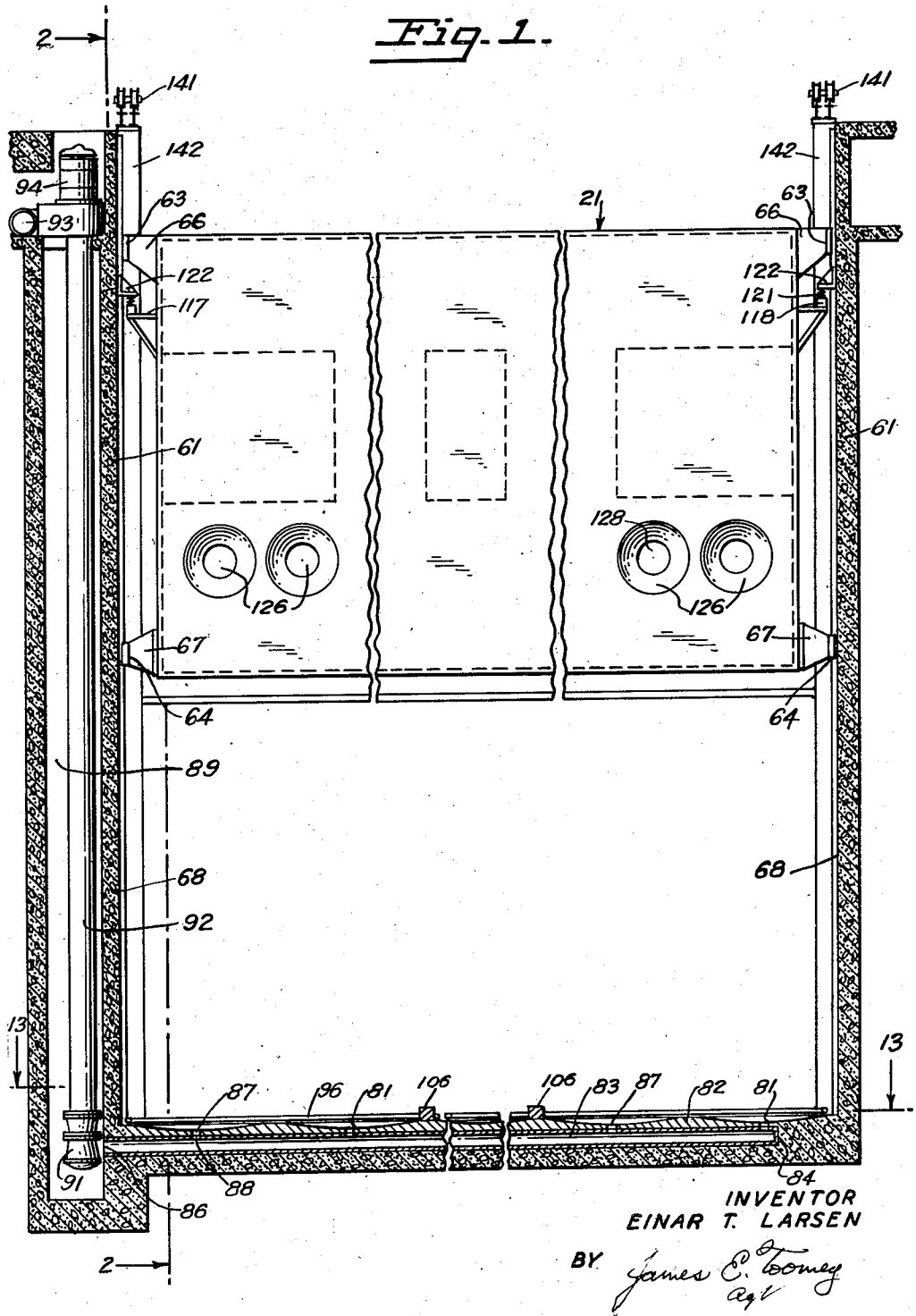
Sept. 25, 1951 E. T. LARSEN 2,568,751

GRAVING DOCK

Filed Nov. 22, 1946 6 Sheets-Sheet 1

Fig. 1.



INVENTOR
EINAR T. LARSEN

BY James E. Toomey
Atty

Sept. 25, 1951 E. T. LARSEN 2,568,751

GRAVING DOCK

Filed Nov. 22, 1946 6 Sheets-Sheet 2

Fig. 2.

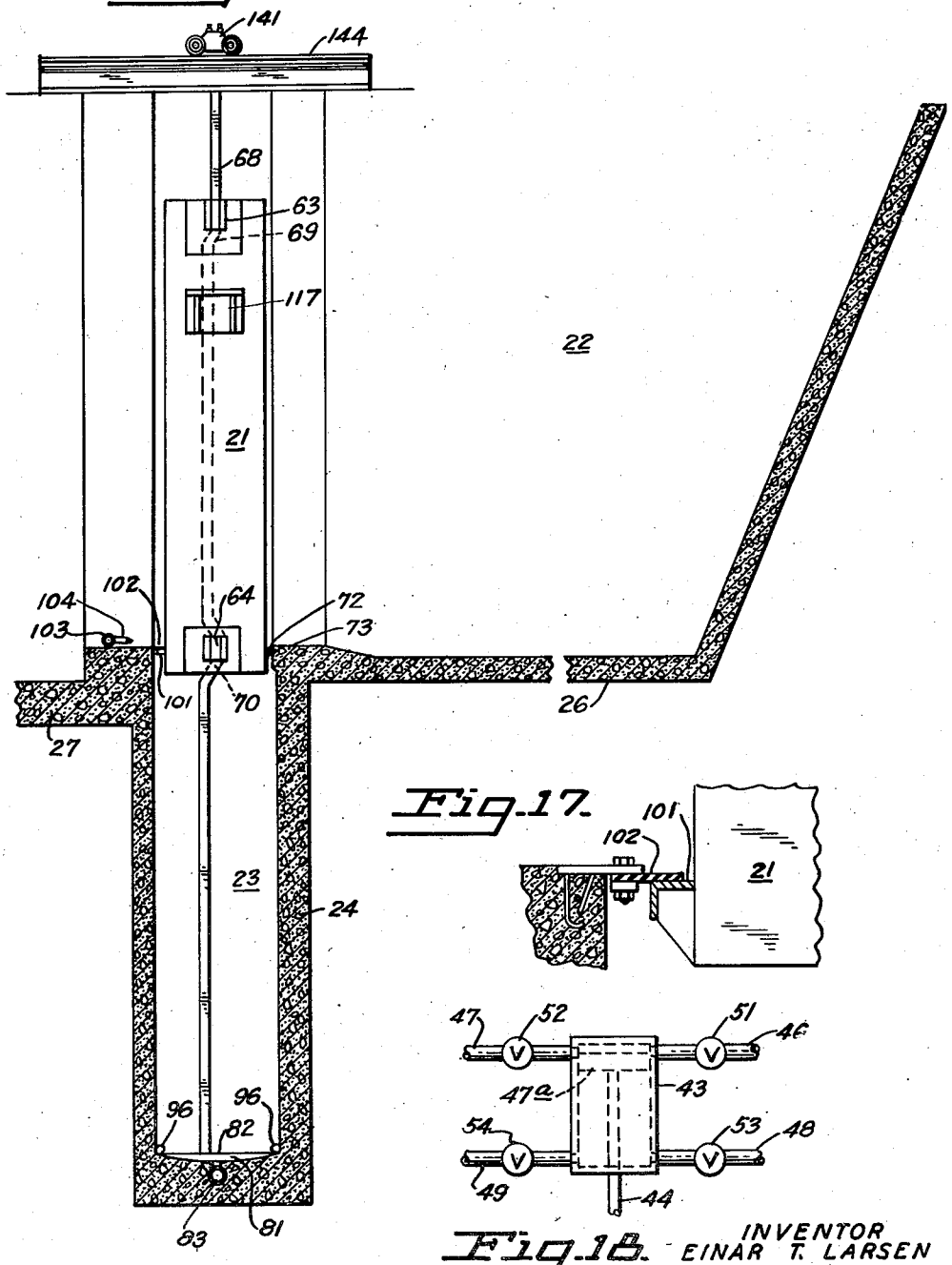


Fig. 17.

Fig. 18.

INVENTOR
EINAR T. LARSEN

BY James C. Toomey
Agt

Sept. 25, 1951 E. T. LARSEN 2,568,751

GRAVING DOCK

Filed Nov. 22, 1946 6 Sheets-Sheet 3

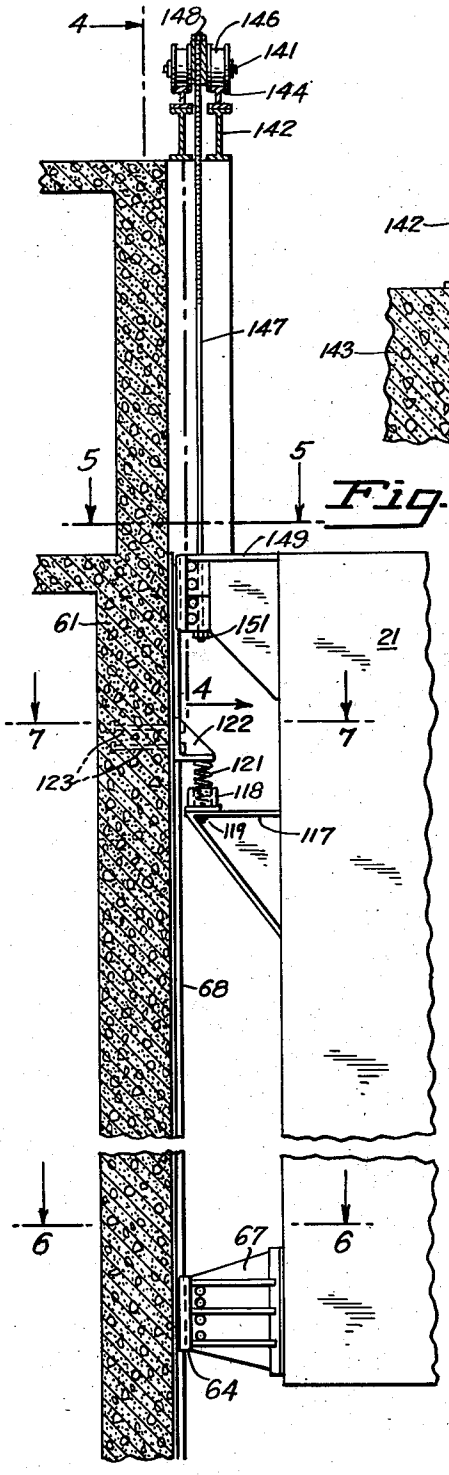


Fig. 3.

Fig. 4.

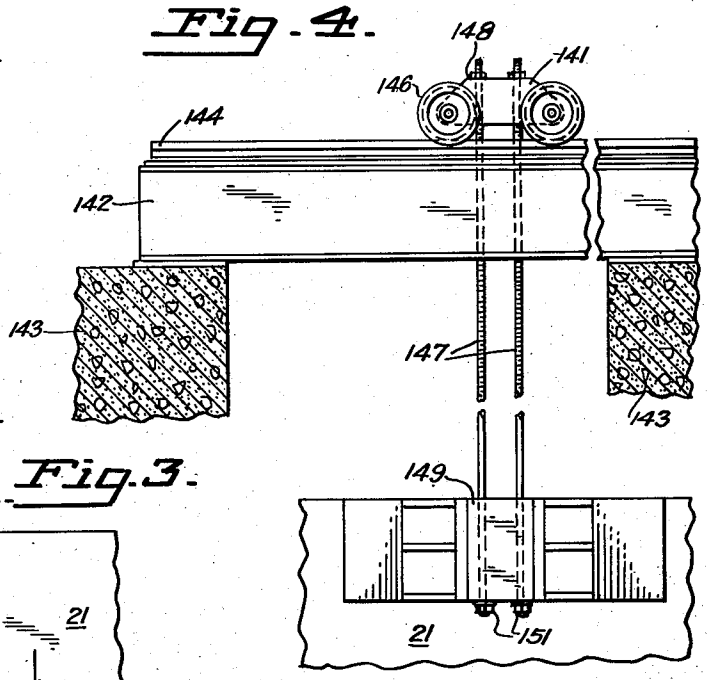
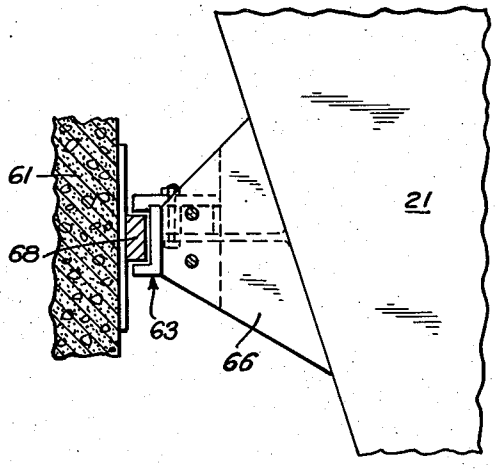


Fig. 5.



INVENTOR
EINAR T. LARSEN

BY James E. Toomey
Agt.

Sept. 25, 1951 E. T. LARSEN 2,568,751

GRAVING DOCK

Filed Nov. 22, 1946 6 Sheets-Sheet 4

Fig. 6.

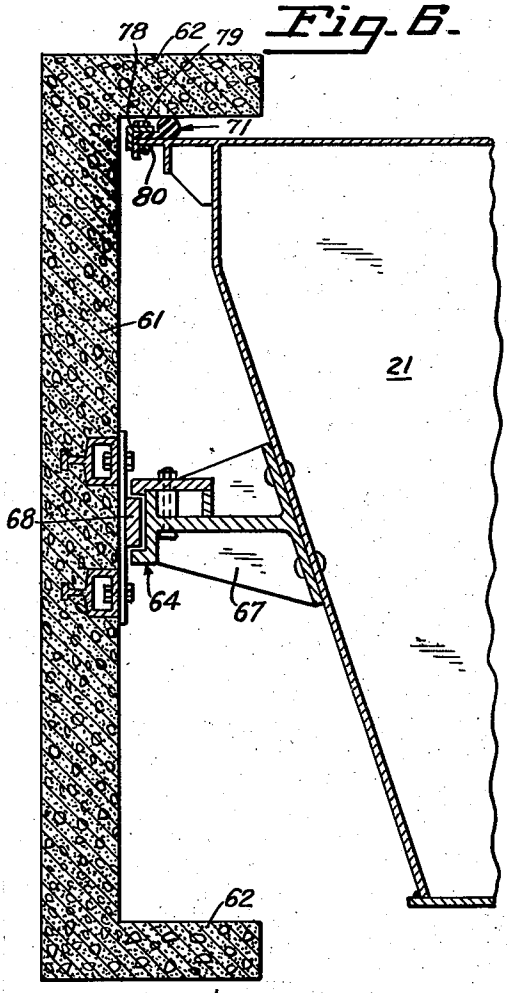


Fig. 7.

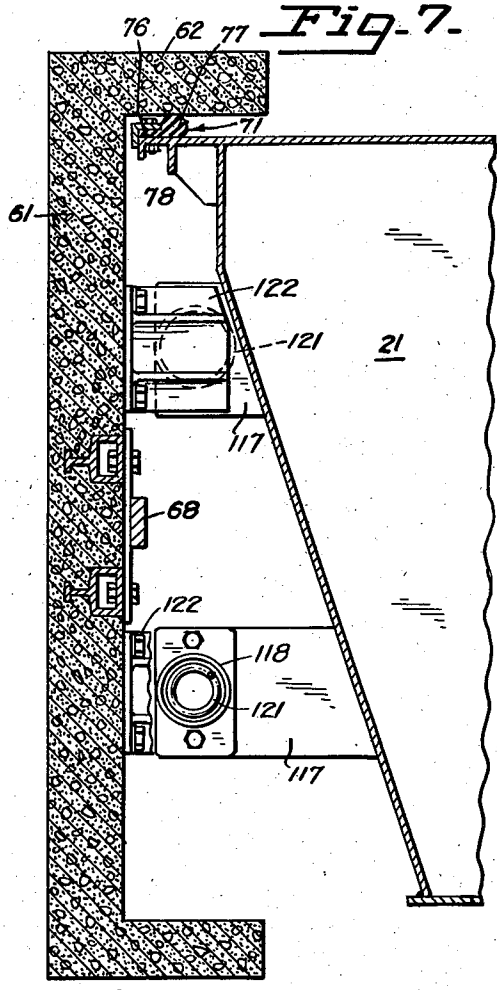


Fig. 8.

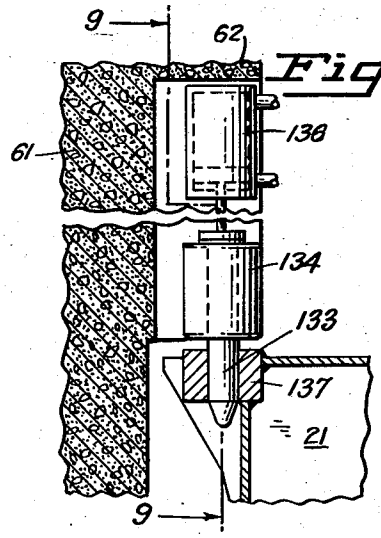
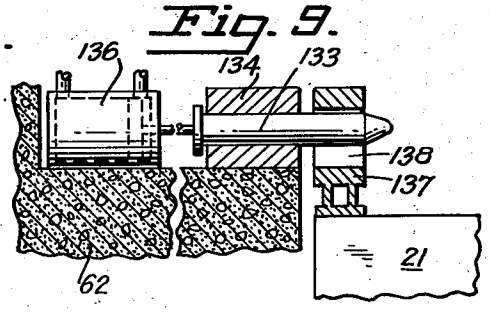


Fig. 9.



INVENTOR
EINAR T. LARSEN
BY James E. Toomey
Atty.

Sept. 25, 1951 E. T. LARSEN 2,568,751

GRAVING DOCK

Filed Nov. 22, 1946 6 Sheets-Sheet 5

Fig. 10.

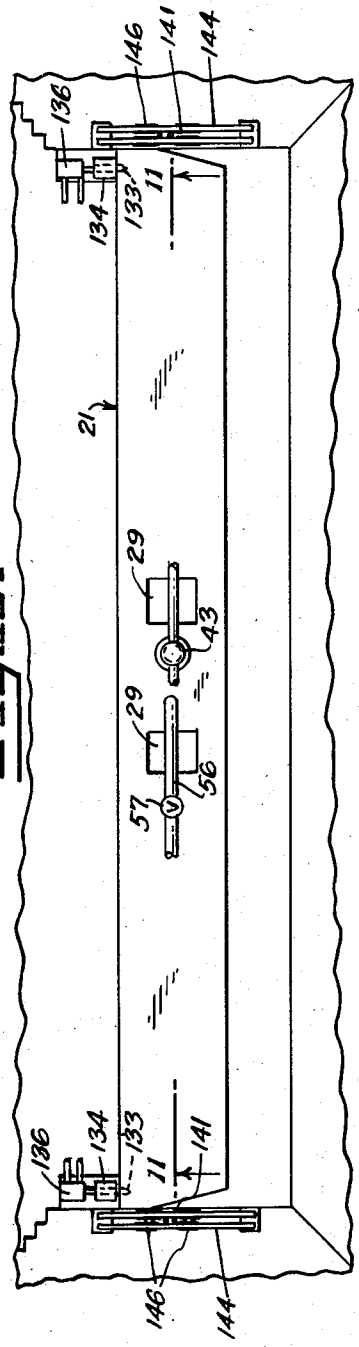


Fig. 12

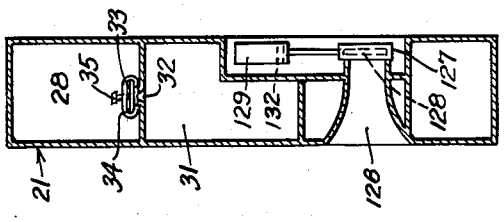
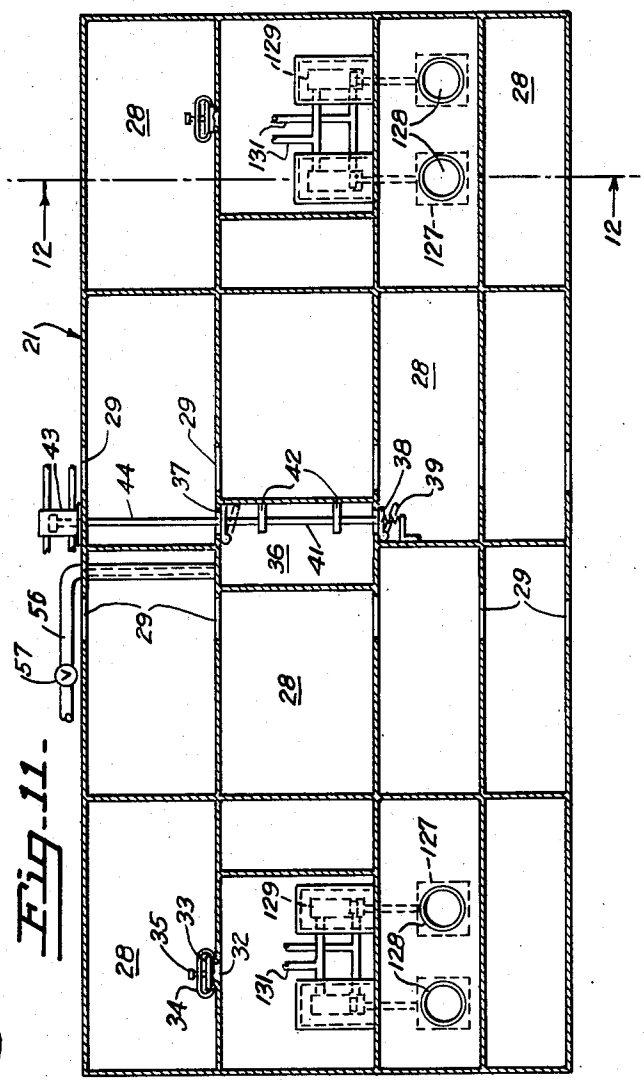


Fig. 11.



INVENTOR
EINAR T. LARSEN

BY James E. Toomey
Agt.

Sept. 25, 1951 E. T. LARSEN 2,568,751

GRAVING DOCK

Filed Nov. 22, 1946 6 Sheets-Sheet 6

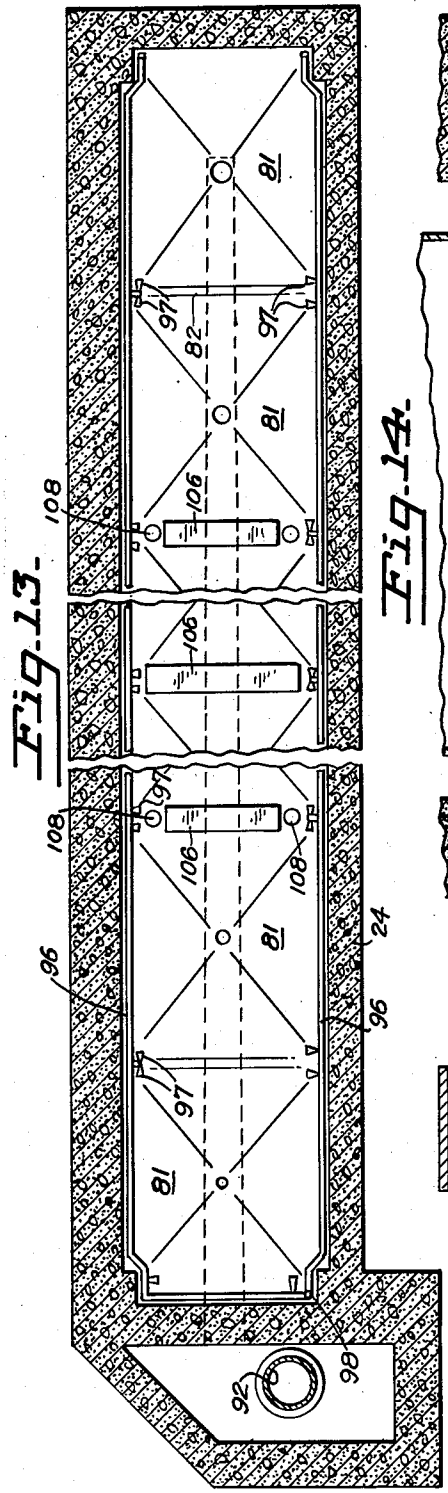


Fig. 13.

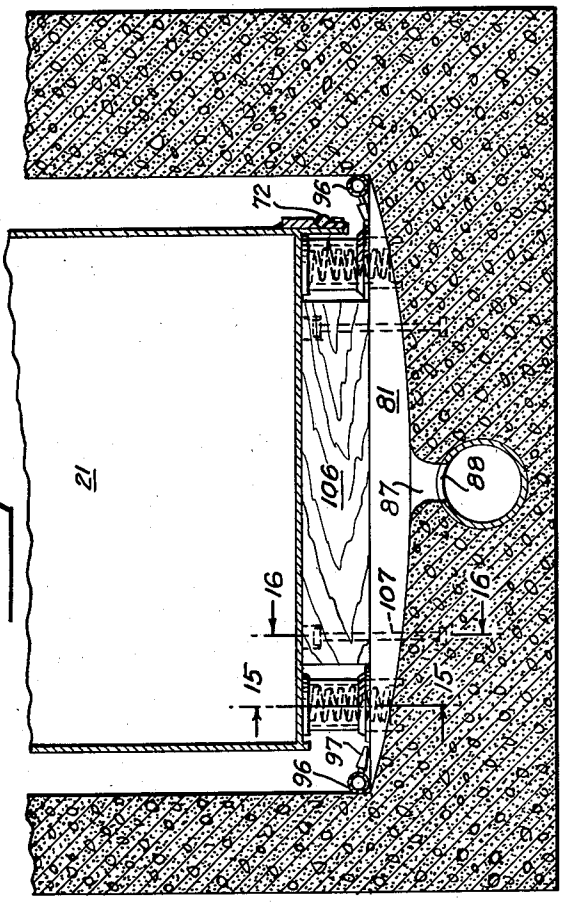


Fig. 14.

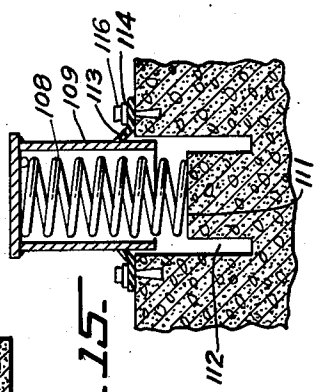


Fig. 15.

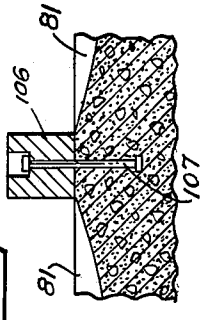


Fig. 16.

INVENTOR
EINAR T. LARSEN

BY James E. Toomey
Agt.

Patented Sept. 25, 1951 2,568,751

UNITED STATES PATENT OFFICE

2,568,751

GRAVING DOCK

Einar T. Larsen, Oakland, Calif., assignor to Kaiser Steel Corporation

Application November 22, 1946, Serial No. 711,741

11 Claims. (Cl. 61—64)

1

This invention relates to gates for graving docks which afford a dry basin in which ships can be repaired or otherwise serviced and new ships can be built.

Such docks are conventionally located with the gate at the sea or other body of water in which the ships can be floated which are to be serviced, repaired or built in the docks. The function of the gate when closed is to seal off the basin from such water so that the basin can be pumped dry to permit repair or other service, or construction of a ship therein, without substantial leakage of such water thereinto. The gate is opened so that a ship to be repaired can be floated into the basin or a serviced or newly built ship can be floated out of it. It has been considered necessary that graving dock gates be large and heavy where large ships are to be accommodated, with the result that it has taken a considerable period of time to open or close them.

Among the objects of this invention are to provide a gate which can be opened and closed faster than heretofore; to provide such a gate and appurtenant parts which are simple in construction and easy to operate, and to provide means for easily and quickly opening and closing it.

Such objects are accomplished by having the gate move vertically, up to closed position, and down to open position into a chamber below the dock mouth; and another object of the invention is to prevent too great an accumulation of silt or debris in such chamber.

Further objects of this invention are to provide means which operate at the end of the closing movement of the gate to improve the sealing effect, and also to provide means which breaks the seal at the beginning of the opening movement.

Still further objects of this invention are to decrease the gravity effect of the actual mass of the gate, to variably control such gravity effect to cause the gate to ascend, descend or remain stationary, and to provide a safety means to retain the gate in its upper or closed position.

Additional objects of the invention will be apparent on reading this specification.

The above objects are attained by application of novel principles and by novel structural features of the gate and appurtenant parts, as will appear more in detail hereinafter. The preferred exemplification of the invention is illustrated on the accompanying drawings, on which

Fig. 1 is a view, partly broken away, showing the sea side of the gate in elevation and the

2

mouth of the basin in section, with the gate in upper or closed position;

Fig. 2 is a section on the line 2—2 on Fig. 1;

Fig. 3 is an enlargement of a part of Fig. 1, showing more details;

Figs. 4, 5, 6 and 7 are sections on the lines 4—4, 5—5, 6—6 and 7—7 respectively, on Fig. 3;

Fig. 8 is a detail view showing a holding pin in plan and appurtenant parts in horizontal section;

Fig. 9 is a section on the line 9—9 on Fig. 8;

Fig. 10 is a top plan view of the gate and basin mouth;

Fig. 11 is a section of the gate on the line 11—11 on Fig. 10;

Fig. 12 is a section on the line 12—12 on Fig. 11;

Fig. 13 is a section on the line 13—13 on Fig. 1;

Fig. 14 is an enlarged vertical cross section through the gate and gate chamber, showing the gate in its lower, closed position;

Fig. 15 is a section on the line 15—15 on Fig. 14;

Fig. 16 is a section on the line 16—16 on Fig. 14;

Fig. 17 is an enlarged section of a detail; and

Fig. 18 is a schematic view of a double acting hydraulic cylinder.

The preferred features of the invention follow. The gate is box-like and hollow, being made of plates of steel or of any other suitable material, with any suitable type of bracing that may be desired. It moves principally vertically, from its uppermost or fully closed position into a chamber in which it assumes its lowermost or fully open position, and vice versa. It also undergoes transverse movements at the end of its closing and at the beginning of its opening movements, the former for the purpose of making a seal, and the latter for the purpose of breaking the seal, so that the sealing material will not be abraded or torn by the movement of the gate. Passages are provided in the gate to allow water to flow through it as it leaves or enters the chamber.

The gate is provided with one or more buoyancy chambers which is or are located to balance the gate and are below the lowest water level, for the purpose of decreasing the weight of the gate. It is also provided with one or more ballast chambers with means to run water thereinto and means preferably of the compressed air type to evacuate such water. The buoyancy and ballast chambers can be so correlated that their effects balance each other so that the gate will float stationary when the ballast chamber or chambers are filled to a predetermined degree, for example, half full, and will sink with more and rise with less ballast water present, making control of the movement of the gate easy and

sensitive to the amount of ballast water present so that the gate will move up or down as fast as desired. Springs resiliently terminate the upward and downward movements of the gate. In its lowermost position the gate rests on suitable supports at the bottom of the gate chamber; and it is held by safety means in its uppermost position. Means are provided to prevent an accumulation of silt or sediment at the bottom and mouth of the gate chamber. Although the gate has preferably all of these features, yet one or more may be omitted as occasion may make expedient. Referring now to the drawings for a detailed description, the gate **21** (Figs. 1, 2, 10, 11 and 12) which selectively closes and opens the mouth of the graving dock **22** moves downwardly into the gate chamber **23**, Fig. 2, formed by a casing **24** preferably made of concrete and integral with the dock bottom **26** and dock opening sill **27**. When open, the gate permits a ship to float into or out of the dock, and when closed, it seals off the opening to permit evacuation of the water within the dock. The gate has a plurality of hollow, box-like subdivisions **28** (Fig. 11), some of which have openings **29** to permit water to pass through the gate as it is raised or lowered. Some of these subdivisions, as those designated **31** can be sealed off completely by suitable means to provide buoyancy chambers which lend buoyancy to the gate and thus make it lighter. Access to such chamber is provided by manholes **32** with a cover **33** to seal them, the covers being held in sealing position by a clamp **34** and a bolt **35** passing through a threaded opening in the clamp and pressing upon the cover. There may be one or more of such buoyancy chambers, any number of them that may be found expedient; and it is preferred that they so balance the effective weight of the gate that there is no tendency for any part of the gate to rise or sink faster than another. Such chamber or chambers are to be sealed during the construction, installation or repair of the gate, before they are submerged.

One or more of the subdivisions of the gate, as for example that designated **36**, has (or have) means to hold a controllably variable amount of ballast water, to provide a ballast chamber. The ballast chamber or chambers, similarly to the buoyancy chambers, is or are located so that no part of the gate has a greater tendency than another to rise or sink. Each ballast chamber **36** has a normally closed, inwardly opening valve **37** (Fig. 11), and a normally closed, outwardly opening valve **38**, the former being preferably but not necessarily at the top and the latter at the bottom for a purpose which will appear hereinafter. The valve **38** is normally held closed by a spring **39**, aided by the water pressure on the outer face of the valve. A vertical push rod **41** is of a length to loosely contact both the lower face of the valve **37** and the upper face of the valve **38**. Brackets **42**, through which the rod can slide, maintain it in proper position. A hydraulic cylinder **43**, shown enlarged on Fig. 18, is carried by the gate, its piston rod **44** normally resting loosely on the upper face of the valve **37**. Pipes **46** and **47** lead into the cylinder at one end, thereof, that is at one side of the piston **47***a* and pipes **48** and **49** at the other. Valves **51**, **52**, **53** and **54** control flow through each of these pipes respectively. Pipes **46** and **48** are each connected to a source of water under pressure (not shown), and pipes **47** and **49** are exhaust or waste pipes. A pipe **56** controlled by a valve **57** is connected to the ballast chamber **36** and to a source (not shown) of compressed air. All of the valves **51**, **52**, **53**, **54** and **57** are located for convenient operation. The piston **47** at which carries the rod **44** can be moved selectively down or up by means of the valves **51**, **52**, **53** and **54**. With the valves **51** and **54** open and the valves **52**, **53** and **57** closed, the hydraulic pressure will move the piston down, the piston rod **44** then opening the valve **37** as shown in dotted lines. This moves the push rod **41** down to open the valve **38** against the pressure of the spring **38**, as shown in dotted lines. With the valves **51**, **54** and **57** closed and the valves **52** and **53** open, the piston and its rod will be moved upwardly by the hydraulic pressure, permitting the spring **39** to close the valve **38**, which closes the valve **37** by means of the rod **41**. The gate is lowered by admitting sufficient water into the ballast chamber or compartment **36**, which is accomplished by opening the valves **37** and **38**, air within the compartment then escaping therefrom through the open valve **37** while water enters through the open valve **38** and perhaps also through the open valve **37**. The gate is raised by removing sufficient water from the compartment **36**, which is accomplished by opening the compressed air valve **57**. The air is under sufficient pressure to open the valve **38** and force water present out therethrough. The push rod **41** then does not maintain the valve **37** closed, but the air pressure in the ballast compartment does. By properly designing the gate features affording buoyancy, and the ballast feature, with respect to each other and to the weight of the gate, any practical maximum speed of ascent and descent of the gate is attainable and such speeds of ascent and descent are easily variably controllable to any not greater than such maxima.

Projecting upwardly from the end walls of the casing **24** which receives the gate when open, are walls **61** (Figs. 1, 6 and 7) which are preferably of concrete and may be integral with such end walls. Such walls **61** preferably have flanges **62** to form opposite U-shaped members which together form a passageway within which the gate moves. The gate itself has a tapered cross section, being narrower at its sea side than at its dock side. Attached to its oblique ends are upper guide shoes **63** and lower guide shoes **64**, by means of brackets **66** and **67** respectively. Guide rails **68** are attached to the walls **61**, the guide shoes sliding along such rails as the gate ascends or descends. The major part of each guide rail **68** is straight and vertical so that most of the movement of the gate in opening and closing is vertical. There are however two jogs **69**, **70** in each guide rail, one for the upper guide shoe and one for the lower, which cause the gate to move a short distance toward the dock side at the end of its closing movement and in the reverse direction at the beginning of its opening movement. Vertical portions **71** (Figs. 6 and 7) of a U-shaped sealing strip lie between the endwise parts of the dock side face of the gate and the adjacent faces of the dock side flanges **62** when the gate is up, these vertical portions being connected by a portion **72** (Fig. 2) extending across between the lower part of the dock side face of the gate and the dock side sill **73**. The sealing strip may be attached to either one of the members between which it is compressed, although it is often preferred to attach it to the gate. It extends upwardly (as at **71**) to a point above the highest water level, and is preferably made of rubber or equivalent flexible waterproof material. It preferably has a cross section simi-

lar to that of a lamb chop, having a flat portion 76 for attachment purposes and an enlarged rounded portion 77 for sealing purposes. Clamps 78 held by bolts 79 and nuts 80 affix the sealing strip, for example to the gate. It is now apparent that a water-tight seal is made between the gate and the structure forming the mouth of the dock basin by the movement of the gate at the end of its closing movement toward such structure; and similarly the gate moves away from such structure at the beginning of its opening movement to free the sealing material to minimize abrasion and tearing thereof.

The upper face of the bottom of the gate chamber is formed to have a series of bowl-like concavities or depressions 81 (Figs. 1, 2, 13, 14 and 16) extending across the width thereof, with the depressions closely adjacent each other and adjacent ones having common defining walls 82. A pipe or conduit 83 is embedded or formed in such bottom, which has a cross section which increases from a smaller closed end 84 to the larger open end 86, the latter being the outlet end. The gate chamber bottom has perforations 87 at the lowermost points of the depressions 81, and the pipe 83 has perforations 88 connecting therewith. The end 86 of the pipe 83 opens into a well 89 in which is a pump 91 which pumps water within and flowing into the bottom of the well 89 upwardly through a pipe 92 having an outlet 93 at the sea side of the gate and appurtenant parts or at some remote point. This produces suction at the openings 87. Means such as a motor 94 is provided to drive the pump. Thus sediment and small debris which can build up a pile or cake within the gate chamber 23 will flow out with water removed by the pump 91. Water will flow into the gate chamber from the sea as the pump is operated. Pipes 96 supply water under pressure to jets 97 which preferably have flared elongated outlets. These jets are arranged at or adjacent the bottom of the gate chamber, they are so orientated with respect to each other as to produce a heavy swirl of water in each depression 81, and they can be used to break up any cake that may have formed and to aid in flushing out the bottom of the gate chamber. A riser 98 is connected to a suitable source of water under pressure and to the pipes 96. In the case of very large gates, the pump 91 may have a capacity of the order of twelve thousand (12,000) gallons per minute, and the pipes 96 may have a diameter of the order of three (3) inches.

The gate sometimes remains closed for long periods of time, and means can be provided, if desired, to then prevent ingress of silt and debris into the gate chamber to lessen the necessity for frequent flushing thereof if conditions would otherwise require it. Such means may comprise a flat shelf 101 (Figs. 2 and 17) of steel or other suitable material attached to, and projecting from the face of, the gate, and a thick somewhat flexible sheet 102 of rubber or equivalent material attached to the gate sill and projecting over the shelf 101. The parts 101 and 102 are so located that they contact to form a self-sealing means as the gate is closed to decrease very substantially any ingress of silt or other solids into the gate chamber. A pipe 103 (Fig. 2) to which a series of nozzles 104 is connected with the nozzles directed toward the parts 101 and 102, can be used to project water, and thereby break up and remove any deposit, at the parts 101 and 102.

Blocks 106 (Figs. 1, 13, 14 and 16) of wood or other suitable material, rest on some of the high parts 82 of the bottom of the gate chamber which may have flat tops for this purpose, and are fixed in position by attachment to the concrete by bolts 107. The blocks extend cross wise, in the direction between sea side and basin side, and the gate rests upon them when in its lowermost position, but its weight thereon is controllable to a minimal amount by controlling the buoyancy of the gate. The blocks are spaced apart from each other and need be but few in number. Softening of the blow of the gate as it descends, upon the blocks, even though it descends comparatively fast, can be accomplished by means of springs 108 located at both ends of blocks which are between the center of the bottom of the gate chamber and each end thereof. Vertical movable cylindrical casings 109 of which the top ends are closed and the bottom ends are open, rest upon the springs, and prevent ingress of sediment and debris to the spring. The springs rest upon depressed abutments 111 formed in the chamber bottom, surrounding which are annular passages 112 to permit axial movement of the casings 109. The tops of the casings 109 are normally above the tops of the cross blocks, to receive and lessen the impact of the descending gate. Truncated-conical aprons 113 of rubber or the like, attached suitably to the bottom by annular plates 114 held in place by bolts 116, contact the casing 109 as they move up and down and prevent ingress of silt and debris.

The gate is also stopped resiliently at the end of its upward movement by means shown on Figs. 1 and 3. Brackets 117 are attached to the gate and cups 118 are attached to the brackets, as by bolts 119. Coiled springs 121 are suitably attached to the cups with their lower ends in the bottoms thereof, the upper ends of the springs being free. Brackets 122 are attached, as by bolts 123, to convenient parts of each wall 61, such brackets projecting over the springs 121. It is now apparent that the springs 119 strike against the brackets 122 as the gate rises, so that its upward movement is resiliently stopped.

The gate (Figs. 1, 11 and 12) has valve-controlled passages 126 therethrough to permit water to flow from the sea to the dock basin, when work on a ship in the basin has been completed and it is desired to float the ship out. Valves 127 which control them comprise plate-like gate valve members 128 which are moved by hydraulic cylinders 129 having appurtenant parts similar to those illustrated on Fig. 18 and operating similarly thereto, either to close the openings, or away therefrom to open them. The gate can be opened when the dock basin is sufficiently full of water, but not before, since a too sudden inrush of water can result in damage. Safety locking means prevents accidental or premature opening of the gate. Pins 133 (Figs. 8 and 9) are mounted on the dock side of flanges 62, to project toward and be movable into and out of engagement with the gate. The pins ride in blocks 134 affixed to such flanges, and they are moved axially in either direction by hydraulic cylinders 136 having appurtenant parts like, and operating similarly to, those illustrated on Fig. 18. Members 137 adapted to receive the pins are attached to the gate and have vertically elongated grooves or openings 138 into which the pins can extend. The hydraulic cylinders are operated to extend the pins when the gate has reached its uppermost position. The elongated grooves 138 are so positioned that the tops thereof are slightly above the

pins 133 to permit easy entrance of the pins there into. The gate can then be allowed to remain there or to descend the very short distance necessary to make the tops of the grooves contact the pins. There need not be much weight on the pins, due to the controllable buoyancy of the gate. Once the gate has been closed, the water in the dock basin can be evacuated by suitable means, conventional or otherwise; and the increasing pressure of the water on the sea side of the gate holds it tightly closed. When the dock basin has again been filled with water, the hydraulic cylinders 136 are operated to withdraw the pins 133, raising the gate slightly first if this is necessary, and the gate can then be opened by admitting water to the ballast chamber.

Means can be provided to raise and support the gate for servicing or repairing it while a caisson gate (not shown) is used to prevent access of water thereto. The supporting means (Figs. 1, 2, 3, and 4) comprises crane carriages 141 over each end of the gate and mounted to be moved in either direction between the sea side and the dock basin side. With this in view, girders 142 are supported on structural members 143 to form a bridge over them and over each end of the gate. Rails 144 are affixed to the girders and the carriages are mounted on flanged wheels 146 which ride on the rails. Threaded bars 147 are suspended from the carriages by means of nuts 148, they can extend through openings in attachment members 149, withdrawal from which can be prevented by nuts 151. The members 149 can be permanently or removably attached to the gate by conventional means. The carriages 141 can be rolled to the proper positions, the bars 147 inserted through the attachment members 149 which may be attached to the gate at both ends thereof, and the gate can then be raised to any convenient height by turning the nuts 148 in the proper direction.

Certain details have been illustrated and described for the purpose of explaining the invention without limiting it, and may be changed or omitted without departing from the spirit of the invention, the scope of which is set forth in the appended claims.

What is claimed is:

1. A graving dock having walls forming a mouth for a ship to pass through, a vertically movable gate to close and open said mouth, sealing means between said walls and said gate, shoes on said gate, guide rails on which said shoes ride to guide the vertical movement of said gate while preventing said sealing means from making a seal between said walls and said gate, said guide rails having jogs therein to guide the gate to cause said sealing means to make a seal between said walls and said gate at the end of the closing movement of said gate and to open said seal at the beginning of the opening movement of said gate.

2. A graving dock having walls forming a mouth for a ship to pass through, a vertically movable gate to close said mouth, a casing forming a chamber to receive said gate under said mouth, said gate being opened by lowering it into said chamber and closed by raising it above the water level sealing strips on said gate, means for raising and lowering said gate including curved guide members attached to said walls and cooperating with projections on the edges of said gate for moving said gate laterally so as to bring said sealing strips into engagement with said walls, when said gate is raised to a closed position, and means to support said gate in open position with its bottom above the bottom of said chamber comprising a series of horizontally disposed blocks at the bottom of said chamber which project thereabove and a series of resilient members adjacent to and projecting above said blocks to thereby cushion the impact of said gate as it comes to rest on said blocks.

3. A graving dock having walls forming a mouth for a ship to pass through, a vertically movable gate to close said mouth, a casing forming a chamber to receive said gate under said mouth, said gate being opened by lowering it into said chamber and closed by raising it above the water level sealing strips on said gate, means for raising and lowering said gate including curved guide members attached to said walls and cooperating with projections on the edges of said gate for moving said gate laterally so as to bring said sealing strips into engagement with said walls when said gate is raised to a closed position, and resilient means to limit the upward movement of said gate comprising brackets attached to said gate having spring means mounted thereon and brackets projecting from the walls of the chamber and so positioned that both brackets resiliently engage each other and restrict the upward movement of said gate as it rises to the closed position.

4. A graving dock having walls forming a mouth for a ship to pass through, a vertically movable gate to close said mouth, a casing forming a chamber to receive said gate under said mouth, said gate being opened by lowering it into said chamber and closed by raising it above the water level sealing strips on said gate, means for raising and lowering said gate including curved guide members attached to said walls and cooperating with projections on the edges of said gate for moving said gate laterally so as to bring said sealing strips into engagement with said walls when said gate is raised to a closed position, and means to remove water and sediment from the bottom of said chamber comprising laterally disposed spray pipes adapted to project water over the bottom of said chamber in such manner as to dislodge deposits of sediment and a pump means adapted to discharge the water and sediment from the chamber.

5. A graving dock gate comprising walls forming a ballast chamber having first and second openings a first valve member at said first opening and operable by pressure from without said chamber, a second valve member at said second opening and openable by pressure from within said chamber, said members being openable by movement in the same direction, means to connect said chamber with a source of compressed air, a valve in said connecting means, means to exert pressure from without said chamber on said first member means to maintain said second member normally closed, means to cause said second member to open with said first member and said first member to close with said second member, said second member being openable independently of said first member, said first member being closable independently of said second member.

6. In a graving dock having walls and a mouth for ships to pass through, the combination of a vertically movable gate, means for alternately moving said gate upward to close and downward to open said mouth, sealing members rigidly fastened to the bottom and side edges of said gate and adapted to contact the mouth portion

of said dock when said gate has been elevated to close said mouth, and curved guide means located along and fastened to the side edges of said mouth and cooperating with projections on the side edges of said gate for moving said gate laterally to bring said sealing members into engagement with the mouth of said dock upon the elevation of the said gate.

7. In a graving dock having walls forming a mouth for ships to pass through, the combination of a vertically movable gate, sealing strips rigidly fastened to the bottom and side edges of said gate and adapted to contact the walls of said mouth, when the gate has been elevated to close said mouth, and means for alternately moving said gate upward to close said mouth and downward to open said mouth including curved guide elements fastened to the walls of said mouth and cooperating with projections on the side edges of said gate for moving said gate laterally to bring the sealing strips on said gate into complete contact with the walls of said mouth when said gate is elevated, and for disengaging said sealing strips from the walls of said mouth when said gate is lowered.

8. In a graving dock having a bottom and walls forming a mouth for ships to pass through the combination of a vertically movable gate, means for alternately moving said gate upward to close and downward to open said mouth, a casing forming a chamber below said mouth and adapted to receive said gate, when it is lowered, a plurality of flanges projecting inwardly from each side wall of the dock mouth so as to provide vertical channels adapted to receive the opposing side edges of the gate therein, sealing strips rigidly secured to the side edges of said gate and adapted to contact the flanges on said walls, a separate sealing strip secured to the bottom portion of said gate and adapted to contact the bottom of said dock when said gate is elevated and curved guide means located within the channels on the said walls and cooperating with projections on the said edges of the gate for moving the gate laterally to bring the said sealing strips into engagement with the mouth of said dock when the gate is raised to close said mouth.

9. In a graving dock having a bottom and walls forming a mouth for ships to pass through the combination of a vertically movable gate for closing said mouth, a casing forming a chamber for receiving said gate under said mouth, said gate being opened by lowering it into said chamber and closed by raising it about the water level, sealing members fastened to the side and bottom edges of said gate and adapted to engage the bottom and walls of said dock so as to continuously encompass the mouth of said dock up to the water level when said gate is in a raised position, means for alternately raising and lowering said gate including curved guide means secured to the walls of said mouth and cooperating with projections on the side edges of said gate for alternately causing said sealing members to become engaged with and disengaged from the mouth of said dock, when said gate is raised and lowered and means for positively locking said gate while in a raised position.

10. A closure for graving docks and like comprising a compartmented gate adapted for vertical movement and to serve as a closure when in its upward position, U-shaped vertically extending channels located opposite each other at the entrance to the graving dock and extending below the bed of the dock a distance equal to at least the height of compartmented gate to thereby form a gate chamber, sealing strips rigidly fixed to the side edges and bottom of said gate, vertically extending rails having a plurality of jogs therein fixed to the base wall of each channel and adapted to cooperate with projections on the sides of said gate when said gate is raised, so as to move the gate laterally and bring the sealing strips on the side edges of said gate into engagement with the inner portions of said U-shaped channels.

11. In a graving dock having walls and a mouth for ships to pass through the combination of a vertically movable gate, means for alternately moving said gate upward to close and downwardly to open said mouth, resilient sealing members rigidly fastened to the bottom and side edges of said gate and adapted to contact the mouth portion of said dock, when said gate has been elevated to close said mouth, curved guide means located on the side edges of said mouth and cooperating with projections on the side edges of said gate for moving said gate laterally to bring said sealing members into engagement with the mouth of said dock upon the elevation of the said gate, a casing forming a chamber to receive said gate under said mouth when said gate is lowered, means for removing water and sediment from the bottom of said chamber comprising spray pipes laterally disposed in the bottom of said chamber and in such a manner as to dislodge deposits of sediment and a pump means adapted to discharge the water and sediment from the chamber, and means for positively locking said gate while in an elevated position.

EINAR T. LARSEN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,530,394	Muller	Mar. 17, 1925
1,618,545	Mann	Feb. 22, 1927

FOREIGN PATENTS

Number	Country	Date
25,970	Great Britain	1901