Sheet 1-2 Sheets.

F. R. Brunot.

Water Gate.

No. 69,070 Patented Sept. 24, 1867.

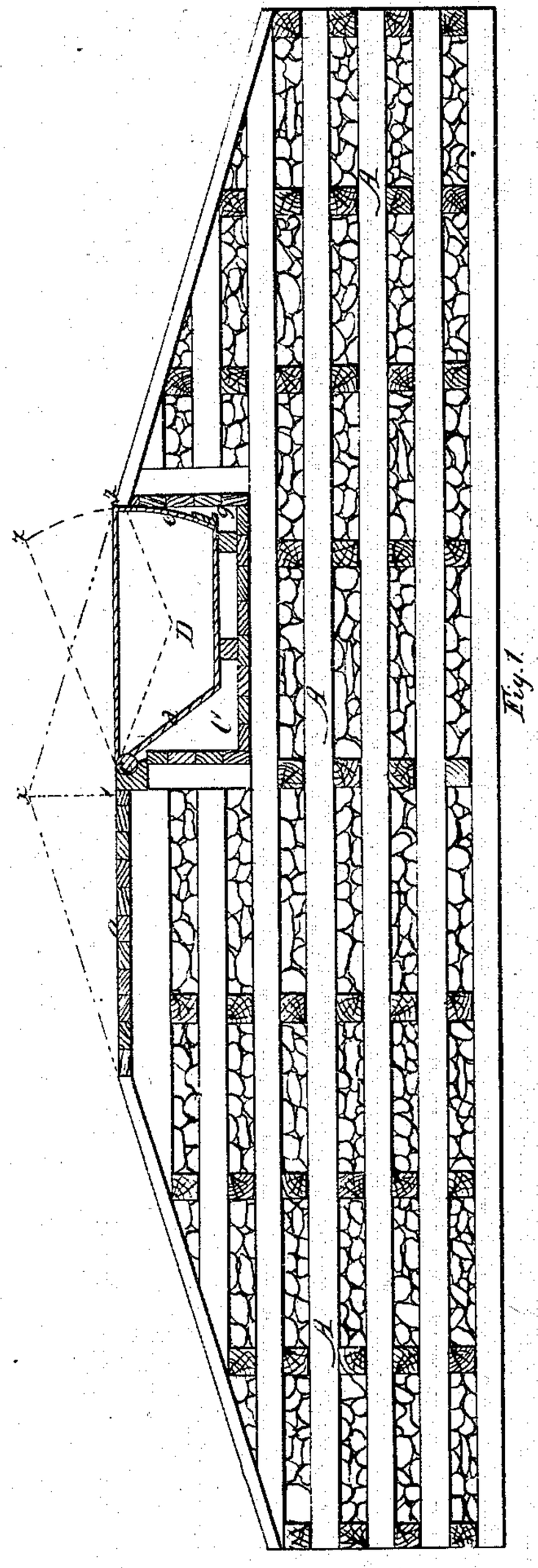

Fig. 1.

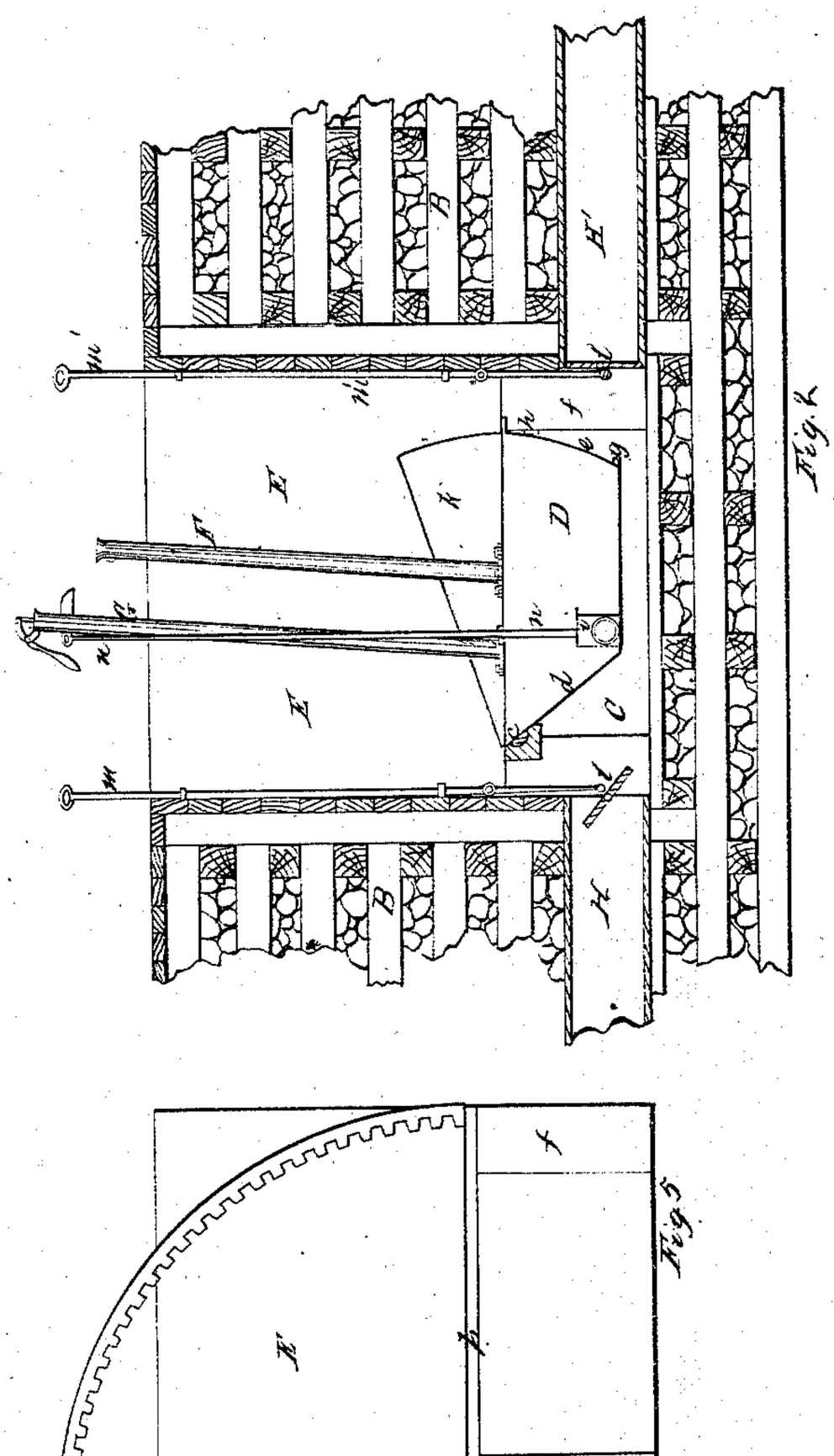

Fig. 2.

Fig. 3.

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Sheet 2–2 Sheets.

F. R. Brunot.

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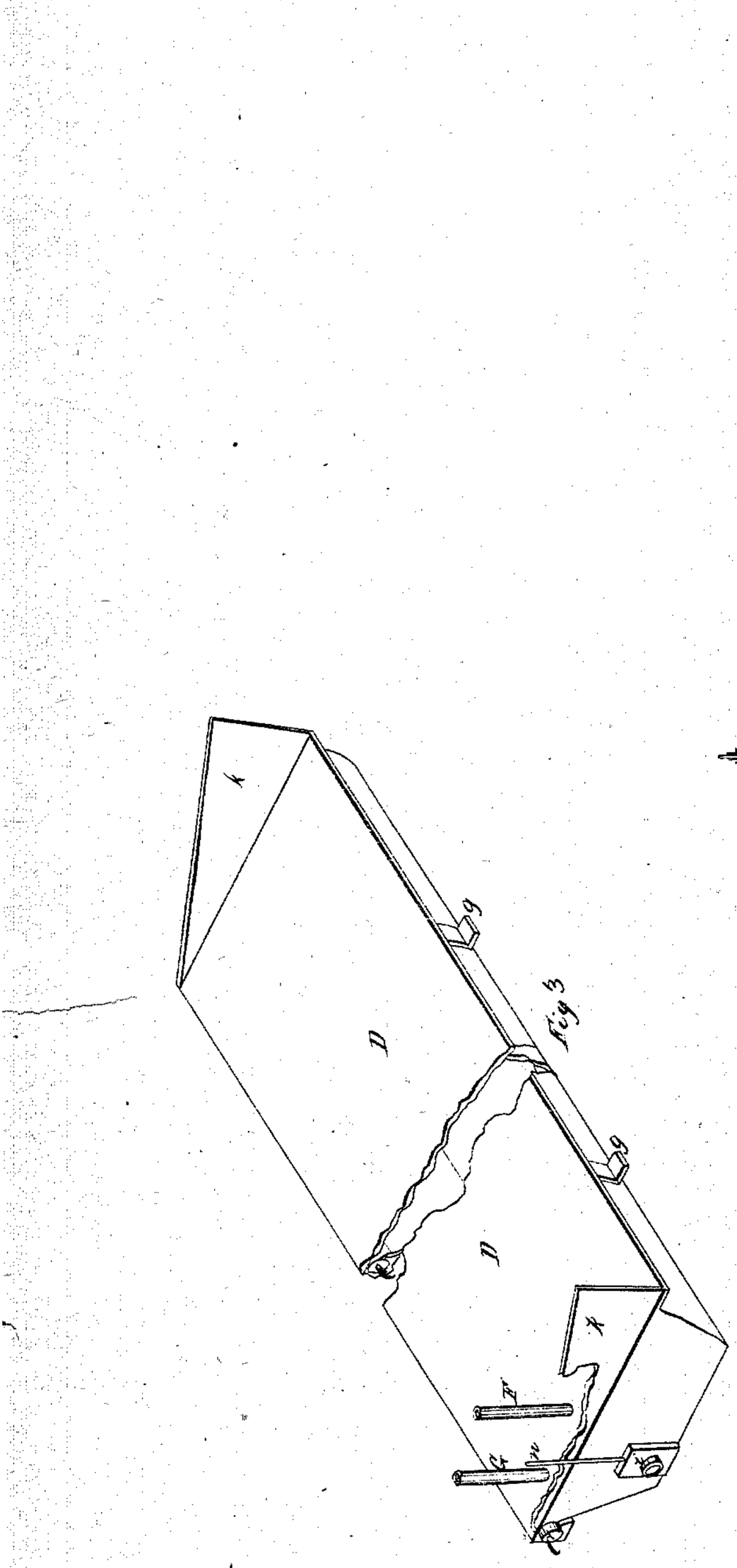

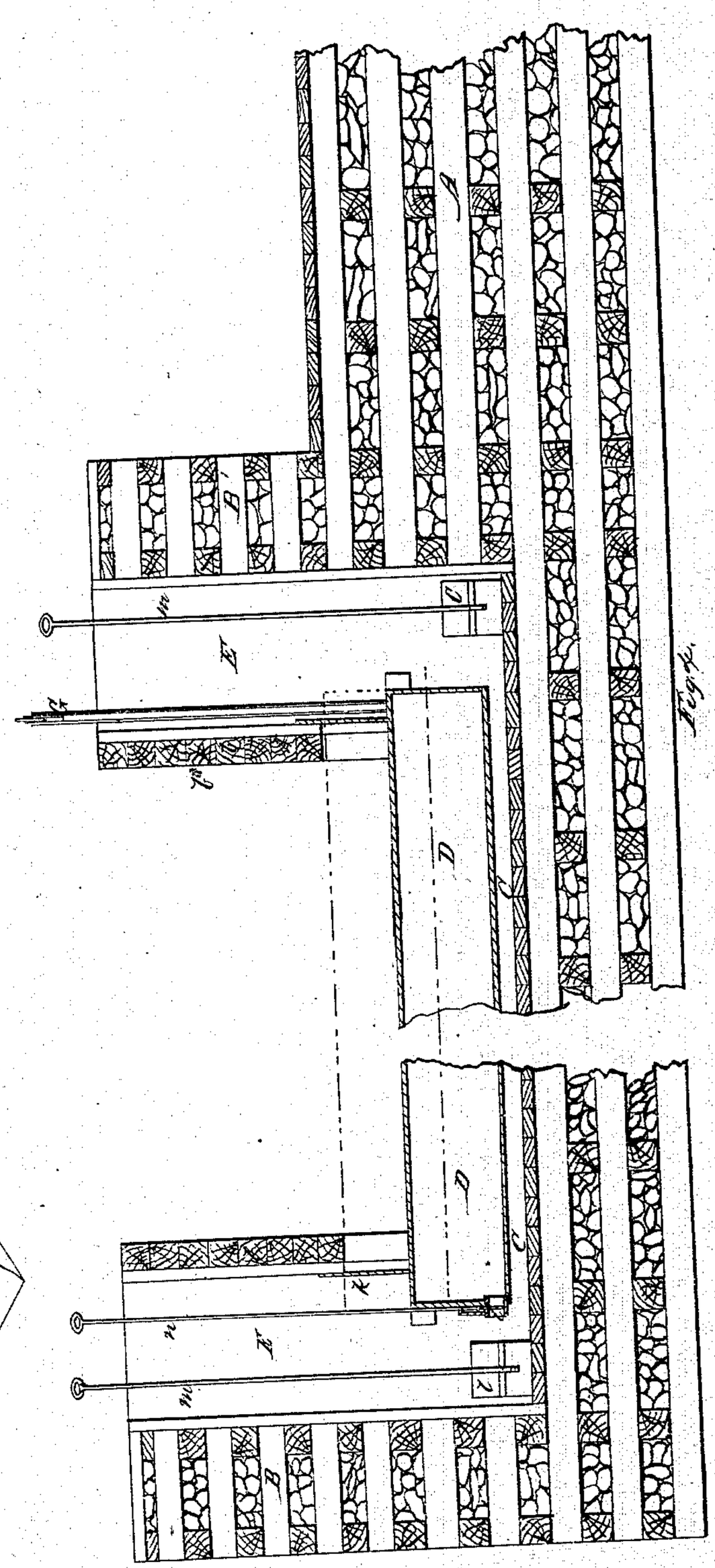

Witnesses.
George H. Christy
W. Bakewell

Inventor.
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FELIX R. BRUNOT, OF ALLEGHENY, PENNSYLVANIA.

Letters Patent No. 69,070, *dated September* 24, 1867.

IMPROVED SLUICE-GATE FOR DAMS OR LOCKS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, FELIX R. BRUNOT, of Allegheny city, in the county of Allegheny, and State of Pennsylvania, have invented a new and useful Improvement in Sluice-Gates for Locks, Dams, and other Hydraulic Structures; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification, which represent my improvement as applied to the formation of a chute or sluice-way in a dam for the slack-water improvement of a navigable stream; the necessary modifications for adapting my invention to other purposes, such as docks, tide-water improvements, and the like, being such as are easily made by those who are skilled in engineering. In the drawings, which are in two sheets—

Figure 1 is a vertical cross-section of a dam furnished with my sluice-gate, the section being made through the chute or sluice.

Figure 2 is a vertical section through the pier or crib at one end of the chute or sluice-way, the plane of section being parallel to that of fig. 1.

Figure 3 is a perspective representation of my sluice-gate.

Figure 4 is a longitudinal vertical section through the dam, sluice-way, and sluice-gate.

(Figs. 3 and 4 are broken through the middle for the purpose merely of reducing the length of the figures.)

Figure 5 is a representation of trap-gate for closing the recesses in the piers.

In the several figures like letters of reference denote similar parts.

The accompanying drawing represents one of the various applications of my invention; and to enable others skilled in the art to construct and use my improvement, I will proceed to describe it as applied to a dam used for creating a lock navigation in a river.

In such improvements it frequently happens that, by reason of a flood or freshet, the water in the stream rises so high that, were the comb (or highest point) of the dam lowered a few feet, boats could easily pass up and down, there being sufficient water to render the use of a lock unnecessary. When this occurs the locks prove a hindrance to navigation during the time of the freshet, and it becomes very desirable to provide some means of lowering the crib of the dam until the water falls so much as to render necessary a resort to the locks. As the sluice-way or passage thus opened in the dam requires to be as wide as possible, in order to afford free passage for boats, rafts, and other craft, the gate must necessarily be long, say from one to two hundred feet, and the difficulty of constructing a gate of such a length of the requisite strength, which shall be readily lowered and raised in times of high water, has heretofore been found insuperable. My improvement is designed to effect the desired object and surmount the attendent difficulties, which I accomplish in the following manner:

In the drawing, fig. 1, A represents a dam made of crib-work and filled with stone, set horizontally in the stream, at right angles to its thread, and constructed in the usual manner. A sluice-way is made in the dam A by removing the upper portion of the dam, from the comb or apex *x* to such depth as may be required to give, together with the height of water above the comb of the dam, a sufficient channel for the passage of boats. In the drawing the depth of sluice-way from *x* to *y* is three and a half feet, which, when there are five feet of water over the comb of the dam, gives about eight feet of water in the channel. The length of this depression in the dam may be one or two hundred feet, more or less, according to the requirements of the navigation. At either end of this depression or sluice-way is a pier, B, raised to the height of the walls of the lock or above the level of ordinary high water. The abutment of the dam, or one of the walls of the lock, may serve as one of these piers. The surface of the sluice-way is sheeted with plank *a*. Below the surface of the sluice-way, and extending from one pier B to the other B′, is a chamber, C, made in the crib-work of the dam, to receive the sluice-gate D. The dam and piers may, if preferred, be built of stone, but if of crib-work, with loose stone filling, as represented, the bottom and sides of the chamber C are lined with plank, so as to be water-tight. In one or both of these piers B and B′ is a recess, E E′, extending from the level of the bottom of the chamber C to the top of the pier, forming a pit or well which may be covered on top or left open, but of such size and so constructed as to give ready access to the valves and other apparatus for operating the sluice-gate D. The sluice-gate chamber C opens at each end into the bottom of the recesses E E′, the front of the recesses being tightly closed by the timber *b* and planking, (see fig. 4,) excepting where the gate enters and for a space above

the top of the gate sufficient to allow it to rise; the opening in the front wall of the recesses, above the level of the gate D, being of the shape of a sector of a circle, the centre of which is at or near the heel-post *c* of the sluice-gate. The sluice-gate is a hollow water-tight vessel, made of sheet iron or wood, or a combination of those articles, which may be braced internally or externally, as may be necessary to give the requisite strength. At the rear edge, near the top of the gate, is placed the heel-post *c*, which works in a quoin framed in the dam and set horizontally lengthwise of the dam at the level of the floor *a* of the sluice-way, as shown in fig. 2. The back wall *d* of the gate D is sloped, so as to give a preponderance of area forward of the middle of the gate, so as to relieve the strain on the quoin or heel-post caused by the buoyancy of the gate when surrounded with water, and so as to place the centre of flotation of the gate in the proper position, parallel with its axis or centre of motion, or such other shape may be adopted as will seem best. The front wall *e* of the gate is curved to the shape of the arc of a circle, having its centre in the heel-post or centre of motion of the gate D, so that as the gate D rises, turning on its heel-post *c*, the front wall *e* of the gate may remain in contact with the wall *f* of the chamber C, thus preventing the passage of water out of the chamber. When the gate D has risen to the position shown by dotted lines in fig. 1 its upper front corner *z* is at the same height as the comb *x* of the dam, and it is prevented from rising further by the front wall *b* of the recess E in the piers. It is also further restrained by the stops *g g* (formed of angle iron) fastened to the front lower corner of the gate, which stops press against a plate, *h*, bolted to the wall *f* of the chamber C, as shown in fig. 2. For the stops *g g* may be substituted a single strip of angle-iron, which, when the gate is raised, will also serve the purpose of making a close joint by pressing against the plate *h*. At each end of the gate D is a flap, *k*, (see figs. 2 and 3,) of the shape of a sector, which projects upwards from the top of the gate, and being so placed as to rest against the sheeting inside of the front wall *b* of the recess E in the piers, serves to close the triangular opening in the pier wall when the gate is down and prevent the passage of water into the recesses in that direction. At one end of the gate (see figs. 3 and 4) there is a water-tight valve, *i*, operated by a rod, *n*, to admit water into the gate D from the chamber C. A similar valve or valves may, in practice, be placed also at the other end. There is also placed at one end (or at both ends if preferred) of the gate D a standing pipe, F, open at top, and communicating at bottom with the interior of the gate; also a pump, G, by which the gate may be emptied if it becomes filled with water. The pipe F is of such height that when the water rises sufficiently in the river to make it proper to lower the sluice-gate D it will overflow the mouth of the pipe, fill the gate, and cause it to sink automatically. The chamber C communicates with the water of the river in the upper and lower pools by the pipes or trunks H H′, one end of each of which opens into the chamber C at the level of its floor inside the piers, while the other end of the lower trunk H′ opens into the lower pool at any point below the bottom of the chamber, while the upper end of the upper trunk H opens into the upper pool at any point beyond and below the level of the comb of the dam. These trunks are closed by valves or wickets *l l′*, operated to open or close at pleasure by the rods *m m′* which extend to the top of the pier through the recesses E E′, as seen in fig. 4. The construction, size, and arrangement of the trunks and valves will of course be varied according to the circumstances and the requirements of special cases. The recesses E E′ may be furnished with a gate or trap, *p*, (see fig. 5,) so situated as to close the recesses and prevent the passage of water upward above the level of such door when closed, and thus make the chamber C water-tight for the purpose of raising the gate D, even when filled with water, (its valve being open,) by the pressure of the water from the upper pool of the river applied beneath the gate. These traps *p* should be capable of being fastened down in order to resist the upward pressure of the water in the chamber C, and may be opened and closed by a toothed arc, *r*, and pinion, *q*, (as shown in fig. 5,) or by some other suitable device.

The operation of my sluice-gate thus constructed is as follows: When it is desired to lower the gate so as to open the sluice-way in the dam, if the back-water or water in the lower level of the stream is not materially above the bottom of the chamber C, the upper wicket *l* is closed and the lower wicket *l′* is opened, which shuts off the water from entering the chamber C from above the dam, and allows the water to escape from the chamber through the trunk H′ and valve *l′* into the lower pool. The gate D, having then nothing to support it, drops down into the chamber C, assuming the position shown in fig. 1, and opening the sluice-way in the dam. If this should not be attended to before the water rises too high in the lower pool to allow the chamber C to be emptied, the valve *i* may be opened to allow the water from the chamber to enter the cavity of the gate; or as soon as the water in the upper pool rises above the top of the standing pipe F the gate D will become filled and will sink by its own weight. As soon as the water in the river falls so low as to render it advisable to raise the gate, and thus restore the dam to its proper height, it is effected by reversing the wickets *l* and *l′* and shutting the lower wicket *l′* and opening the upper one, *l*, when the water from the upper pool will fill the chamber C and cause the hollow gate D to rise by its own buoyancy, unless it has been filled with water in order to sink it, in which case, the lower wicket *l′* being left open, the water is run out of the gate D by raising the valve *i*, which is closed again before water is admitted into the chamber C for the purpose of raising the gate. If it should be desired to raise the sluice-gates while the water is too high in the lower pool to allow the chamber C being supplied, this may be effected by emptying the gate D of water by means of the pump G, the lower wicket *l′* to the trunk H′ being closed to prevent the gate sinking when the river falls. Another mode of raising the gate D when filled with water is to shut and fasten down the traps *p p* in the recesses E E′, which close the only exit for water from the chamber C, and then, by opening the wicket *l* of the upper trunk H, the head of water entering the chamber C, pressing on the bottom and rear side of the gate D, raises it up and sustains it in an elevated position. The mode of raising and lowering the gate by pumping it out, or filling it with water through the valve *i*, is resorted to whenever there is but little fall from the upper to the lower pool, or when there is dead water. The wickets *l l′* and pump G and valve *i* may be worked from either end of the sluice-gate, the apparatus being duplicated and placed at both ends for that purpose. These valves and wickets may also

be made self-acting by means of floats connected with the valves in the hollow gate D and the wickets of the water-trunks H H′.

It will be observed that the principles depended upon for the operation of the gate are its buoyancy as a water-tight vessel, when filled with air, to raise it, and the gravity of the vessel and of the water within it when it is filled with water in order to lower it, forces which, so long as the apparatus is kept in order, cannot fail in their operation. The great length and weight of the gate present no serious difficulty, as this is counteracted by the buoyancy of the contained air, so that there is more fear of the gate sagging upwards in the middle than downwards. This tendency may, however, be easily counteracted by means of the stops before mentioned.

My improvement is also applicable to various other purposes in hydraulic architecture, a few of which I will name. By the use of two or more gates, one placed at each end of the piers, forming the sides of the sluice-way in the dam, they may serve all the purposes of a lift-lock in time of high water, and be dropped out of the way when the river is navigable without such help; or two dams may be used, with a sluice-gate in each, for such a purpose. Or, on the other hand, an ordinary lift-lock may be converted into a sluice-way by the use of such a sluice-gate as I have described placed in the bottom or breast-wall of the lock. It may also be used for wiers in canals or reservoirs, stop-gates, flood-gates, tide-gates, and for all similar purposes.

As a modification of construction of such sluice-gates, especially when used in locks, I may state that the gate may be made solid, like the leaf of an ordinary lock-gate, and the power to raise it be applied by floats or buoys attached thereto at each end, but outside the chamber of the lock, the gate being laid horizontally across the chamber. The gate may also be made to rise and fall perpendicularly in grooves in the lock-wall, so as to sink into a pit below the floor of the lock and be raised by buoys or floats, as before mentioned.

Although I have described the heel-post of the gate, on which it turns, as placed up stream, which I consider better, because it gives the pressure of the pool to aid in lowering it, and because vessels and other things passing down stream would not be so likely to injure the gate if they attempted to pass over it when raised, yet this is not necessary, and the position of the gate may be reversed, so as to have the heel-post down stream.

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

1. In a sluice-way in a dam, dock, lock, or other hydraulic structure, a hollow sluice-gate furnished with a valve or valves for the admission or exit of water, and so placed in a chamber or recess in the sluice-way, lock, or other structures, furnished with apparatus for admitting the head of water into the chamber under the gate or emptying the chamber of water, as to raise or lower the gate at pleasure, substantially as and for the purposes hereinbefore described.

2. The standing pipe, open at any required height, for the admission of water into the sluice-gate, in combination with the hollow sluice-gate or float into which the pipe opens, constructed and operating substantially as described, for the purpose of closing or lowering the sluice-gate automatically at the required stage of water, as hereinbefore set forth.

3. The gates for sluices, docks, locks, and other hydraulic structures, in combination with hollow floats, so constructed with valves for the admission or exit of water as to raise and lower or open and close the gates at pleasure, in the manner substantially as hereinbefore described and for the purposes set forth.

In testimony whereof I, the said FELIX R. BRUNOT, have hereunto set my hand.

FELIX R. BRUNOT.

Witnesses:

A. S. NICHOLSON,

GEO. H. CHRISTY.