

(No Model.)

4 Sheets—Sheet 1.

W. A. JONES.

HYDROPNEUMATIC WEIR AND LOCK GATE.

No. 552,063.

Patented Dec. 24, 1895.

Fig. 1.

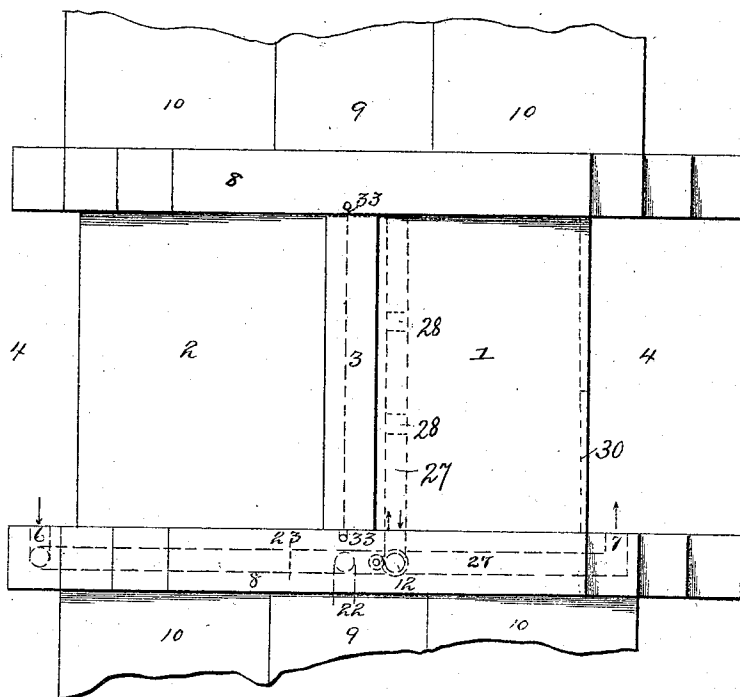
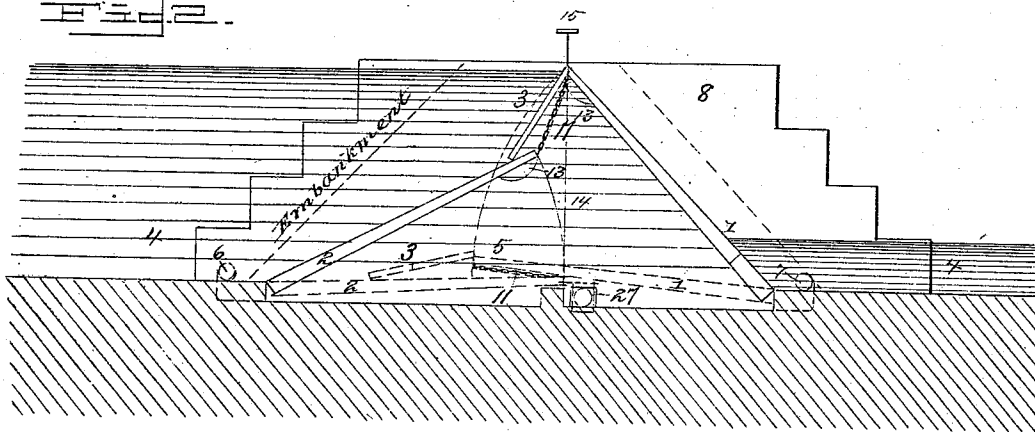


Fig. 2.



Witnesses
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(No Model.)

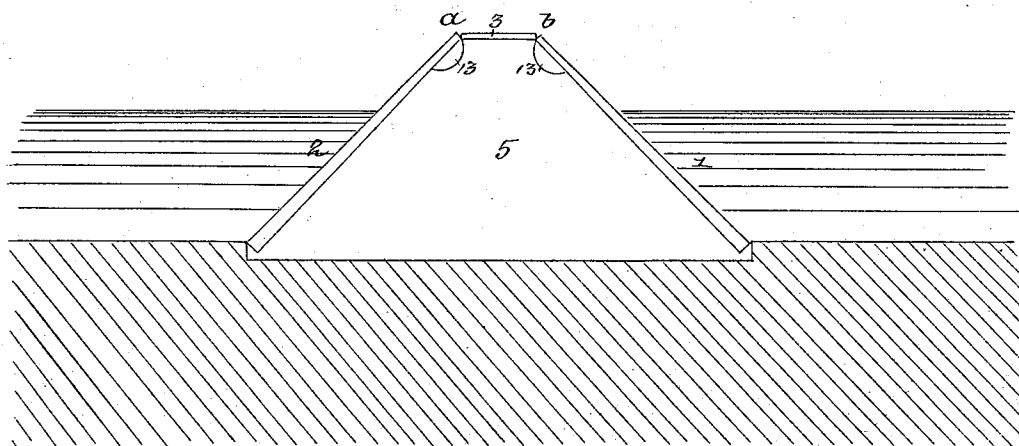
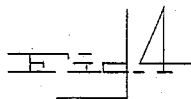
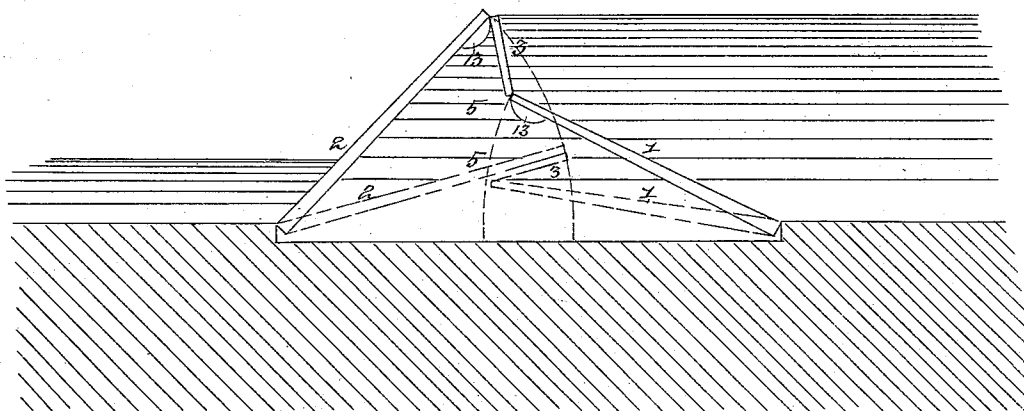
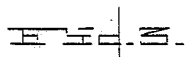
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No. 552,063.

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Witnesses
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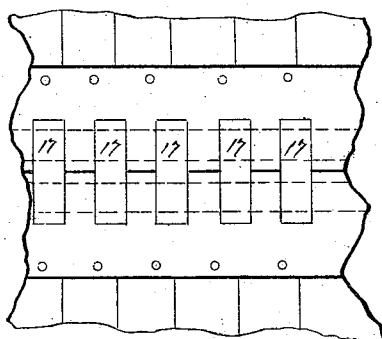
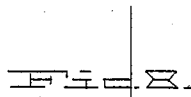
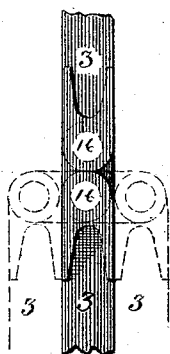
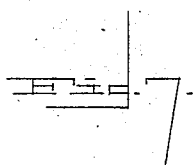
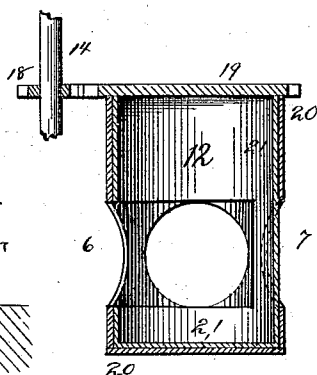
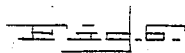
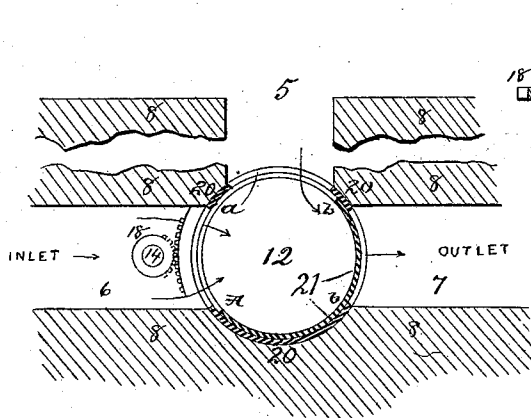
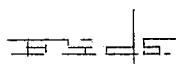
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4 Sheets—Sheet 3.

W. A. JONES.
HYDROPNEUMATIC WEIR AND LOCK GATE.

No. 552,063.

Patented Dec. 24, 1895.



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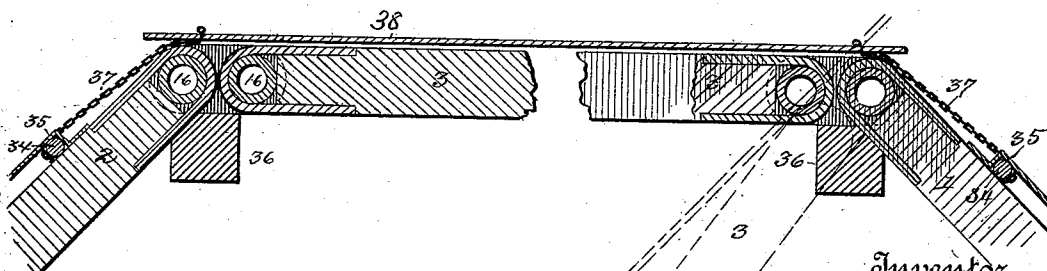
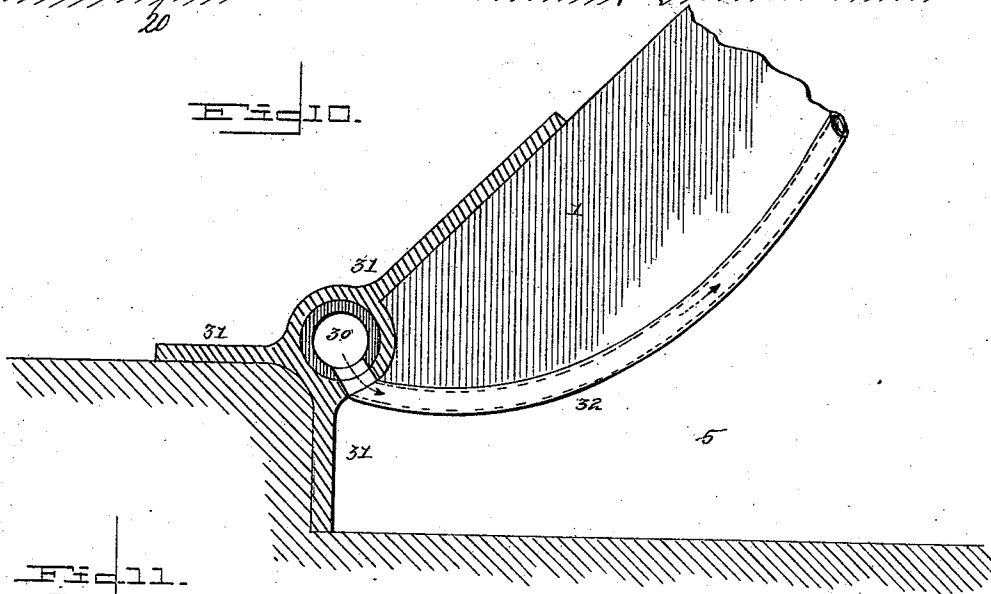
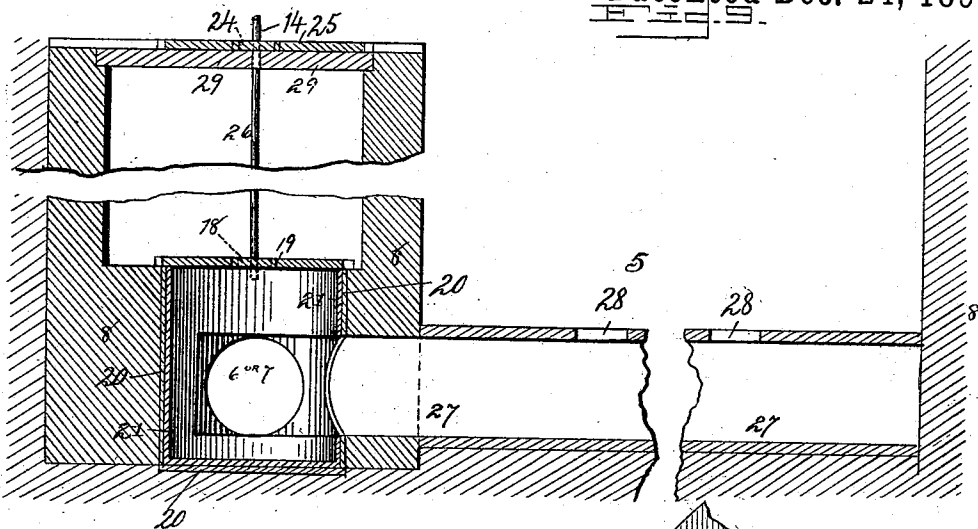
4 Sheets—Sheet 4.

W. A. JONES..

HYDROPNEUMATIC WEIR AND LOCK GATE.

No. 552,063.

Patented Dec. 24, 1895.



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UNITED STATES PATENT OFFICE.

WILLIAM A. JONES, OF THE UNITED STATES ARMY, ASSIGNOR OF TWO-THIRDS TO WILLIAM SAUNTRY, OF STILLWATER, MINNESOTA, AND ROBERT A. LANG, OF EAU CLAIRE, WISCONSIN.

HYDROPNEUMATIC WEIR AND LOCK-GATE.

SPECIFICATION forming part of Letters Patent No. 552,063, dated December 24, 1895.

Application filed October 24, 1891. Serial No. 409,698. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. JONES, major, Corps of Engineers, United States Army, residing at St. Paul, Ramsey county, Minnesota, have invented a certain new and useful Improvement in Hydropneumatic Weirs and Lock-Gates; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings.

My invention relates to improvements in folding or "bear-trap" weirs. Its object is to provide a weir which can be raised and lowered under all conditions of head of water in the water-way closed by the weir, and also to provide means of resisting a pressure from either the front or back of the same.

It has for a further object to provide a movable weir which can be used as a lock-gate.

In the ordinary construction of bear-trap weirs, there is required a difference of level between the water on the front and back of the weir, and the same will only resist a pressure from the back of the said weir.

As a means of raising and lowering the leaves of a bear-trap weir, my invention consists of a collapsing tube placed transversely across and beneath each of the moving ends of the front and back leaves of the weir, the same to be alternately filled with or emptied of air by means of an air-pump forcing air through the hollow shaft of the bottom hinges of the weir-leaves, and thence in and out of the collapsing tubes by means of pipes or hose, the buoyancy of the air acting to raise the weir, and the weight of the weir lowering the same in the absence of air in the tubes.

My invention further consists of introducing water into the hydraulic chamber beneath the leaves of the weir under a pressure in excess of that produced by the water resting upon the said weir, this serving as a means of raising the said weir or lowering the same by releasing the said pressure from the hydraulic chamber beneath the weir. This pressure may proceed from a reinforcement of the head of water in the water-way at the weir, first, by the head of an outside water-supply, and, second, by a head produced by a pump.

My invention further consists of connect-

ing the intermediate leaf of the weir with the front and back leaves of the same, in such manner that the weir will maintain itself in position and operation, by double-acting hinges in such manner as to permit the weir to reverse whenever the head of water changes from back to front, and hold up the weir at any time against a head of water on either the back or front of the weir. The intermediate leaf may however be left free at its lower end, sliding upon the side leaf while the latter is connected by chains with the other side leaf. This construction also permits the weir to reverse—that is, to resist the pressure from the reverse or opposite direction—as follows: The reverse pressure acting on the upper side leaf presses its crest against the bottom side of the lower side leaf, pushing it up and closing the hydraulic chamber. As is obvious cleats may be placed or located to stop this movement at any desired point; but such cleats are not shown or claimed, as the same do not involve invention in themselves or in their application in general. When the valve is opened so as to cut off the inlet of water from the upper pool into the hydraulic chamber 5 and allows the water in the said chamber to escape into the lower pool the weir falls at any point by the descent. By setting the valve so that the same quantity of water enters the chamber 5 as escapes from it the weir becomes fixed in that position and thus the crest of the weir may be held at any desired elevation and the surplus water will flow over it.

As a means of facilitating the operation of a bear-trap weir, my invention further consists of a device whereby steam can be introduced into the hydraulic chamber so that ice may be melted and dispersed from the same. The steam may be led in by a pipe or hose in any way suggesting itself to the mechanic.

My invention further consists of a locking arrangement placed upon or near the joints between the intermediate and back and front leaves of a bear-trap weir in such manner as to enable the same to be held firm at its maximum elevation for any length of time, this in order to enable the water to be pumped out of said weir and repairs to be made in the hy-

draulic chamber, and also to enable the said weir to be operated in a dam used for collecting water in a reservoir.

In the operation of a folding or bear-trap weir, my invention further consists of a valve 5 formed and so placed as to operate upon both the intake and the exhaust water, to regulate the inflow and at the same time the outflow, and by which either the inflow or the outflow 10 can be shut off while the other may be open, and which will also maintain automatically the crest of the weir at any height under the water-level. This valve consists of a cylinder closed at the bottom but open at the top. 15 Upon three sides of this cylinder, fronting respectively the inlet and outlet channels and the transverse tunnel under the weir, openings are cut. Within this cylinder is inserted a second cylinder, having a top and bottom and fitting closely inside the first cylinder; but the 20 second cylinder is half cut away on its side only. Around the top of this second cylinder are cogs engaging a pinion having a shaft extending to the top of the abutment, and upon the upper end of which is placed a wheel or other suitable device for turning the shaft. 25 The novelty of this device consists in its capability of operating reciprocally or non-reciprocally upon the water in the flumes. By setting the opening of the inside cylinder against the port in the hydraulic chamber the valve works reciprocally on the intake and exhaust water. When the exhaust is closed the intake is wide open, and vice versa. There is an intermediate position when the intake and exhaust 35 are equally open, or nearly so, which replaces the same quantity of water within the hydraulic chamber as is being exhausted from it. In this condition the weir can neither rise nor fall and its crest will be maintained at any desired level. By reversing the valve and placing the closed side of the inside cylinder against the port in the hydraulic chamber it no longer works reciprocally—that is, 45 it will be in position so that by turning it in one direction the intake may be opened and reversing it shut off while the exhaust will remain closed, or turning it in the other direction the intake will remain closed, and the exhaust opened and shut off in the reversal 50 of the valve. In this position by slightly opening the intake or exhaust the quantity of water within the hydraulic chamber may be held constant, and the crest of the weir can neither rise nor fall.

The valve operates the weir as follows: Open the intake and close the exhaust and the water will enter and raise the weir. At any desired elevation set the valve so that 60 the quantity of water in the chamber is held constant and the weir will maintain its position. For lowering the weir reverse the above conditions. It is obviously important that the operator shall know the precise positions 65 of the valve, and I have invented an indicator to show this. On the top of the abutment, immediately over this valve, duplicates of the

pinion and cogged barrel-head are operated by the pinion-shaft in such manner as to show the operator at all times the position of the 70 valve.

In a bear-trap or folding hydraulic weir my invention further consists of a transverse water-tunnel upon the bottom of the hydraulic chamber, into which the water passing 75 through the valve first enters, and from which the said water is admitted to the said chamber so as to equalize the pressure from said water along the whole length of the weir.

My invention further consists of the construction and combination hereinafter described, and particularly pointed out in the claims. In order that the leaves of a bear-trap weir may rise and fall freely their ends must not press too tightly against the water-way walls. On the other hand it is important to have these joints water-tight in order to maintain the pressure in the hydraulic chamber while the weir is being raised.

By the term "bear-trap weir" is meant a 90 rising-and-falling weir formed of two or more leaves joined together and to the floor of the water-way, the said leaves being raised by introducing water beneath them from the upper pool and lowered by exhausting said water 95 into the lower pool.

In the drawings herewith submitted and forming a part of this specification, Figure 1 is a plan view of the weir with its abutments. Fig. 2 is a diagram section of the weir, showing the same standing against a head on its back. This shows a compound intermediate leaf, the upper edge of the upper side leaf connected by chains with the upper edge of the lower side leaf, while its part 3 slides free 105 but closely upon the upper side leaf. This part 3 is hinged closely upon the crest of the lower or pressure leaf. Fig. 3 is a diagram section showing the same standing against a head on its front. Fig. 4 is a diagram section showing the same standing at maximum height. Fig. 5 is a transverse section, and Fig. 6 is a longitudinal section, of the cylinder-valve. Fig. 7 is a cross-section of the joint between two leaves of the weir; and Fig. 115 8 is a plan of the same, showing the double-acting hinge. The construction of these hinges, as shown, enables two adjacent leaves of the weir to turn clear round through an angle of about one hundred and eighty degrees, so that the weir may be reversible in its action. Fig. 9 is a detail showing the transverse water-tunnel, from which the water from the sluiceways is fed uniformly into the hydraulic chamber along the whole length 125 of the weir, thus avoiding the unequal pressures produced by introducing all of the water into the hydraulic chamber at one point. Fig. 10 is a detail showing the hinge with hollow shaft at the bottom of the weir-leaves, 130 through which shaft air may be pumped in any well-known way into the collapsing air-tubes, from which tubes the air will exhaust upon opening a cock connected with the

tubes, but not shown. Fig. 11 is a detail of the reversible idler and the means of locking the weir at maximum elevation.

The terms "back" and "front" herein used in describing the weir are employed in the same sense as when applied to a dam, "back" meaning the upstream or pond side of the weir and "front" meaning the other side.

In the drawings the different parts in detail are represented by figures as follows: 1 is the front leaf of weir; 2, back leaf of weir; 3, intermediate leaf of weir; 4, water-way closed by weir; 5, hydraulic chamber beneath weir; 6, sluiceway for filling chamber; 7, sluiceway for emptying chamber; 8, abutments to weir; 9, top of dam; 10, slopes of dam; 11, chain connections between said leaves; 12, cylinder-valve; 13, collapsible air-tube of canvas or other flexible but water-tight material; 14, pinion-shaft for valve; 15, hand-wheel for pinion-shaft; 16, reversing-hinge between leaves of weir; 17, link members of hinge; 18, pinion working in cogs on rim of head of cylinder-valve; 19, head of cylinder-valve; 20, outside cylinder of cylinder-valve; 21, inside cylinder of cylinder-valve; 22, inlet for water from reservoir or pump; 23, gate to be closed when pump or reservoir water is used; 24 and 25, duplicates of pinion and cogged barrel-head working on top of abutment to show operator the position of valve; 26, manhole; 27, water-flume for filling hydraulic chamber; 28, outlets from water-flume into chamber; 29, cover for manhole; 30, hollow hinge-rod at foot of each principal leaf of weir extended into sluiceways in abutment and there connected with air-pump, (the pump not shown;) 31, hinge at bottom of weir-leaves; 32, air-pipe leading from hollow hinge-rod along middle of weir-leaf to collapsing air-tube, one on each leaf; 36, heavy metal bolts, four in number, which are thrust horizontally out from the faces of the pier into and fitting the top angles of the weir when raised to full height, this for the purpose of locking the weir in this position.

37 represents chains, at intervals, leading from eyebolts in idler 38 to the two metal rods 34, which extend clear across along the back and front leaves of the weir and engage automatically in the hooks 35 which at the time being are at the crest of the weir. At the bottom of the idler they disengage automatically from the hooks and slide along the front and back leaves in the folding or movement of the intermediate leaf in the act of reversing. Fig. 11 shows the idlers (of metal) at the summit in the act of reversing. From this position whichever leaf of the weir goes down, the idler will follow and take its proper position.

Operation: The weir being folded on the bottom, and there not being sufficient difference of level in the superincumbent water between the front and back of same to operate it as an ordinary bear-trap weir, the cylinder-valve is set, Fig. 5, so that the inlet to

the hydraulic chamber is open and the outlet closed. Air is then pumped into the collapsing tubes until sufficient buoyancy has been obtained to raise them by rotating about their bottom hinges. The weir will then rise to the surface of the water, and the hydraulic chamber will fill with water to the same level. At this point close the gate 23 and let the water under pressure from a reservoir or pump (not shown) enter the hydraulic chamber through the pipe 22. The gate will then rise to the position shown in Fig. 4. The joints between the weir-leaves and the abutments are kept water-tight by means of suitable packing inside the chamber. By strongly clamping the angles a and b formed by the meeting of the upper ends of the front and the back leaf with the ends of the intermediate leaf, Fig. 4, the water-pressure inside the weir can be relieved and the weir will maintain its position indefinitely against a head on either side. In this position, after properly setting the cylinder-valves, the water inside the chamber can be pumped out and the same freely entered for repairs. Whenever a head on either side accumulates sufficient by its pressure within the hydraulic chamber to hold up the weir against its weight, the cylinder-valve is set so as to allow the water to enter the chamber from that side, the clamps are removed, and the weir will settle to the position shown in either Fig. 2 or Fig. 3, and will automatically maintain itself against that head or any increase thereof. In Fig. 2, the hydraulic pressure is received by the leaf 1 and maintained by its structural resistance and its fastenings at top and bottom. In Fig. 3, on the other hand, the pressure is carried by leaf 2. From either of these positions the crest of the weir may be lowered to any desired point, allowing the water to discharge freely over the weir, by properly adjusting the cylinder-valve. For instance, by turning the same so as to open the discharge and close the filling-flumes the weir will fall as fast as the water escapes from the chamber. The descent may be stopped at any point by so setting the valve that the water which escapes from the hydraulic chamber will be exactly replaced by that which enters it from the upper pool. By reversing these conditions the weir may be stopped at any point while rising. As a log-sluice the weir will be lowered to such a point as to allow logs to pass freely over its crest and then be held there. As soon as the logs are through, the outlet-sluice is closed by the cylinder-valve and the weir rises automatically to the upper level of the water and cuts off further discharge. As a movable weir in rivers, it would be held at such level as might be necessary for slack-water navigation during low-water periods; but during high water or floods it would be laid flat to allow free passage to the water. As a lock-gate, in passing a boat from the upper to the lower level, the lock-chamber would either be full with the lower gate closed, or empty with the

upper gate closed. In the former case raise upper gate by auxiliary air-hoists. Then empty lock-chamber by gradually lowering lower gate. Boat passes out. In latter case
 5 raise lower gate by means of a sluice from the upper pool, at same time gradually lowering upper gate. Lock-chamber is full and upper gate open at same moment. Boat passes in.

In case there is a current in the water over
 10 the weir when it is folded flat the latter should be raised far enough above the water-level to create a head sufficient to operate it and the valve properly set. Then the current would raise the water on the back of the weir up to
 15 its crest, and thereafter the weir would rise automatically with the rise of the water until it reached a position something like that shown in Figs. 2 and 3, when the surplus water would flow over the weir.

20 I disclaim the combination, with the submerged water-gate, of the water-tunnel connecting with the water-way on each side of the gate, an outlet for said tunnel communicating with the way between the wings of the gate,
 25 and a three-way gate or valve connecting said tunnel with its outlet.

Having described my invention and set forth its merits, what I claim is—

1. In a bear trap hydraulic weir, the combination with the leaves of the weir, of means
 30 for supplying water into the hydraulic chamber from an auxiliary source of water supply other than that in the water way whereby the pressure of the water from said auxiliary
 35 source of supply may be utilized to raise the leaves of the weir, substantially as and for the purposes described.

2. In a rising and falling weir, collapsible chambers applied beneath the leaves of the
 40 weir and adapted to be filled with air to float the leaves and to be exhausted of air, after pressure is released, by the water pressure upon said chambers, substantially as and for the purposes described.

3. A bear trap weir capable of resisting pressure in reverse directions, said weir comprising hinged leaves and a connection of the same to each other whereby they are adapted
 45 to adjust themselves to resist said pressure according as the excess of water pressure is
 50 from either side, substantially as and for the purposes described.

4. A bear trap weir capable of resisting pressure in reverse directions, comprising
 55 leaves hinged in the water way at their lower ends, and an intermediate leaf, and connections of the same whereby each is adapted to adjust itself to resist said pressure as the excess of water pressure may be from one side or
 60 the other, substantially as and for the purposes described.

5. In a bear trap hydraulic weir, capable of resisting pressure in reverse directions, side leaves hinged at their lower ends, in
 65 combination with an intermediate leaf hinged to the upper end of one of them, and chains

connecting the upper or moving ends of the two side leaves and rigidly fastened to the end of each, said connections being such that the said leaves are adapted to adjust them-
 70 selves to resist pressure as the excess of water pressure may be from one side or the other, substantially as and for the purposes described.

6. The combination with the leaves of the
 75 bear trap, of the fender or idler connected at each end therewith for automatic disconnection, substantially as and for the purposes described.

7. In a bear trap hydraulic weir, collapsing
 80 air chambers attached to side leaves adapted to be filled with air under pressure and exhausted by the water pressure and means for filling the same with air.

8. The combination with the bear trap, of
 85 the intake and outlet conduits and the transverse tunnel all meeting at a common point, and the three way cylinder valve located at said point of meeting, substantially as and
 90 for the purposes described.

9. A rising and falling weir, capable of resisting pressure in reverse directions, composed of side leaves hinged to the floor of the water way and connected together at their upper ends by chains rigidly attached to each,
 95 and a middle leaf hinged to the crest of one of them, said chains and leaves being so arranged and connected as to resist superior pressure from one side or the other of the weir, in combination with filling and dis-
 100 charging flumes in the water way wall, a valve or valves controlling said flumes, and the closed hydraulic chamber formed by the leaves of the weir and the floor and walls of the water way, substantially as and for the
 105 purposes described.

10. A rising and falling weir, capable of resisting pressure in reverse directions, composed of side leaves hinged to the floor of the water way and connected together at their
 110 upper ends by chains rigidly attached to each and a middle leaf hinged to the crest of one of them, in combination with the filling and discharging flumes, a valve or valves controlling the said flumes, and air chambers in or
 115 on the leaves, substantially as and for the purposes described.

11. In a bear trap hydraulic weir, the combination with inlet and outlet flumes and ports, of a valve adapted to reciprocally regulate the intake and exhaust of water so that
 120 the proportion of one to the other may be varied or by its adjustment vary the intake while the exhaust is shut off and vice versa, substantially as and for the purposes de-
 125 scribed.

12. The combination in a bear trap hydraulic weir, of the water way, the operating flumes and ports, the valve or valves to regulate the exhaust of water proportionately to the in-
 130 take and by adjustment to vary the intake while the exhaust is shut off and vice versa,

and an indicator on the wall of the water way to show the valve positions, substantially as and for the purposes described.

13. In a reversible bear trap hydraulic weir, the combination of the water way, the side leaves, the chain connection between the upper ends of the side leaves, the intermediate leaf hinged to the crest of one of said leaves, the collapsible air chambers, the operating flumes, valve and indicator, and the transverse flume extending across the hydraulic chamber, substantially as and for the purposes described.

14. In a reversible bear trap hydraulic weir, the combination of the side leaves, the chain connection between the upper ends of said leaves, the intermediate leaf hinged to the crest of one of said leaves, the water way, the operating flumes, and a valve adapted to reciprocally regulate the intake and exhaust of water and by adjustment to vary the intake while the exhaust is shut off, and vice versa, substantially as and for the purposes described.

15. The combination of the water way, the bear trap or folding weir, the hollow hinge shaft and the collapsing air tube, substantially as described.

16. The combination of the reversible bear trap weir, and the transverse water tunnel used for the purpose described, substantially as and for the purposes described.

17. The combination of the reversible bear trap weir, and the steam hose for melting ice in the weir, substantially as shown.

18. The combination of the water way, the reversible bear trap weir, the hollow hinge shaft and collapsible air tube, the cylinder valve, the transverse tunnel and the steam hose, substantially as and for the purposes described.

In testimony that I claim the foregoing I have hereunto set my hand this 20th day of October, A. D. 1891.

WILLIAM A. JONES.

Witnesses:

JOHN W. LANE,
SAM V. MORRIS.