creates a shallow

water condition such that when the tide level changes, the dirt fill is often exposed thereby permitting mangrove and weeds to grow in the fill dirt giving rise to considerable expense required for the removal of this growth.

The arrangement of the present invention is particularly adapted for use with canals and is intended to give as nearly as possible a natural river bank appearance to the finished waterway. The retaining wall structure comprises a substantially integral reinforced concrete arrangement including a bottom portion, a side portion and a top portion, the bank of the waterway is provided with a suitable slope upwardly from the bed of the waterway, and the side portion of the retaining wall structure rests upon this bank.

The top portion of the retaining wall structure includes a laterally outwardly extending part which extends substantially normally to the side portion and which has a generally wedge-shaped or V-shaped cross sectional configuration tapering to a relatively sharp edge in a direction away from the side portion.

The area of the junction between the bank of the waterway and the adjacent ground portion is provided with a recess or trench which extends substantially parallel with the waterway and which is provided with a cross sectional configuration complementary to the part of the top portion which is of V-shaped cross sectional configuration. The top of the retaining wall structure is substantially flush with the adjacent ground surface for appearance sake, and the wedge-shaped part serves to hold the retaining wall structure in place and lock it in postion so that it cannot move downwardly or outwardly into the associated waterway. With this arrangement, all anchor cables and deadmen employed in the prior art can be eliminated.

The wedge-shaped part will support the retaining wall in position even when portions of the associated back-fill at the bank of the waterway becomes soft and saturated with water. The weight of the retaining wall structure pulls down on the wedge-shaped portion actually tending to pack the earth tighter therebeneath, and in addition the pressure of the top layer of earth on this wedge-shaped portion causes this part of the earth to become more compact.

This wedge structure further serves to prevent any water from draining down and accumulating under and behind the retaining wall structure.

The lower portion of the side portion of the retaining wall structure extends downwardly within a recess formed substantially along the junction of the bed and the bank of the waterway, and accordingly, no mangrove or other weeds can grow in this area since the bank of the waterway is completely covered by a layer of the retaining wall structure from the top of the bank all the way down to the bed of the waterway. The necessity for the back-fill at the outer side of the retaining wall and within the waterway has been elinmated, and accordingly no further problem with undesired growth in such back-fill is present.

The sloping wall construction of the present invention will afford very little expansion and contraction movement, and the retaining wall structure further incorporates integral boat ramp means which is interconnected with the retaining wall portions along the waterway by curved corner portions which permits any necessary expansion or contraction to take place without damaging the retaining wall structure.

The bank of the waterway is shaped to the desired configuration such that it slopes upwardly from the bed of the waterway at an angle of approximately 135 degrees. With this approximate angle, no forms are required for pouring of the concrete since the sloping bank of the waterway and the bed of the waterway act as the base

of the form and by utilizing a special "heavy mix," rapid and lower cost pouring of the retaining wall structure is possible.

In the completed form, it will be noted that the weight of the retaining wall structure offsets the pressure of the back-fill both by the angle at which the side wall portion of the retaining wall structure is disposed and further by the pressure and packing effect of the wedge-shaped part of the top portion of the retaining wall structure.

The present invention also contemplates a novel method of making retaining wall apparatus, this method being such as to substantially reduce the cost of making the retaining wall structure and further enabling the structure to be completed much more quickluy than is possible with present methods.

An object of the present invention is to provide new and novel retaining wall apparatus especially adapted for use with canals along waterfront developments and the like and to give a natural river bank appearance to the waterway.

Another object of the invention is to provide retaining wall apparatus including means for holding and locking the apparatus in operative position and eliminating the necessity of anchor cables and deadmen or similar arrangements employed in the prior art for holding the retaining wall in place.

A further object of the invention is the provision of retaining wall apparatus including means for preventing water from draining down under and behind the retaining wall.

Still another object of the invention is to provide retaining wall apparatus which prevents plant growth along the retaining wall at the water edge.

Still a further object of the invention is the provision of a retaining wall structure which reduces expansion and movement of the completed wall.

Yet another object of the invention is to provide a retaining wall apparatus including integral boat ramp means interconnected with the remaining portions of the retaining wall structure so as to substantially eliminate damage to the structure due to expansion or contraction thereof.

A still further object of the invention is to provide a new and novel method of making a retaining wall structure which substantially reduces the cost of the retaining wall and which enables the wall to be completed much more quickly than with prior art methods.

Other objects and many attendant advantages of the invention will become more apparent when considered in connection with the specification and accompanying drawings, wherein:

FIG. 1 is a top plan view of a portion of a waterway incorpoarting the retaining wall apparatus of the present invention;

FIG. 2 is a top perspective view partly broken away of a portion of the retaining wall structure shown in FIG. 1;

FIG. 3 is a sectional view taken substantially along line 3—3 of FIG. 2 looking in the direction of the arrows;

FIG. 4 is a top perspective view illustrating the initial steps of carrying out the method of the present invention;

FIG. 5 illustrates further steps in carrying out the method;

FIG. 6 illustrates still further steps in carrying out the method; and

FIG. 7 illustrates further steps in the method of the present invention.

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, a waterway such as a canal or the like includes a bed portion **10**, and the finished bank portion is indicated by reference numeral **12** in FIGS. 1 through 3 inclusive, the adjacent ground portion extending outwardly from the upper part of the bank being indicated by reference numeral **14**. The portion of earth indicated generally by reference numeral **16** in FIG. 3 may comprise back-fill such as generally the case in a waterfront development including canals as contemplated by the present invention.

The retaining wall structure is indicated generally by reference numeral **20**, and as seen particularly in FIG. 1, a plurality of spaced ramp portions **22** may be provided along the retaining wall, these ramp portions being of such a construction as to facilitate launching of a boat into the water of the waterway.

As seen particularly in FIG. 3, the retaining wall includes a bottom portion **26** which fits snugly within a recess or trench **27** formed along the junction of the bed portion **10** and the bank portion **12** of the waterway. It will be noted that as illustrated this recess **27** may be substantially arcuate in cross section, although the cross sectional configuration thereof may be varied as desired, it being important that the recess extend down below the normal point of junction between the bed portion and the bank portion.

The retaining wall also includes a side portion **28** and a top portion **30**, each of these aforementioned portions of the retaining wall being of a generally one-piece, uniform, homogeneous material as will hereinafter more fully appear. In particular, the material used in the retaining wall is principally concrete. Reinforcing means **32** in the form of a wire mesh is embedded within the side portion of the retaining wall, and further reinforcing means is provided in the top portion of the retaining wall in the form of elongated rods **34** and **36** embedded within the concrete. The reinforcing means may be of any suitable material such as steel or the like, and the upper part of the wire mesh may be secured as indicated by reference numeral **33** to elongated rod means **34**, while the rod means **34** and **36** may be tied together by suitable wires **38** provided at longitudinally spaced portions of the reinforcing rods. This over-all structure provides a very rigid and strong arrangement.

The top portion of the retaining wall includes a laterally outwardly extending portion indicated generally by reference numeral **40**, this portion extending substantially perpendicularly to the side portion **28** and being wedge-shaped or V-shaaped in cross sectional configuration, this tapering portion **40** including an upper surface **46** and a lower surface **48** which taper to a relatively sharp point **50**. It will be noted that the tapering portion **40** is snugly received within a correspondingly shaped recess or a trench **42** provided along the junction of the upper part of the bank of the waterway and the adjacent ground portion.

As seen in FIG. 3, it will be noted that the upper surface of the top of the retaining wall is substantially flush with the adjacent ground portion, and that the ground portion will bear down upon the upwardly facing surface **46** of the tapering portion **40**. On the other hand, the downwardly facing surface **48** of the tapering portion will bear downwardly upon the earth therebeneath to lock the retaining wall in position and to compact the material therebeneath. It is also evident that the bottom portion **26** of the retaining wall extends down below the bed of the waterway, and accordingly the entire bank is covered by the side portion of the retaining wall apparatus positively preventing any plant growth at or near the waterline in the waterway.

It is also evident as seen in FIG. 3 that the tapering portion **40** will effectively serve to prevent water from draining down behind and under the retaining wall structure, and furthermore this arrangement completely eliminates the necessity of providing anchor cables and deadmen or the like since the angular relationship of the side portion of the retaining wall and the interengagement of the tapering portion **40** with the recess **42** positively serves to support and hold the retaining wall in operative position.

As seen particularly in FIGS. 1 and 2, the ramp portions **22** are connected with the adjacent parts of the retaining wall by curved or arcuate corner portions **60**, the

ramp portions extending backwardly to the rear portions thereof wherein the sides of the ramp portions join with the back of the ramp portion by further curved or arcuate corners **62**. It will be understood that the cross sectional configuration of the various walls of the ramp portions will be substantially the same as that shown in FIG. 3, and the wall portions of the ramp means merely comprise continuations of the wall portions of the adjacent retaining wall. The ramp portions provide a more gradually sloping surface **66** than the side portions of the retaining walls adjacent thereto, this more gradually sloping surface **66** permitting a boat or the like to be readily launched into the water which extends part way up along this surface as seen in FIGS. 2 and 3 wherein the surface of the water is indicated generally by reference numeral **68**.

The rounded corners connecting the ramp portions with the adjacent parts of the retaining wall as well as the rounded corners at the back of the ramp portions allow any necessary expansion or contraction movement to take place without damaging the over-all wall structure.

Referring now to FIGS. 4–7 of the drawings, the method of making the retaining wall apparatus according to the present invention is illustrated. As seen especially in FIG. 4, the first step in the method is to place spaced temporary dams **72** and **74** within the waterway, such dams extending from one bank to the other of the waterway, the original banks of the waterway being indicated by reference numeral **12'** in contrast to the finished bank portions **12** previously described. These temporary dams may be formed of earth or any other suitable material.

Means is provided for removing the water from the area between the dams, and this may take the form of a suitable means such as a pump **76** of relatively conventional construction, this pump including an inlet conduit **78** adapted to suck water out of the space between the dams, and a discharge conduit **80** being provided for discharging water from the space between the dams to the waterway beyond one of the dams as illustrated. It is apparent that as seen in FIG. 4 the water may be removed from the area between the dams to enable the retaining wall of the present invention to be constructed along the bank of the waterway between the dams. The body of water within the waterway beyond the dams is indicated generally by reference numerals **82**.

Referring now to FIG. 5, after the water has been removed from between the dams **72** and **74**, suitable apparatus such as a power-operated mechanism generally indicated by reference numeral **90** is provided for shaping the bank to its desired configuration. The earth removed during this operation may be placed in a truck **92**, and the earth may be moved by means of the truck to any desired location. The mechanism **90** may also be employed for shaping parts of the bank to provide recessed areas **94** which are adapted to form the ramp portions as aforedescribed.

In shaping the bank **12** to the finished configuration, a suitable slope is provided, and as illustrated in FIG. 3, the angle defined between the bed **10** and the bank portion **12** is indicated by *a*, this angle being approximately 135 degrees. This angle need not necessarily be exactly 45 degrees but is chosen so as to provide the optimum position of the retaining wall and yet at the same time enable the retaining wall to be poured without the necessity of providing any forms during the pouring of the concrete.

Referring now to FIG. 6, after having shaped the bank of the waterway to the desired finished configuration, the trenches of recesses **27** and **42** are formed. This may be done with automatic machinery, or as illustrated in FIG. 6, workmen indicated by reference numerals **100** and **102** may simply prepare these recesses manually by shoveling out the earth to provide the desired finished configuration of the recesses as aforedescribed. It should be understood that these recesses will also extend around the areas **94** as shown in FIG. 5 so that the retaining wall can also be poured in place within the ramp portions as well.

Referring now to FIG. 7, the next steps of the method may be clearly understood. After having formed the recesses **27** and **42** as seen in FIG. 6, the wire mesh **32** is then laid in place adjacent the bank portion **12**. This wire mesh may be supported in spaced relationship to the bank by any suitable spacer means in a well known manner. The reinforcing rod means **34** and **36** are also then placed in the operative position as aforedescribed and as illustrated in FIG. 3, and supported in the desired position by suitable spacer means. The upper portion of the wire mesh is secured to reinforcing rod means **34** by wrapping certain wires of the mesh therearound, and wire means **38** is also wrapped around reinforcing rod means **34** and **36** to tie these members together.

After having placed the reinforcing means in position, a suitable mechanism such as a concrete mixer **110** is provided, this apparatus including a discharge chute **112**. The concrete is then discharged directly from the chute, the concrete flowing down along the bank **12** and into the lower recess **27**, the concrete then forming a substantially uniform layer along the bank portion extending up to the top of the bank portion, and the concrete also flows into the tapering recess **42** and substantially fills this recess. It will be understood that the reinforcing means is embedded within the concrete in the final form as seen in FIG. 3 since the concrete will freely flow into surrounding relationship to the reinforcing means.

As mentioned previously, no forms are necessary for pouring the retaining wall since the sloping bank and the bottom recess **27** act as a base and the use of a special "heavy mix" concrete permits rapid and low-cost pouring of the concrete wall.

After the retaining wall including the offset ramp portions has been poured, the surface of the retaining wall apparatus may be smoothed out in a well known manner and the completed structure is then allowed to harden and become set.

After the concrete has set up, the earth dams **72** and **74** may be removed whereupon the water again enters that portion of the waterway within which the retaining wall apparatus has been formed, and the over-all structure is ready for use.

It will be understood that long sections of a canal or the like may be provided with retaining walls as aforesaid, either performing the operation all at one time, or various individual sections may be made at different times as desired.

It will also be noted that the upper part of the wall may be manually shaped after the concrete has been poured to assure that the topmost portion of the retaining wall is substantially flush with and fairs into the adjacent ground surface.

It is apparent from the foregoing that there is provided according to the present invention new and novel retaining wall apparatus which is especially adapted for use in canals of waterfront developments or the like and is provided to give a relatively natural river bank appearance thereto. Means is provided formed integral with the retaining wall to lock and hold the wall in place and to eliminate the necessity of anchor cables, deadmen and other similar arrangements. The arrangement of the retaining wall structure is such as to prevent water from draining behind and under the wall, and expansion movement of the completed wall is reduced to a minimum: In addition, integral offset boat ramp portions are provided and are connected with the remaining retaining wall portions so as to substantially eliminate any damage to the retaining wall structure due to expansion or contraction thereof. The present invention also provides a new and novel method of making retaining wall apparatus which substantially reduces the cost of the retaining wall structure and which enables the retaining wall structure to be manufactured in a considerably less

amount of time than required with prior art arrangements.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, and since the scope of the invention is defined by the appended claims, all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents are therefore intended to be embraced by those claims.

I claim:

1. Retaining wall for a waterway having a bed, a bank portion sloping upwardly and outwardly from said bed and making therewith an angle of approximately 135 degrees, and a ground portion extending from the top of said bank portion and outwardly thereof; a generally integral retaining wall structure formed principally of concrete and including reinforcing means therewithin, said retaining wall structure including a bottom portion, a side portion and a top portion, said side portion being disposed in abutting relation to said bank portion of the waterway, said top portion including a part extending laterally outwardly of said side portion and tapering downwardly to a smaller dimension in a direction away from said side portion, there being a recess formed along the junction of said bank portion and said ground portion, said laterally extending part of the top portion of the retaining wall structure fitting relatively snugly within said recess, and said structure including an integral offset ramp section having ramp side portions, ramp top portions and ramp bottom portions, said ramp side portions having a more gradually sloping surface than the side portions of said retaining wall, the side and top portions of said ramp section being interconnected with said first-mentioned side and top portions by integral curved wall portions to minimize damage to the over-all structure upon expansion or contraction thereof.

2. Retaining wall for a waterway having a lower bed portion, a bank portion sloping upwardly and outwardly from said bed portion and making therewith an angle of approximately 135 degrees, and a ground portion extending from the top of said bank portion, there being a first recess formed along the junction of said bed portion and said bank portion, there being a second recess formed along the junction of said bank portion and said ground portion; said retaining wall being formed principally of concrete with reinforcing means therein, and including a bottom portion, a side portion and a top portion, the bottom portion of said retaining wall structure being disposed in said first recess, said side portion of the retaining wall structure lying along said bank portion, said top portion of the retaining wall structure including a part extending laterally outwardly from said side portion and tapering downwardly to a smaller dimension in a direction away from said side portion, said tapering part being received within said second recess, and said structure including an integral offset ramp section having ramp side portions, ramp top portions and ramp bottom portions, said ramp side portions having a more gradually sloping surface than the side portions of said retaining wall, the side and top portions of said ramp portion being interconnected with said first-mentioned side and top portions by integral curved wall portions to minimize damage to the over-all structure upon expansion or contraction thereof.

References Cited

UNITED STATES PATENTS

592,738	10/1897	Judson	61—39
1,187,502	6/1916	Chenoweth	61—38
1,275,860	8/1918	Cunningham	61—38
1,638,656	8/1927	Chenoweth	61—37
1,812,364	6/1931	Oursler	61—39

OTHER REFERENCES

Engineering News-Record: Well Points Dry Seaside Trench, August 1934, page 163, Unit 354, Class 61–Subclass 49.

EARL J. WITMER, *Primary Examiner.*