No. 849,378. PATENTED APR. 9, 1907.

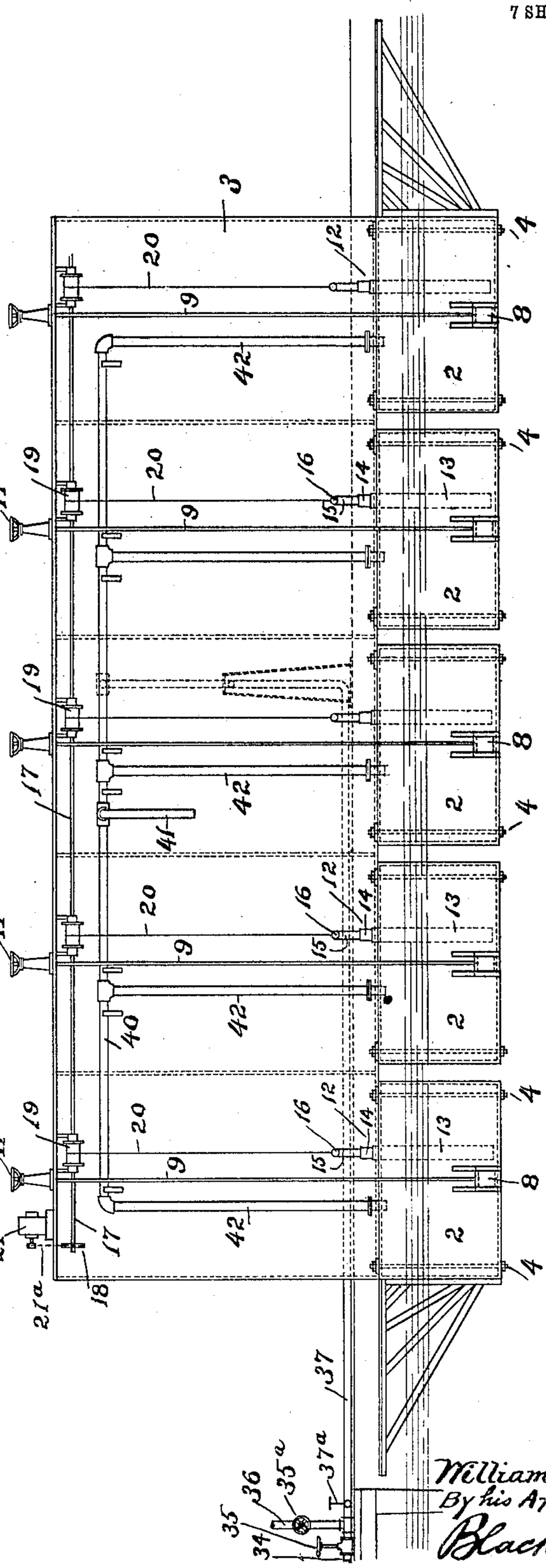
W. T. DONNELLY.

FLOATING DRY DOCK.

APPLICATION FILED SEPT. 24, 1906.

7 SHEETS—SHEET 1.

Fig. 1.



Witnesses
Geo. W. Eisenbraun:
Jas. A. Morris

Inventor
William Thomas Donnelly
By his Attorneys
Blackwood Bros.

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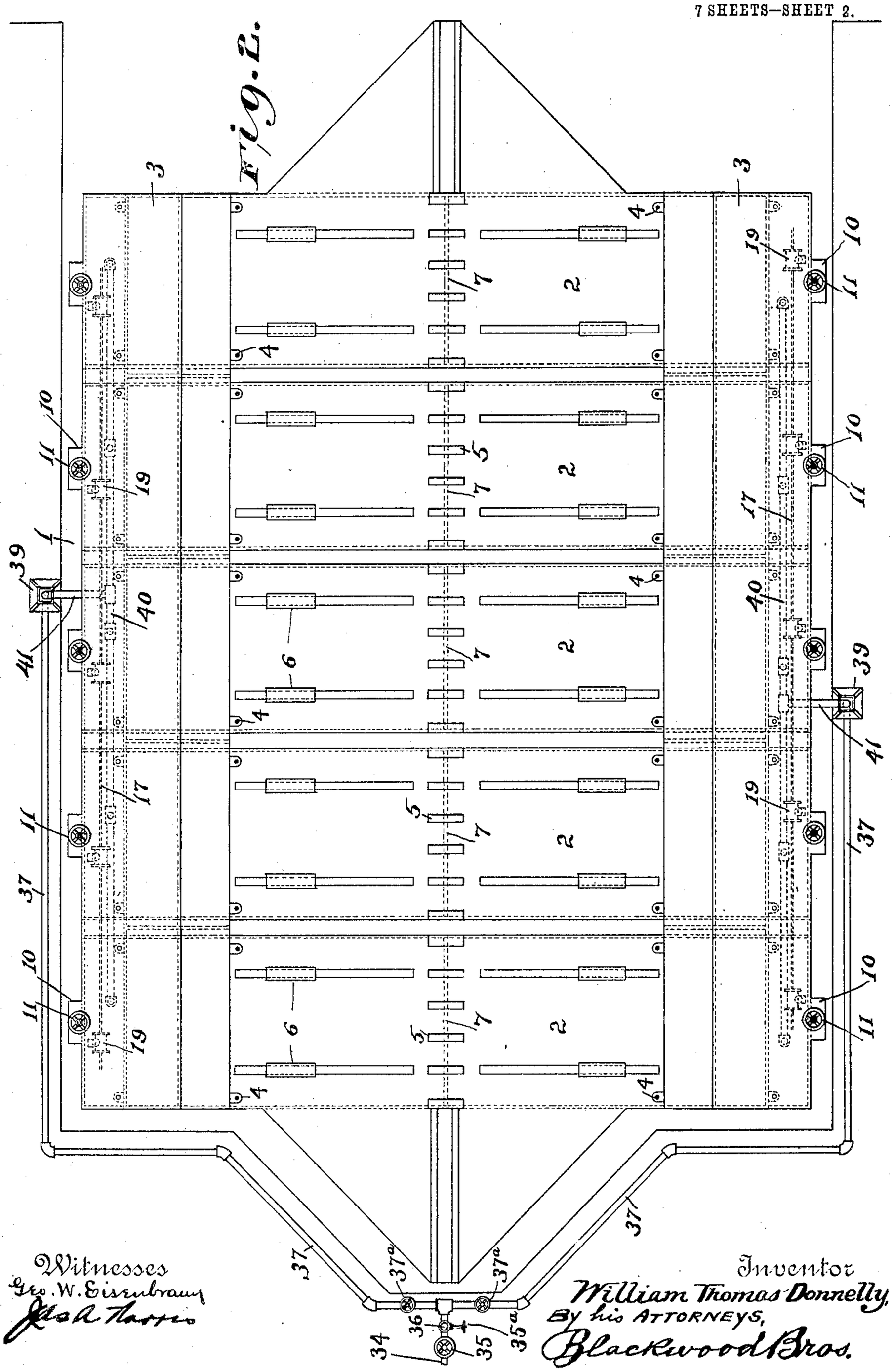
7 SHEETS—SHEET 2.

Fig. 2.



Witnesses
Geo. W. Eisenbraun
Jos. A. Harris

Inventor
William Thomas Donnelly,
By his Attorneys,
Blackwood Bros.

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7 SHEETS—SHEET 3.

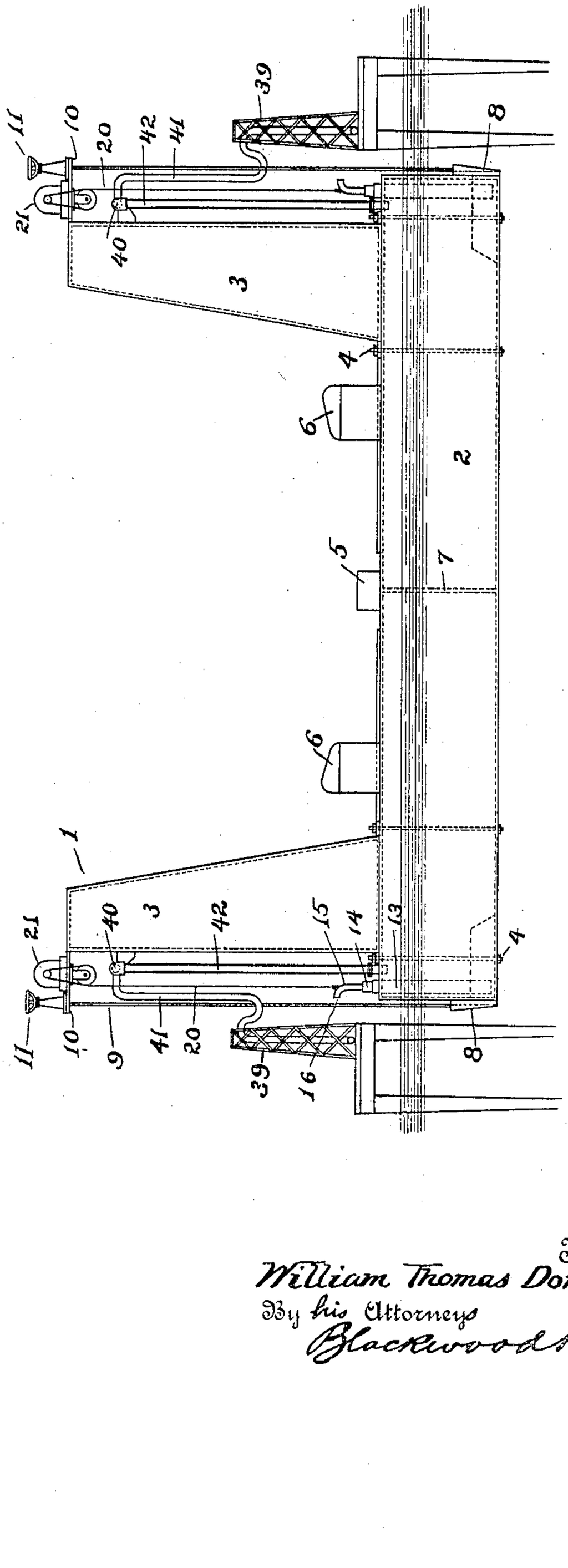

Fig. 3.

Witnesses
Geo. W. Eisenbrandt
Geo. A. Morris

Inventor,
William Thomas Donnelly,
By his Attorneys
Blackwood & Bros.

No. 849,378. PATENTED APR. 9, 1907.

W. T. DONNELLY.

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7 SHEETS—SHEET 4.

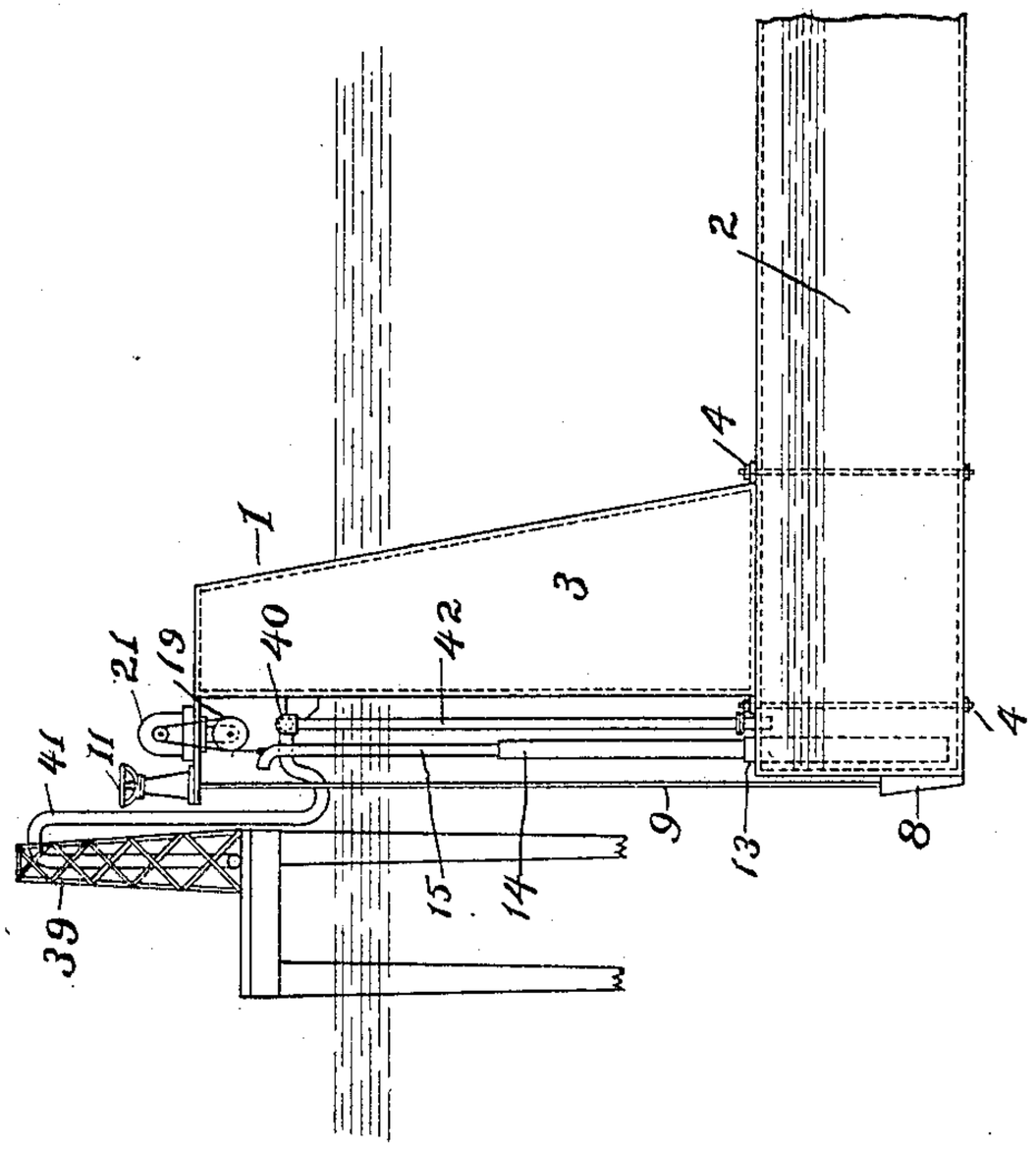

Fig. 5.

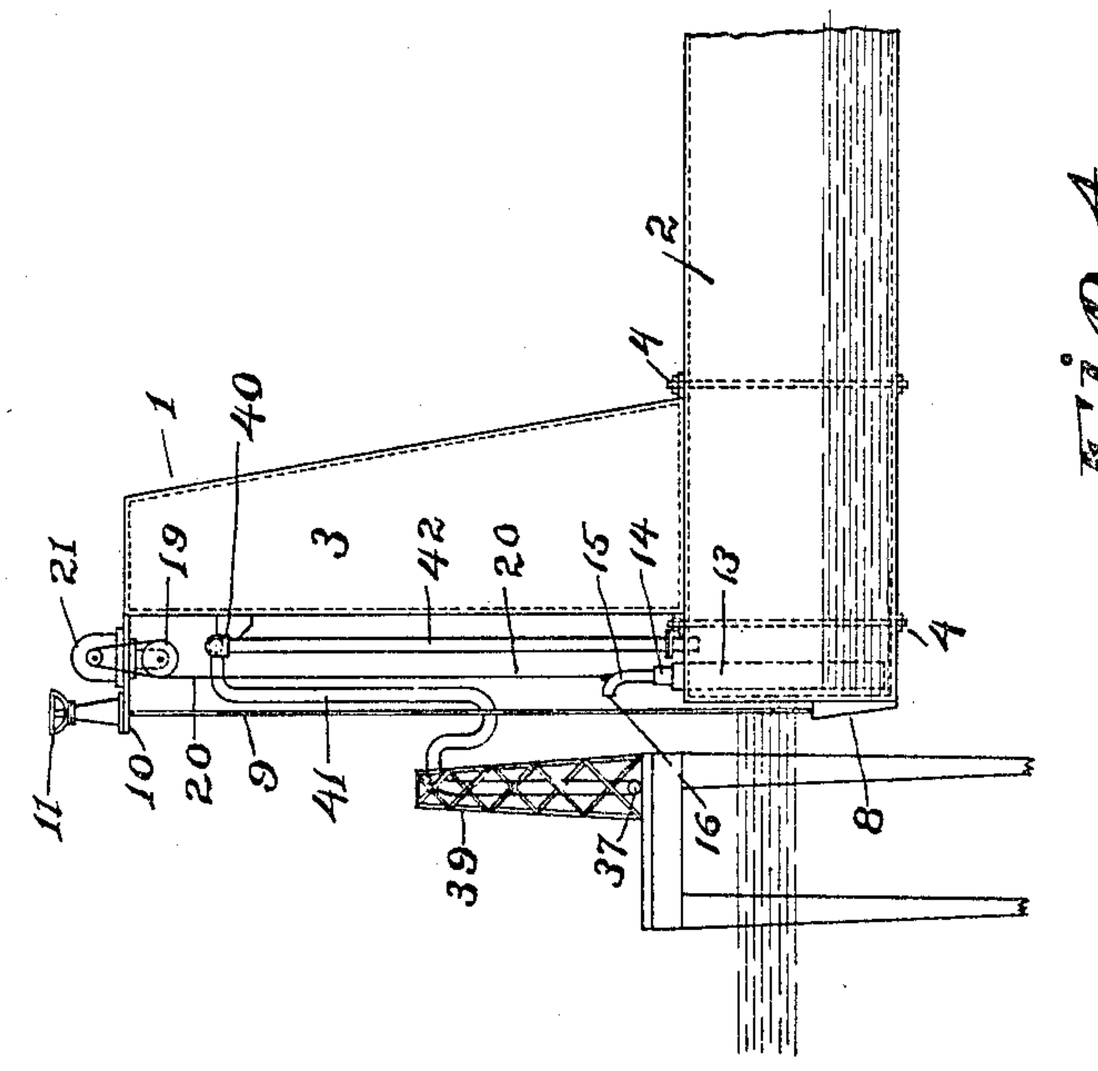

Fig. 4.

Witnesses
James F. Brown
Jas. A. Norris

Inventor.
William Thomas Donnelly
By his Attorneys
Blackwood & Bro.

No. 849,378. PATENTED APR. 9, 1907.

W. T. DONNELLY.

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7 SHEETS—SHEET 5.

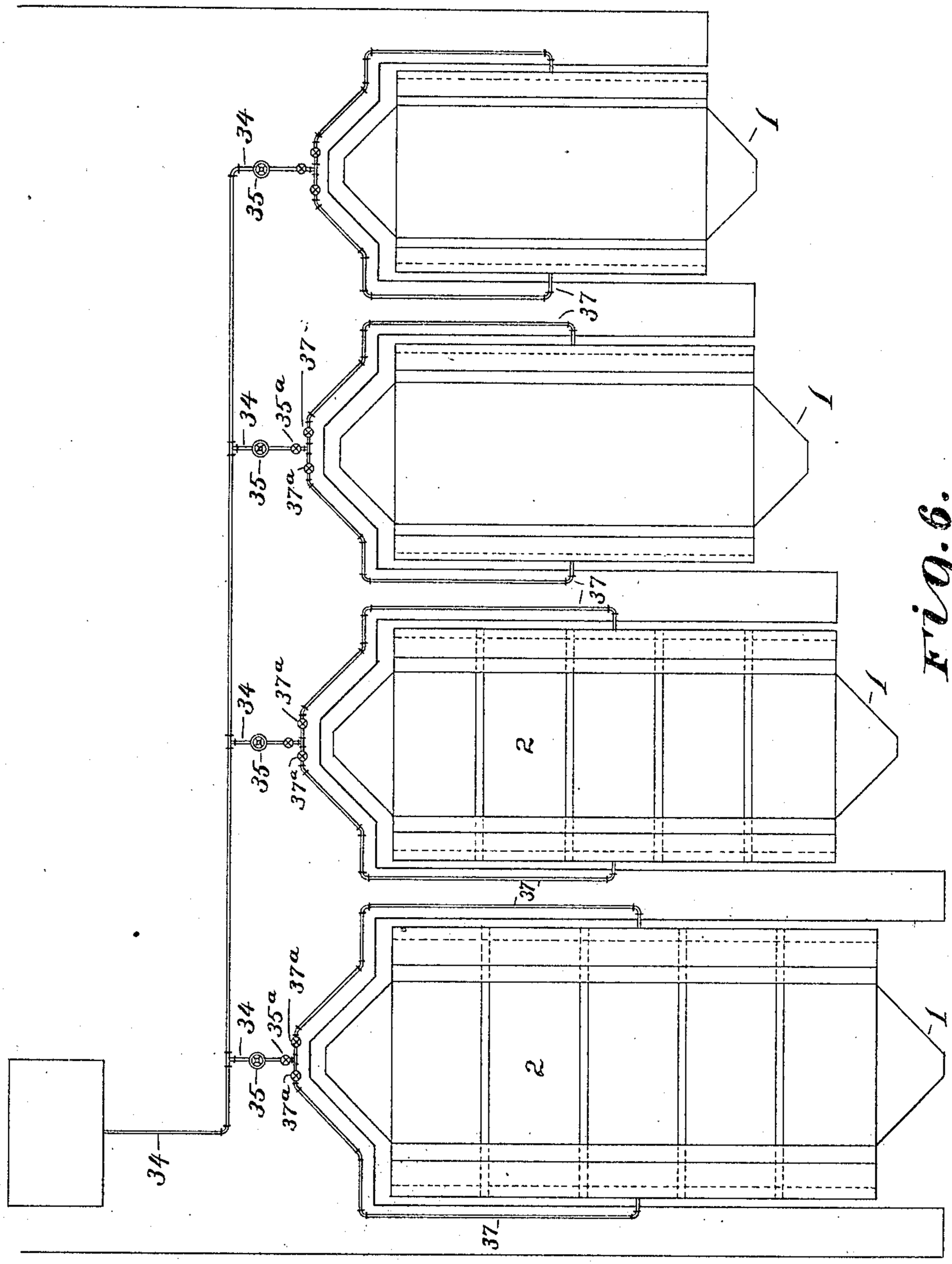

Fig. 6.

Witnesses
Geo. W. Ersenbrandt
Jas. A. Norris

Inventor
William Thomas Donnelly.
By his Attorneys
Blackwood Bros.

No. 849,378. PATENTED APR. 9, 1907.

W. T. DONNELLY.

FLOATING DRY DOCK.

APPLICATION FILED SEPT. 24, 1906.

7 SHEETS—SHEET 6.

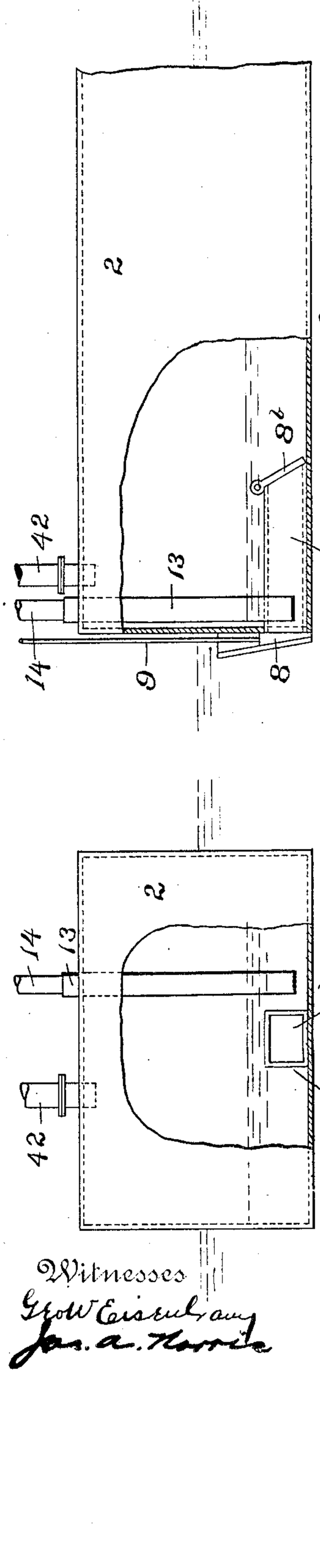

Fig. 8.

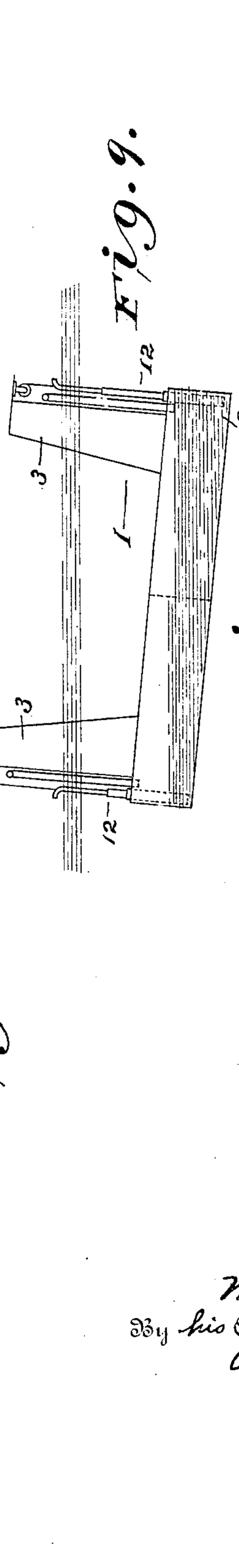

Fig. 9.

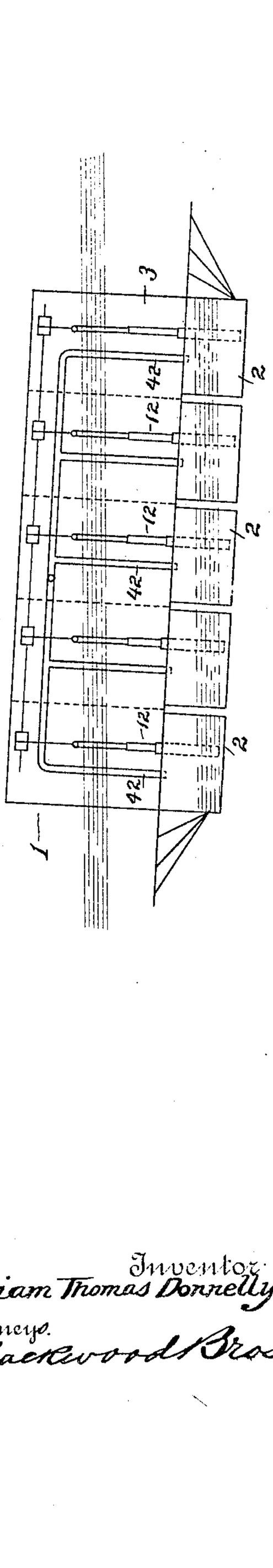

Fig. 10.

Fig. 7.

Witnesses
Geo. W. Eisenbrandt
Jas. A. Norris

Inventor:
William Thomas Donnelly,
By his Attorneys.
Blackwood Bros.

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7 SHEETS—SHEET 7.

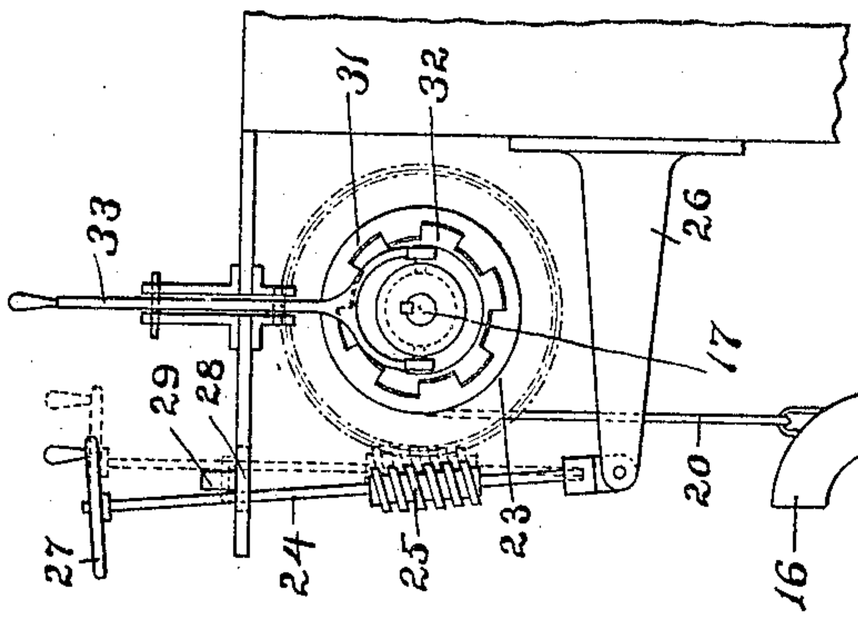

Fig. 12.

Fig. 11

Witnesses
Geo. W. Essenbaum,
Jas. A. Harris

Inventor
William Thomas Donnelly
By his Attorneys
Blackwood Bros.

UNITED STATES PATENT OFFICE.

WILLIAM THOMAS DONNELLY, OF BROOKLYN, NEW YORK.

FLOATING DRY-DOCK.

No. 849,378. Specification of Letters Patent. Patented April 9, 1907.

Application filed September 24, 1906. Serial No. 335,883.

To all whom it may concern:

Be it known that I, WILLIAM THOMAS DONNELLY, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Floating Dry-Docks, of which the following is a specification.

My invention relates to improvements in floating dry-docks.

In all floating dry-docks the safety of the dock and vessel depends upon the proper distribution and control of the pumping-power, and as the floating dry-docks in use at present require so much machinery, valves, and other parts for their operation and control it is consequently necessary to employ a number of men under the direction of a dock-master, who, while responsible, has to depend to a great extent upon those under him for the control of the dock and vessel. It has also been the practice to provide floating dry-docks with pumping machinery located upon the dock itself, this machinery being in the nature of a plurality of separate pumps, one or more being located in each separate pontoon or water-tight compartment of the dock and all driven from the same source of power, and in some cases one or more large pumping plants have been employed to which water was conducted under the control of valves from the various pontoons of the dock. The first method above referred to required a great multiplication of mechanical parts, and consequently was complicated and difficult of control, and the second method was hardly more desirable with its complication of valves and pipes, and both of these methods of pumping had the further disadvantage that the pumps and power plant were available for use only upon the particular dock for which they had been designed.

My invention therefore has as its object to accurately control a dock while being raised or lowered, no matter what the position or the size of the vessel may be which it is employed to dock, by providing simple and efficient means for producing air and supplying it under pressure to the compartments thereof, for controlling the delivery of air to and exhaust of air from said compartments, and for controlling the delivery of water to and exhaust of water from said compartments, whereby air or water may be delivered to or exhausted from any desired combination of compartments or the dock as a whole, as may be required.

An important part of my invention is the control of the discharge of water from the various compartments. I speak of the discharge of the water in contradistinction to the control of the delivery of the air into the different compartments for the following reasons: When air is to be delivered into a submerged compartment or pontoon at a distance below the surface of the water it is necessary to deliver the air at a pressure equal to the hydraulic head at which the pontoon is submerged. If the delivery of the air to the pontoon is controlled and the delivery of the water uncontrolled, a lifting effect will be produced; but it will not be under control, for as soon as the pontoon commences to rise the hydraulic head is decreased, and even if the supply of air is immediately cut off the air that is within the pontoon (which in the case of a floating dock may be of large volume) will expand and drive out more water, and the action will continue in an increased amount as the pontoon rises and under some conditions will bring the structure to the surface with great violence. Besides this, when a number of pontoons are connected together the one or group that is slightly in advance or ahead of the others would tend to increase its lead, so as to throw the whole structure out of balance. By controlling the outflow of the water from the various pontoons individually and collectively I entirely overcome this difficulty and all objection to the use of air.

Another feature of my invention is to make of the wings closed compartments, without inlet or outlet valves, and the dimensions of the wings such that when all the pontoons of the dock are completely flooded the descent of the dock will be automatically arrested at the maximum depth for which it is designed.

It has for a further object to provide means whereby when two or more docks are located in the immediate vicinity of one another all can be pumped by the same air-producing means that would ordinarily be required for one, this being of particular value in connection with floating dry-docks, as the work they have to perform is of such nature that they require a very large amount

of power for a very short time—say, from one to two hours a day, or even for not more than two or three hours a week.

Referring to the drawings, Figure 1 is a side elevation of a floating dry-dock embodying my invention; Fig. 2, a top plan view; Fig. 3, an end elevation. Fig. 4 is a side elevation of one side of the dock, showing the position the dock assumes when elevated; Fig. 5, a side elevation of one side of the dock, showing the position the dock assumes when lowered and submerged. Fig. 6 is a top plan view of a number of dry-docks pumped from a common source of power. Fig. 7 is an end view of one of the pontoons, partly in section. Fig. 8 is a side view of one of the pontoons, partly in section. Fig. 9 is an end elevation of the dock, showing the position of the several parts when the dock is listed sidewise. Fig. 10 is a side elevation of the dock, showing the positions of the several parts when the dock is inclined longitudinally. Fig. 11 is a side elevation, partly in section, on an enlarged scale, of the mechanism for effecting a change in level of the discharge-outlets. Fig. 12 is an end view of the mechanism shown in Fig. 11.

Referring to the drawings, in which like reference characters denote like parts throughout the several views, 1 represents the floating dry-dock, which as shown is composed of a series of five pontoons 2, but which may comprise a greater or less number, as may be found necessary to meet the different requirements.

Side walls or wings 3, which are hollow and made air and water tight, are mounted on the pontoons in the usual manner and secured by suitable bolts 4. The pontoons are also provided with the usual keel-blocks 5 and bilge-blocks 6.

The pontoons are each provided with a longitudinal central bulkhead 7 and with a flood-gate 8, said flood-gate being opened and closed by means of a rod 9, which is mounted in a bracket 10, projecting laterally from the top of the side wall or wing 3, and said rod being screw-threaded at its upper end and provided with a hand-wheel 11, by which it is operated. A short section of pipe 8^a extends inwardly from each of the flood-gates of the pontoons and is provided with a check-valve 8^b at its inner end to prevent the egress of water by way of the flood-gates. (See Fig. 8.) Each pontoon is also provided with a water-outlet 12, which comprises a number of extensible and retractible telescopic tube-sections 13, 14, and 15, the section 13 being mounted in the pontoon and its lower end terminating near the bottom thereof and the section 15 being provided with a laterally-extending nozzle or mouth 16, which is designed to always be above the surface of the water floating the dock.

The means for raising and lowering the outlets 12 simultaneously comprises shafts 17, extending longitudinally on each side of the dock and mounted in hangers 18, secured to lateral projections on the tops of the wings and provided with drums 19, which are loose on the shaft, and on each of which is wound one end of a rope or chain 20, while the other end of said rope or chain is attached to the section 15 of the telescopic outlet 12, and for turning the shaft 17 a motor 21 is employed, which may be operated by electricity, compressed air, or any other power, and which is operatively connected to a sprocket-wheel on the shaft 17 by means of a sprocket-chain 21^a. To keep the drums from moving laterally, sleeves 22 are provided, which are clamped to the shaft 17 on opposite sides of the drums.

To provide means to raise and lower the outlets independently of each other, each drum 19 is provided with a worm-gear 23 and a vertical shaft 24, provided with a worm 25, designed to engage said worm-gear, said shaft being pivoted to a bracket 26, extending from the side wall or wing of the dock and being free to turn axially on the bracket 26 and provided with a hand-wheel 27 at its upper end, by which it is operated. The shaft 24 passes through an elongated slot 28 in the bracket 10, and a slidable latch 29 is provided, which normally holds the shaft 24 and worm out of engagement with the worm-gear of the drum.

For throwing each of the drums 19 into operation—that is, so that it will move with the shaft 17—a two-part clutch 30 is provided, one part 31 of which is formed on the side of the drum 19 and the other part or jaw 32 slidably mounted on the shaft 17, and a forked lever 33 is operatively connected to said jaw for causing the two parts of the clutch to engage and disengage.

To raise or lower one of the outlets independently of the others, the latch 29 is withdrawn and the inclination of the shaft 17 is changed so as to bring the worm 25 into engagement with the worm-gear 23. The forked lever 33 is then moved into position shown by the dotted lines, (see Fig. 11,) carrying the jaw 32 with it, and thus releasing the drum 19 from engagement with the shaft 17. Then by turning the hand-wheel in either direction the outlet will be raised or lowered as to any desired elevation.

34 is a pipe which is connected with any suitable air-supply under pressure situated on the pier, said pipe being provided with a main valve 35 for controlling the air-supply and a valve 35^a, having a discharge 36 to the atmosphere, and 37 are branch pipes having valves 37^a and extending laterally from the pipe 34 along each side of the dock to towers 39, and at said towers are connected with horizontal pipes 40 on the dock by flexible means, such as flexible pipes 41, for the pur-

pose of affording a freedom of movement of the dock in raising or lowering without interrupting the flow of air, the pipes 40 having downwardly-depending vertical pipes 42, which extend into the top of the pontoons.

Having described my invention, the operation of the dock in handling a vessel of the full size of the dock is as follows: The dock will be considered as raised and ready for sinking, with keel and bilge blocks prepared for a vessel. Under these conditions the main valve 35 in the air-supply pipe is closed and the relief-valve 35[a] to the atmosphere and the valves 37[a] are open. All the flood-gates 8 to the various compartments of the pontoons are closed. The deck of the dock (the part upon which the keel and bilge blocks rest) is presumed to be from one to two feet above the surface of the water and the water within the pontoons about four feet below that on the outside, (an amount sufficient to represent the structural weight of the dock.) The first operation will be to partially open all the flood-gates 8 and allow the water to flow into the interior of the various compartments, when the dock will at once commence to sink, and as it does so one side which may have had its valves opened wider or sooner than the other may settle faster. When this occurs, the dock-master instead of ordering the valves partly closed on that side will close or partly close the valve 37[a] on the side of the dock which is filling too quickly. This will have the effect of holding in the air on that side of the dock and retarding the inrush of water and bring the dock to an even keel. As the deck of the dock comes near the surface of the water the flood-gates will be nearly closed and the dock will be carefully leveled by controlling the water-inlets and the air-outlets from each side. The dock will then be allowed to settle until the water floods the deck, and will then be found to settle much faster with the same opening of gates. The dock will continue to descend as long as water is allowed to enter the pontoons or until they are full. In this case the side walls will support the entire structural weight of the dock. It is not the intention to allow water to enter the side walls at any time, and their size is such that they will limit the sinking of the dock to the maximum depth for which it is designed, thus furnishing a safeguard against the sinking of the dock by accident. During the sinking the dock has been controlled laterally by controlling the escape of the air, and its descent can finally be entirely arrested by entirely preventing the escape of the air by closing the relief-valve 35[a]. When the deck of the dock is submerged, the motors 21 on each wing of the dock are started up and the outlets 12 are raised as fast as the dock is lowered, thus keeping them in about the same relation to the surface of the water. The relation of the parts of the dock when submerged are shown in Fig. 5.

By closing the relief-valve to stop the descent of the dock the pressure of the air, if any remains in the pontoons, may be brought up to the point which represents the hydraulic head to which the dock has been sunk and will represent the pressure at which air must be introduced to displace the water.

The closing of the flood-gates is a matter of little or no importance, as the pressure of air prevents any more water from entering, and as check-valves prevent the egress of the water by way of the flood-gates they may be left open or any convenient time taken to close them. With the dock in this condition, the ship is warped into place and correctly located above the blocks. The dock-master then observing that he has a greater pressure of air in the main supply-pipe 34 than is called for by the depth to which the dock has been submerged, opens the main supply-valve 35, (it being understood that the valves 37[a] are open.) The air is admitted to the surface of the water in all the compartments of the dock at an equal pressure. Attention is called to the fact that there are no other valves and that the delivery of air at an equal pressure is certain and cannot be interfered with, intentionally or otherwise.

The only outlets from the separate compartments of the pontoons of the dock are those from the extensible and retractible outlet-delivery connections. These the dock-master has previously leveled up, so that they are the same distance above the surface of the water and all in plain sight along each side of the dock. A little consideration will make it clear that the pressure upon the surface of the water in the chambers of the dock must not only equal the hydraulic head of the depth of immersion, but that to deliver water from the outlets it must be as much greater as is necessary to raise it to the outlets, and as there are no obstructions—valves or otherwise—in these outlets they will all deliver water at the same time and to the same amount, and if it is even considered that due to some slight imperfection of construction one outlet may deliver water with a slightly-greater resistance than another, the system provides for a perfect and permanent correction of this by slightly lowering it relative to the others.

The dock-master at first opens the main supply-valve only slightly, and is thus able to graduate the pumping to any desired amount. This is particularly important, as it is desirable to bring the dock gently against the bottom of the vessel, so as not to disturb the blocking which comes first in contact with the vessel. When the dock has been brought up and pressed firmly against the bottom of the vessel from one end to the

other, the main supply-valve will be closed and the bilge-blocks drawn in under the bilges of the vessel in the usual manner. The main supply-valve will then be opened and the pumping continued. It may appear in a short time that one side of the dock is coming up faster than the other, caused by placing the ship out of center. As soon as this is apparent the dock-master has a perfect control of the situation. He can shut off all the pumping-power with one valve, or he can divert more of the pumping-power to the lower side by partially closing the delivery-valve to the high side, or he can cause the outlets on the lower side to be lowered faster than on the high side, and any one of these methods will cause more water to be delivered from the lower side and will bring the dock and vessel to an even keel.

As the vessel is raised the outlets are lowered by being retracted equally on each side, which motion is very slow and deliberate, never more than one foot in two minutes. The lateral horizontal plane of the dock and vessel will ordinarily be maintained by varying the rate at which the outlets on the opposite sides of the dock are lowered. Under these conditions of the admission of air and control of the outlet of the water the dock will be raised until the deck is above water, when the vessel will be dry-docked and ready for the execution of any repairs or examination that may be necessary. Attention is called to the fact that whenever the vessel is raised a part of the way or distance out of the water and the air-pressure gives out or fails from any cause the dock will not sink back. The only change will be that the water in the discharge-outlets at that time will fall back into the pontoons—that is, the dock is in no way sustained by the air-pressure, which acts with all the functions of a pump to remove the water from the pontoons of the dock.

When the ship is to be floated off the dock, the operation is as follows: The main supply-valve 35 is closed. The relief-valve 35[a] and the valves 37[a] are opened. The flood-gates 8 are all presumed to have been closed before the air-pressure used in raising the dock was allowed to escape. The first operation is to open the flood-gates the same as for lowering the dock light, it being taken into consideration that a less amount of opening will cause an equal rapid descent, for the reason that owing to the weight of the ship there will be more difference in the level of the water within and without the dock to cause the water to enter faster. When the deck of the dock approaches the surface of the water, the flood-gates will be nearly closed, as previously described in the case of lowering the dock light, and in this case another precaution will be taken. It is presumed that the compartments have all filled evenly; but to test this it is only necessary to close the relief-valve to the atmosphere and turn on the air-pressure, it being understood that the outlets are all set at the same height, and if it is a fact that all the compartments are equally full water will appear at all the discharge-openings at the same time. If it does not, it will only be necessary to continue the pumping slowly until it does, when it will be apparent that all contain an equal amount of water, and the air-pressure can then be let off and the lowering continued with a certain knowledge of the amount of water in each compartment, and this testing of the filling can be made at any point in lowering the dock and ship and repeated as many times as desired. When the dock descends to the necessary draft to float the vessel and give the necessary clearance above the blocks, the vessel can be warped out and the dock will be ready to be pumped up light, as the dock without the vessel is a very evenly-balanced structure, and as the pumping with air is a perfectly-balanced pumping system entirely under the control of one man the raising of the dock can be done in a period of time only limited by the capacity of the air-supply.

Slight modifications of this method of pumping are required under the following circumstances: first, when the vessel draws considerably more water at one end than at the other; second, when the vessel is much shorter than the dock; third, when through injury or from other cause the vessel has a considerable list which it is not practical to correct before the vessel enters the dock.

First: In this instance the procedure is the same until the dock is lowered to the depth necessary to take the deepest draft of the vessel and the vessel is in place over the blocks. The clearance of the vessel over the blocks may then be one foot at the stern and perhaps six feet at the bow. It is desirable that a vessel in dry-docking should take the blocks throughout her entire length at as near the same time as possible. To accomplish this, it is only necessary to so adjust the discharge-outlets that water will at first be delivered only from those that are located at the end of the dock corresponding to the lightest draft of the vessel. This is done by raising those from which the discharge is to be retarded and then turning on the air-pressure in the usual way, when the dock will rise at one end only, and by regulating the air-supply to give a very gentle delivery the dock can be controlled and brought to an inclination longitudinally corresponding to the keel of the vessel, and when this has been accomplished those outlets that have been raised are to be lowered until the water commences to flow from them. If this is done before the dock is raised against the vessel, it is apparent that water can be delivered from all the

compartments with the dock at an angle, and the dock can be maintained at this angle while being raised to the keel of the vessel. It is desirable to maintain this condition until the vessel is firmly on the blocks and the bilge-blocks have been drawn into place. As soon as this has been done and before the vessel has been lifted any considerable distance out of the water the dock and vessel should be leveled up by raising those outlets at the end of the dock that is farthest up, so as to stop the discharge of the water from them until the discharge from those near the other end have brought the dock to a level, when these should be lowered until water will deliver from them. When this is done, it will be noticed that they will deliver water before they reach the level of the other outlets. This is because there will be more water in these compartments than in the others, and the difference in the level at which they discharge is an exact measure of the difference of the water-level in the compartments. In raising the outlets toward one end it is not necessary that they should be all raised an equal distance, and by graduating them carefully the pumping in each compartment can be made to exactly correspond to the inclination of the dock. In ordinary cases great accuracy in this respect is not necessary, as the strength of the side walls is made such as to distribute a reasonable difference of water-level in the pontoons. When the dock and vessel have been brought to a horizontal position, the raising proceeds as described for the previous case. In lowering this vessel the dock is lowered in a horizontal position until the vessel is well immerged. Before there is any danger of floating at the lighter end the dock is given the proper rake or inclination by closing the flood-gates at the light end, and when the rake has been obtained the closed gates are opened and the vessel lowered parallel to her water-line until floated.

Second. When the vessel is shorter than the dock, it is desirable to locate her near one end. In this case the procedure is the same as in the first case until the vessel is in contact with the keel-blocks and the bilge-blocks are drawn. Then when pumping is commenced it will be found that the end of the dock without the vessel will rise faster, and to correct this the outlets on that end will be raised to retard or stop the discharge of water, and repeated adjustments of these outlets will keep the dock and vessel in a horizontal position. The gradual increased height at which these outlets will deliver water will indicate the greater amount of water in these pontoons over those on which the vessel rests. As soon as the vessel is raised entirely out of the water it will be found necessary to pump all the compartments evenly, and the outlets will be adjusted to do so. In lowering the vessel all compartments are to be flooded evenly until the vessel takes the water, when the flood-gates to the light end of the dock are to be partly closed to hold that end back and keep the dock horizontal until the ship floats.

Third. When the vessel has a considerable list, in this case it is desirable to lower the dock for somewhat more clearance than is generally necessary, and when the vessel is approximately in position all that is necessary to bring the dock to the same angle of list is to admit air only to that side of the dock corresponding to the high side of the vessel. The pumping on that side only will soon list it until the angle of heel is the same as the vessel. The outlets on both sides of the dock should then be adjusted to deliver water at the same time. This will insure the dock rising without changing its angle of inclination. The vessel should then be carefully located and the pumping continued until the keel-blocks are firmly pressed against the keel, when the bilge-blocks should be drawn and care taken that they are all in contact with the bilges of the vessel. The pumping is then continued and the outlets on the low side of the dock gradually lowered faster than those on the other, which will cause more water to be delivered from that side, and the dock and vessel will be brought to an even keel. It will then be found that the outlets on the side toward which the vessel heeled will have to be kept lower to keep the dock level, and this amount corresponds to the difference of the weight of the vessel on opposite sides, which was the cause of the list.

During any or all of these operations at any time the exact relative level of the water in the compartments can be determined by noting the relative level of the outlets when they deliver water.

While my invention is shown and described as applied to a floating dry-dock of the well-known Rennie type, it will be understood that it is equally applicable to any other type of dock, either solid or sectional, and while I have herein shown and described the air-producing means as located on the shore it is evident that it may with equal facility be located on the dock itself or any other floating structure.

I do not desire to be understood as limiting myself to the specific details of construction and arrangements as herein described and illustrated, as it is manifest that variations and modifications may be made in the features of construction and arrangement on the adaptation of the device to various conditions of use without departing from the spirit and scope of my invention and improvements. I therefore reserve the right to all

such variations and modifications as properly fall within the scope of my invention and the terms of the following claims.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a floating dry-dock water-inlet means, unrestricted water-outlet means, means for supplying air under pressure to the various compartments and means for controlling the expansion of the air in said compartments while the dock is rising, substantially as described.

2. In a floating dry-dock water-inlet means, unrestricted water-outlet means, means for supplying air under pressure to the various compartments and means for controlling the delivery of water at the outlets, whereby the expansion of air is kept under control while the dock is rising, substantially as described.

3 In a floating dry-dock water-inlet means, unrestricted water-outlet means, means for supplying air under pressure to the various compartments and means for controlling the expansion of the air in said compartments while the dock is rising and thereby controlling the rising of the dock, substantially as described.

4. In a floating dry-dock water-inlet means, extensible and retractible water-outlet means and means for exhausting the water therefrom, substantially as described.

5. In a floating dry-dock, pontoons, water-inlet means, extensible and retractible water-outlet means therefor, and means for exhausting water therefrom, substantially as described.

6. In a floating dry-dock, pontoons, water-inlet means, extensible and retractible water-outlet means, air-inlet means and means for controlling the introduction of air, substantially as described.

7. In a floating dry-dock, water-inlet means, extensible and retractible water-outlet means, and means for simultaneously extending and retracting said outlet means, substantially as described.

8. In a floating dry-dock, water-inlet means, extensible and retractible water-outlet means and means for independently extending and retracting said outlet means, substantially as described.

9. In a floating dry-dock, water-inlet means, extensible and retractible water-outlet means, embodying telescopic sections and means for exhausting water therefrom, substantially as described.

10. In a floating dry-dock, water-inlet means, extensible and retractible water-outlet means, embodying telescopic sections, means for extending and retracting said outlet means and means for exhausting water therefrom, substantially as described.

11. In a floating dry-dock, water-inlet means, extensible and retractible water-outlet means, embodying telescopic sections, means for simultaneously extending and retracting said outlet means, substantially as described.

12. In a floating dry-dock, water-inlet means, pontoons, extensible and retractible water-outlet means therefor, embodying telescopic sections and means for extending and retracting said outlet means, substantially as described.

13. In a floating dry-dock, water-inlet means, pontoons, extensible and retractible water-outlet means therefor, embodying telescopic sections, and means for independently extending and retracting said outlet means, substantially as described.

14. In a floating dry-dock, water-inlet means, pontoons, extensible and retractible water-outlet means, embodying telescopic sections, means for simultaneously extending and retracting said outlet means, air-inlet means, and means for controlling the introduction of air, substantially as described.

15. In a floating dry-dock, water-inlet means, pontoons, extensible and retractible water-outlet means therefor, embodying telescopic sections, air-inlet means, and means for controlling the introduction of air, substantially as described.

16. In a floating dry-dock, pontoons, extensible and contractible water-outlet means therefor, embodying telescopic sections, means for independently extending and contracting said outlet means, air-inlet means, and means for controlling the introduction of air, substantially as described.

17. In a floating dry-dock, water-inlet means, and extensible and retractible water-outlet means always extending above the surface of the water floating the dock, substantially as described.

18. In a floating dry-dock, water-inlet means, water-outlet means always extending above the surface of the water floating the dock, means for supplying air under pressure to the various compartments and means for controlling the expansion of the air in said compartments while the dock is rising and thereby controlling the rising of the dock, substantially as described.

19. In a floating dry-dock, pontoons, water-inlet means, and extensible and retractible water-outlet means always extending above the surface of the water floating the dock, substantially as described.

20. In a floating dry-dock, pontoons, water-inlet means, water-outlet means always extending above the surface of the water floating the dock, means for supplying air under pressure to the various compartments and means for controlling the expansion of air in said compartments while the dock is rising and thereby controlling the rising of said dock, substantially as described.

21. In a floating dry-dock, pontoons, water-inlet means, extensible and retractible water-outlet means always extending above the surface of the water floating the dock and means for exhausting the water therefrom, substantially as described.

22. In a floating dry-dock, water-inlet means, extensible and retractible water-outlet means, air-inlet means and means for controlling the introduction of air, substantially as described.

23. In a floating dry-dock, water-inlet means, extensible and retractible water-outlet means, air-inlet means and means for controlling the exhaust of air substantially as described.

24. In a floating dry-dock the sides of which consist of water-tight chambers, water-inlet means, unrestricted water-outlet means, means for supplying air under pressure to the various compartments and means for controlling the expansion of the air in said compartments while the dock is rising, substantially as described.

25. In a floating dry-dock the sides of which consist of water-tight chambers, pontoons, water-inlet means, unrestricted water-outlet means, means for supplying air under pressure to the various compartments and means for controlling the expansion of the air in said compartments while the dock is rising, substantially as described.

In testimony whereof I have signed my name in the presence of two subscribing witnesses.

WILLIAM THOMAS DONNELLY.

Witnesses:
JOHN R. SCOTT,
GEORGE EISENBRAUN