4 Sheets—Sheet 1.

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Dam and Lock.

No. 229,682. Patented July 6, 1880.

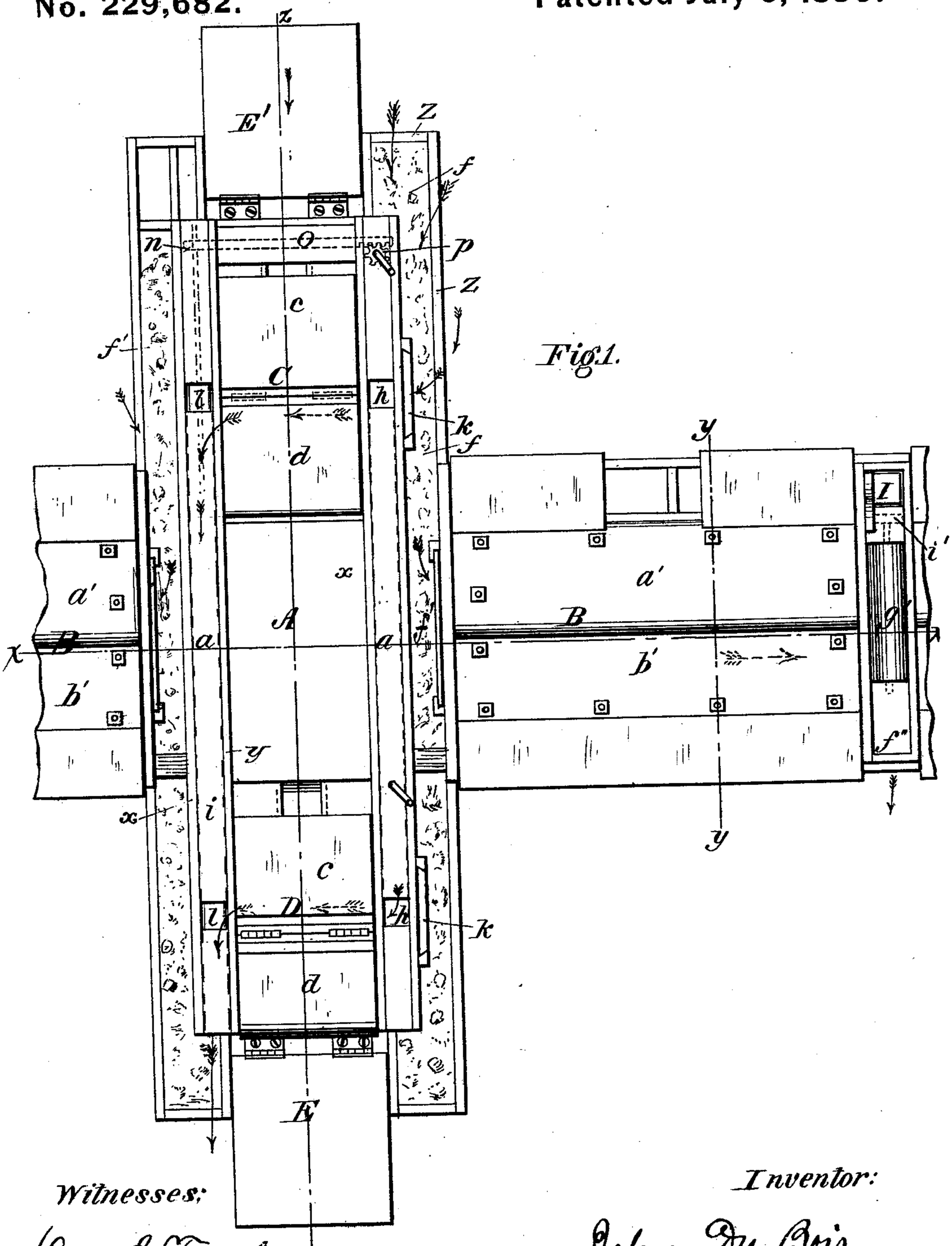

Fig 1.

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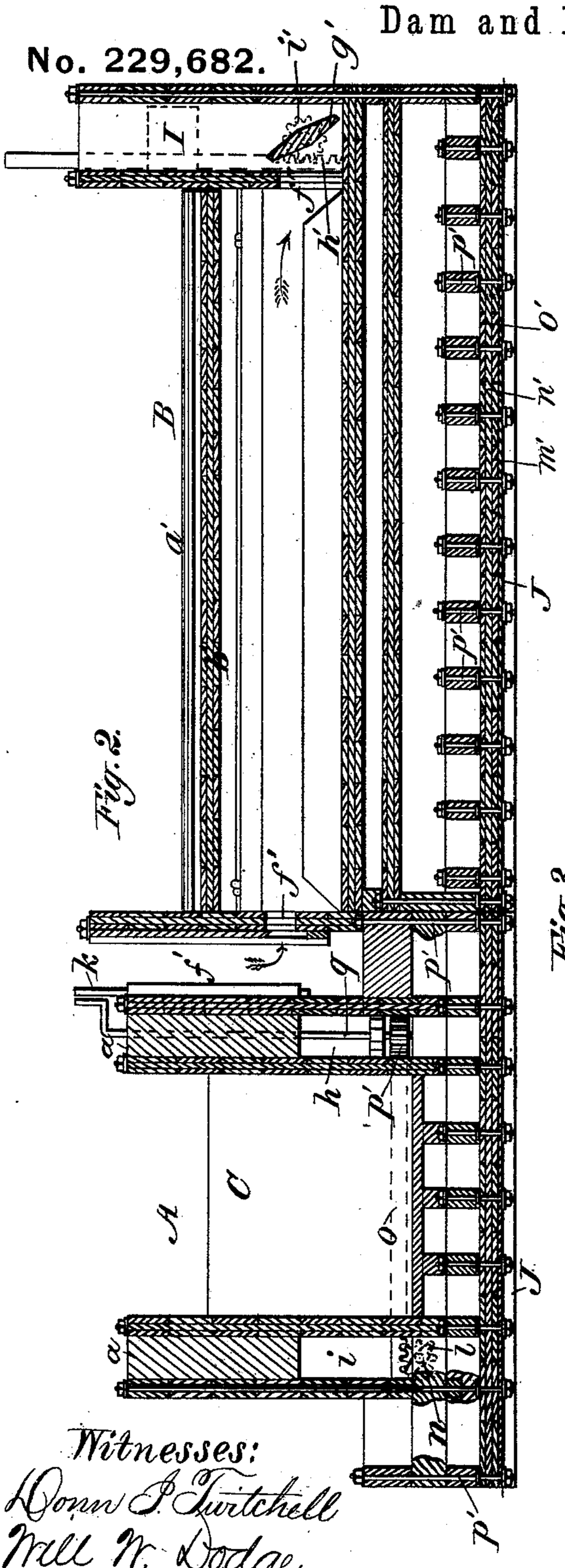

Fig. 2.

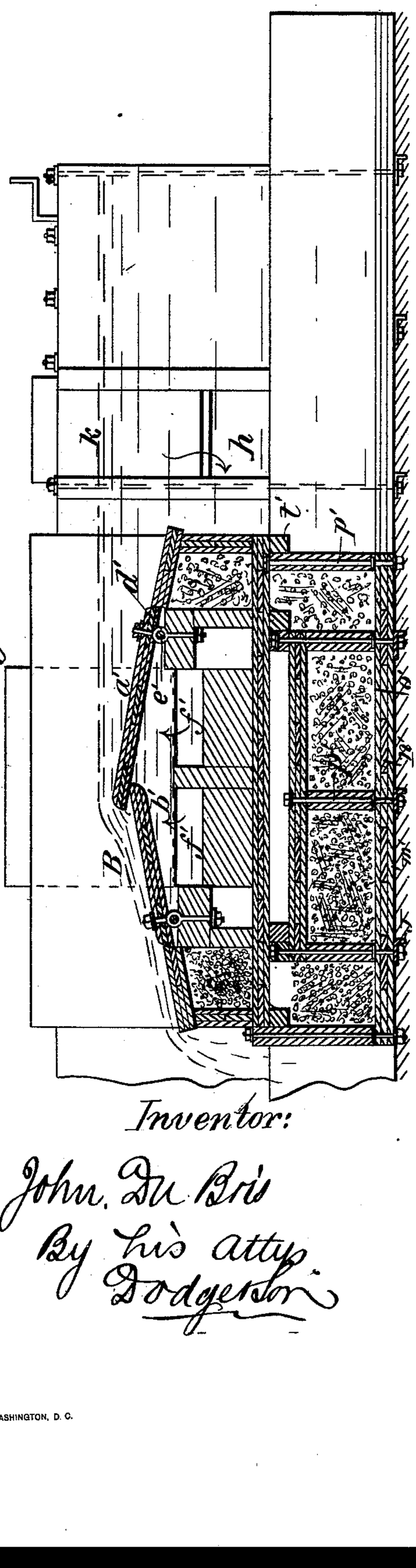

Fig. 3.

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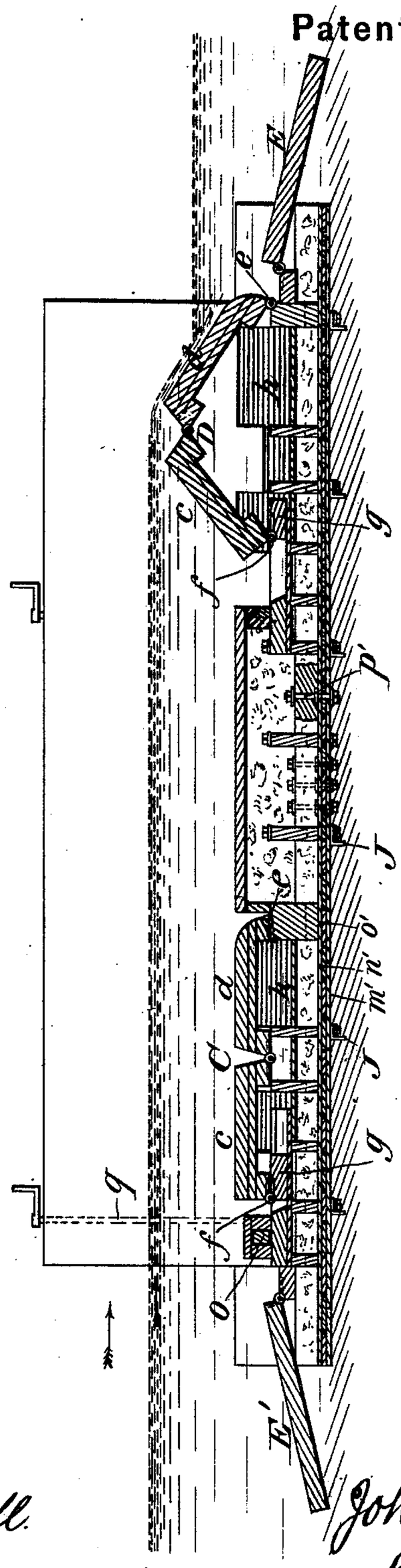

Fig. 4.

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Dam and Lock.

No. 229,682. **Patented July 6, 1880.**

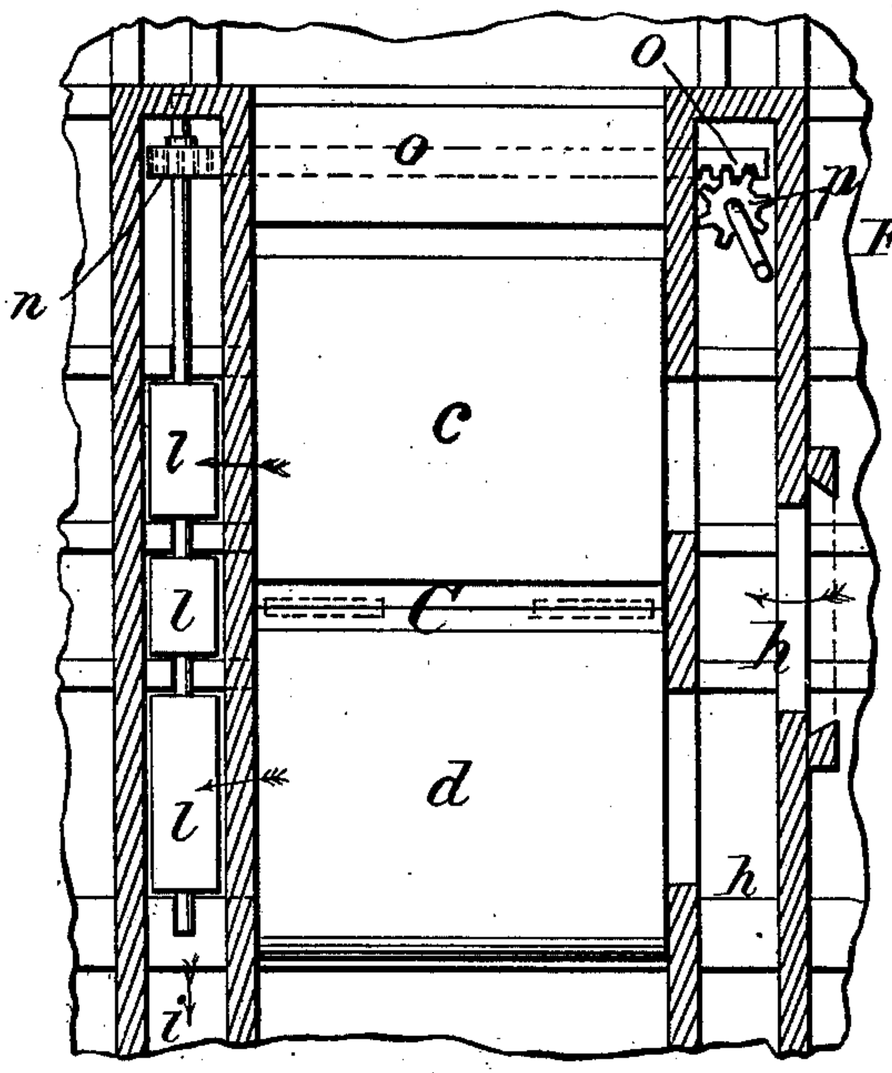


Fig. 5.

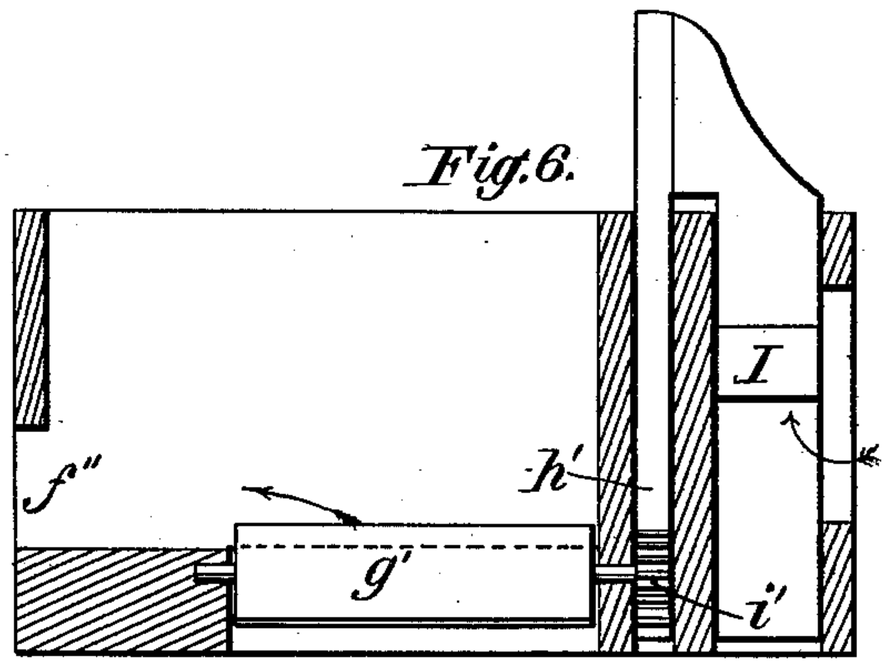


Fig. 6.

Fig. 7.

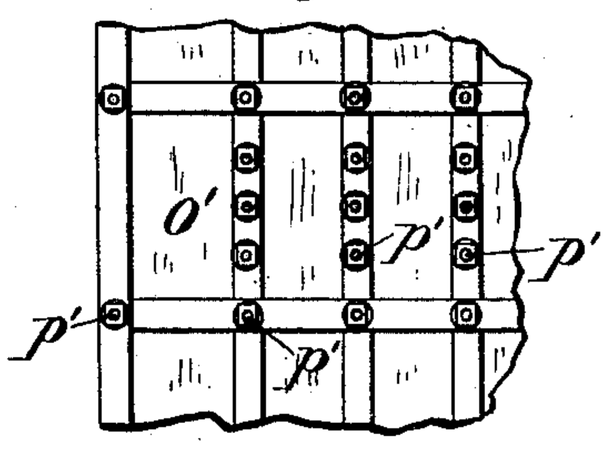


Fig. 8.

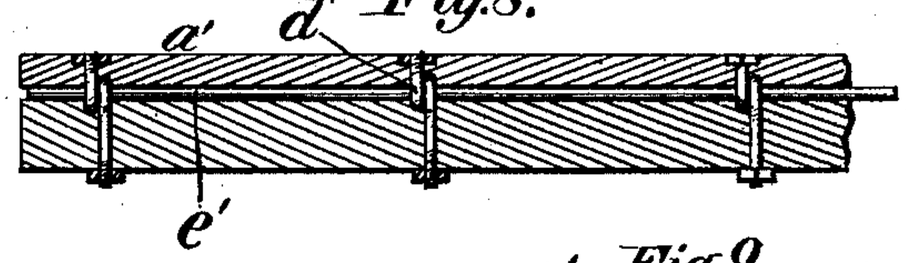
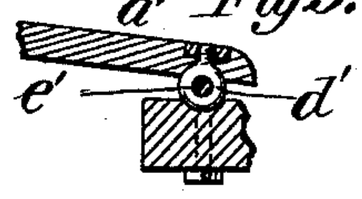


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOHN DU BOIS, OF WILLIAMSPORT, PENNSYLVANIA.

DAM AND LOCK.

SPECIFICATION forming part of Letters Patent No. 229,682, dated July 6, 1880.

Application filed February 10, 1879.

To all whom it may concern:

Be it known that I, JOHN DU BOIS, of Williamsport, in the county of Lycoming and State of Pennsylvania, have invented certain Improvements in Dams and Locks, of which the following is a specification.

My invention relates to a dam and lock designed more particularly for the purposes of slack-water navigation, to retain the water in large streams in order to render them navigable in the dry season, when, under the natural conditions, there would be a scarcity of water.

The objects of the invention are to cheapen and expedite the operation of building and placing the dam and lock, to prevent the danger of the water washing out the bottom beneath the dam, to avoid interference with navigation while building the dam and lock, to avoid the necessity of locking up or down to a height greater than the deficiency in the height of the water, and to render the dam automatically variable in height to correspond with the height of the river.

My dam and lock are built and completed, or nearly so, on shore, and after being floated to their places in the stream are sunk into position, and before or after being sunk they are filled at the base with gravel or stone to secure them in place and give them solidity.

The dam and lock are both constructed mainly of timber, in the peculiar manner hereinafter described, forming part of my invention, and on the under side are provided with transverse projecting angle-irons, which seat themselves in the bottom and serve the double purpose of holding the bodies in place and of preventing the passage of water thereunder.

The main gates of the lock and of the dam consist each of two wings or leaves jointed together and arranged to rise at the middle under the pressure of the water which is admitted beneath them for the purpose. The peculiar construction of the gates and dam in this respect and the application of an automatic float to govern the height of the dam according to the height of the stream are important features of the invention. Another feature consists in constructing the base and the body of the dam in separate parts, the first to be adapted to fit the bottom and placed in position prior to the dam proper, which is floated into position and sunk thereon.

Figure 1 represents a top-plan view of my dam and lock, which are intended to be used jointly, and which are in many details identical in construction. Fig. 2 represents a vertical section on the line *x x* transversely across the lock and lengthwise through the dam; Fig. 3, a transverse section of the dam on the line *y y*; Fig. 4, a longitudinal section of the lock on the line *z z*; Fig. 5, a plan view of one end of the lock on an enlarged scale, with portions broken away in order to show the arrangement of flumes and gates; Fig. 6, a transverse section of the dam, showing the manner in which the float is arranged to operate the gate; Fig. 7, a plan view on an enlarged scale, showing the manner in which the bases of the lock and dam are constructed; Figs. 8 and 9, respectively, a longitudinal and a transverse section through the hinge of the dam.

In order that the nature of the invention may be more readily understood, I will first describe the general construction and mode of operation of both the dam and the lock, and afterward the details of construction or manner of building them, and also the manner of placing them in position.

A represents the lock, and B the dam, which latter extends entirely across the stream except at the point occupied by the lock. The lock consists, in the main, of two parallel side walls, *a*, built upon a base or foundation, and of two transverse rising and falling end gates, C and D. Each gate is divided across the middle into two leaves or flat sections, *c* and *d*, which are hinged together in such manner that their joined edges may be raised to any desired height or depressed until the gate assumes a flat position on the base or bottom, so that the entire body of water passes above it. The two positions of the gate are shown in Fig. 4, in which the gate C is shown depressed and the gate D elevated.

The lower or downstream end of each gate is attached by a hinge, *e*, to the base or bottom, and the upper end connected by a hinge, *f*, to a series of horizontally-sliding blocks, *g*, working either in grooves or upon guides in the base, the sliding connection being neces-

sary in order to permit the elevation of the gate at the middle.

The elevation of the gates is effected by admitting and confining water beneath them, and the degree of elevation is controlled and limited by regulating the admission and discharge of the water, or by permitting the free admission of the water and regulating the rate of discharge.

The upper gate, C, may be made buoyant, so as to float in the water, or weighted so as to sink. In the former case the gate will readily rise while the lock is filled with water, upon the admission of water beneath it, and can only be depressed by permitting the water to escape from beneath it and applying a downward pressure through mechanical means. The latter arrangement will constitute the subject of a separate patent.

If the gate C be constructed to sink in water, it can be raised when the lock is filled by hydraulic pressure or lifting mechanism applied in a suitable manner. One simple manner of securing the elevation of the gate, supposing the level of the water above the lock to be higher than the lower gate, is to close the upper gate, E′, and thus give to the water entering beneath gate C a head higher than the water-level in the lock. When this is done suitable means will be provided for actuating gate E′.

In order to secure the admission of the water beneath the two gates the lock is provided with a long flume, *h*, communicating with the stream above the lock and extending inward beneath both gates, as shown in dotted lines in Fig. 1 and in Figs. 2 and 4 The escape of the water from beneath the gates takes place through a flume, *i*, which discharges at the lower end of the lock, and which opens beneath both gates on the opposite side from that on which the water is admitted, the inlet-flume *h* being on one side of the lock and the outlet-flume *i* on the other, so that the water passes transversely under the gates, as indicated by the arrows.

In order to control or shut off the admission of water beneath the gates, small cut-off gates *k* are arranged in the positions shown in the drawings. These gates may be constructed and operated in any suitable manner.

For the purpose of controlling the escape of the water from beneath the gates C D, which is ordinarily the means employed to control their elevation, small gates *l* are located in the discharge-flume at or near the ends of the main gate, as shown in Figs. 1, 2, and 5. When the gates *l* are opened the water will flow freely under the main gates and out through the discharge-flume, allowing the main gates to fall; but as the small gates *l* are closed the water confined under a head and pressure beneath the main gates will force them upward to a height corresponding to the extent to which the small gates are closed, not exceeding the height of the water above the lock.

The small flume-gates *k l* may be of any ordinary or suitable construction; but it is preferred to pivot them at or near the middle, as indicated in Fig. 5, in order to have the pressure balanced on the two sides, or substantially so, so that they may be operated easily.

Means for operating both the inlet and the outlet gates, which are located on opposite sides of the lock, will be arranged on one and the same side of the lock, in order that the attendant need not cross the same. Fig. 5 illustrates a simple arrangement for operating from one side of a lock a gate located on the other side, consisting of a pinion, *n*, attached to the journal of the gate and engaging with a rack-bar, *o*, which extends across the bottom of the lock and engages at the opposite end with a pinion, *p*, on the lower end of a vertical shaft, which has its upper end provided with a crank or hand wheel by which to turn it.

It will, of course, be understood that the flumes and flume-gates are so arranged as to admit of the main gates being operated alternately and independently of each other.

For the purpose of closing the end of the lock when for any purpose it is to be pumped out, and while it is being floated to its place in the stream, I hinge to the ends of the lock large gates E E′, which may be turned down upon the bed of the stream out of the way, as shown in Figs. 1 and 4, or turned up against and across the ends of the lock. The upper gate, E, also serves to assist in controlling the action of gate C under certain conditions stated elsewhere herein.

Passing next to the dam, which is adjustable in height, it will be seen, on reference to Figs. 1 and 3, to consist of two longitudinal leaves, *a′* and *b′*, arranged to rise and fall at their adjoining edges, which form the comb of the dam, in substantially the same manner as the main gates of the lock, and indeed the construction may be identical in the two cases. It is preferred, however, in the dam to hinge the outer ends or edges of both leaves or sections, and to have them overlap and slide upon each other at the middle, as represented in Fig. 3, the upper or upstream section extending over the other in order that the pressure of the water upon it may produce and maintain a close contact between them. This construction, which is somewhat cheaper than that represented in the lock, is also advantageous in that it is free from liability to be disabled by the accumulation of sediment, &c., at the upper end. The construction may also be adopted for the lock-gates, if desired.

When the edges of the sections slide upon each other, as shown, chains, rings sliding upon rods, or other devices may be employed to prevent them from separating. It is necessary that the hinges of the dam-sections, and also the hinges of the lock-gates, shall be very strong, and also that they shall produce a tight joint between the sections and the bases to which they are attached, and I therefore construct the hinges as represented in Figs. 3, 8, and 9 by providing the base and the sec-

tion each with a series of eyebolts, d', and passing a continuous rod, e', through said bolts, between the section and the base, and then tightening the bolts and drawing them into the wood until the rod bears both above and below. The rod thus arranged serves to unite the parts firmly, and also to produce a tight joint, which is not affected by the rise and fall of the sections.

For the purpose of securing the elevation and depression of the dam a flume, f', is arranged to conduct water beneath it from the higher elevation of the stream above, and a flume, f'', arranged to conduct the water from beneath the gate into the stream below.

A small gate or valve, g', located in the flume f'', serves to control the escape of the water from beneath the dam-sections, and thereby controls the height of the dam, in the same manner that the height of the lock-gate is controlled.

In order to control the valve or gate g' and the height of the dam automatically, I make use of a float, I, as shown in Figs. 1 and 6, mounted in the stream above the dam and provided with a rack-bar, h', moving upon a pinion, i', on the gate-shaft. The rise and fall of the water causes the float to rise and fall accordingly, and the float, in turn, opens and closes the gate, so as to render the escape of water from under the dam-sections proportionate to the height of water in the stream.

While it is preferred to connect and arrange the float and gate g' in the manner shown, it is obvious that any other connection and arrangement may be adopted, provided the same results are attained, the essential feature of the invention in this regard consisting in the application of a float to control the passage of the water beneath the gate-sections. By properly adjusting the float the falling of the water will cause it to partially or wholly close the gate g', and thereby cause the dam to rise until the water reaches the desired height, and when the stream rises above the desired level the float opens the gate g' and causes the dam to fall until the level of the water is down to the desired point, thereby leaving the stream open to navigation, in the same manner as if no dam existed.

Having described the general construction and mode of action of the dam and lock, I will now describe the manner in which they are built up, the mode of construction being essentially alike in the two.

A site is first selected on the shore suitable for the building and launching of the dam and lock, and ways or slides provided upon which to build them. On the ways for the lock I place a series of transverse angle-irons, J, of an L shape, as shown in Fig. 4, the irons being placed with one edge extending downward in such position as to extend crosswise of the lock when it is completed. Upon and across these angle-irons I place a close flooring of heavy plank, m', upon which I place a second flooring of transverse boards, n', which is, in turn, covered with a third flooring, o', extending transversely across the same, as shown in Figs. 2 and 4. The floors are all dressed to an exact thickness and nailed down firmly and closely. After the laying of the floor is completed I insert through the floor-boards and through the angle-irons a large number of vertical bolts, p', each having a nut and washer on the lower end, below the floor-irons, and a collar or flange above the floor and resting firmly thereon, as shown, so that the flooring is drawn firmly together and the angle-iron clamped against the floor between the collar and nut, so as to produce a water-tight joint. The bolts are extended upward above their collars a greater or less distance, each one having a height equal to that to which the superstructure is to be carried at that particular point. Upon the triple flooring thus nailed down I commence a crib-work, consisting of longitudinal and transverse timbers arranged at short distances apart and preferably let into each other, as shown in Fig. 2. Around the outside the crib-work or the outside timbers are carried up to a height of about six feet, or high enough to extend above the surface of the water when the floor is seated upon the bed or bottom of the river. This outside wall and the bottom are made tight, in order to exclude the water and admit of the entire lock being floated into the stream.

In applying the timbers they are bored with suitable holes and driven down upon the vertical bolts, and after they have all been applied nuts are screwed down upon the upper ends of the bolts, so as to force the timbers tightly together and render the whole structure strong and solid.

The side walls, a, are built upon and integral with the crib-work of timbers, and made solid except at the base, where they contain the flues, and are carried upward to such height as to extend above the water when the lock is sunk into position, and the bolts, which are located at suitable points, are extended up through the walls, and to a height equal to that of the walls when completed. This arrangement contemplates the idea of building the walls in the first instance to such height only as to extend above the water, and subsequently building them up of masonry to the required height, the masonry to be laid directly upon the wooden walls; but, if preferred, the walls may be built to their full height of timber in the first instance.

The bolts extending up through the walls are, like the others, provided on the upper ends with washers and nuts to secure the whole mass together. The cross-timbers or crib-work divide the base of the structure into a series of cells or compartments, and before placing the structure I fill as many of these cells with gravel or stone as can be done without sinking the structure.

The timbers which form the walls may be laid together in any suitable manner which

will give strength and rigidity, cross-pieces and cross-bolts being used, as required, to hold the pieces together.

At suitable periods in the course of construction the flumes are constructed, the gates applied, and the minor details provided, the entire structure being completed and ready for use, as regards all portions to be submerged, before it leaves the stocks or ways.

In the construction of the dam precisely the same steps are taken as in the construction of the base of the lock, the angle-irons, flooring, and crib-work being built up and bolted together, and finally the dam-sections hinged upon the top and the minor parts applied. The cells or compartments in the bottom, like those of the lock, are filled with gravel, and the angle-irons, like those of the lock, extend crosswise of the stream when the dam is in place.

When the two structures are completed I select a site in the deeper portion of the stream and prepare a foundation first for the lock by leveling the bottom, either by filling in or excavating, or both, as occasion may require. The lock is then launched and floated over the site and water admitted to cause it to sink to its place on the bottom. This being done, when the water in the stream is low there is little current to be contended with, and as the whole bed of the stream is left open at the sides there is no hinderance or impediment to navigation.

After setting the lock, the dam made complete, or in as many sections as circumstances may require, is launched and scuttled in the same manner.

As the structures settle to their places the angle-irons or mud-sills are forced down into the bed, and serve the double purpose of offering an immense resistance to any movement of the structures and of preventing the leakage of the water under them, as the water will not work downward under and upward behind the irons.

It is well known that the undermining of dams commences in and is due to the slow percolation of water through or under them, and that if this is prevented all danger is avoided; and hence the great value of the iron strips or sills arranged to seat themselves in the bottom. It is manifest that the particular form, arrangement, and manner of securing the irons are matters of secondary importance, and that they may be modified provided they are arranged to extend downward and seat themselves in the bed of the stream.

When the bed of the stream is very rough or irregular operations may be facilitated by making the base of the dam separate from the top, adapting it to fit the bottom, and sinking it in place before applying the superstructure, to which the gates will be attached, as shown in Fig. 3. The superstructure will in such case be provided with transverse flanges or beams, t', to engage with the base and hold it from shifting thereon, as represented.

I am aware that it has been proposed to construct the base or foundation of a lock and the footings of the side walls of timber, and float the same over the spot at which it is to be located, and subsequently build the walls thereon either by anchoring the foundation and permitting it to float during the operation, or by sustaining it temporarily in the water. My method of procedure differs therefrom in that I build the walls in the first instance, and before launching the structure, to a height greater than the depth of the water, so that the structure, after reaching its destination, may be sunk at once to its place, and that when so sunk its walls will stand above water, so that no masonry or other work need be done beneath the water.

My plan is advantageous in that it avoids the expense, trouble, and danger incident to the floating of the structure while its walls are being completed.

I am also aware that floats have been used to operate directly a waste-gate beneath which water escaped, and I am also aware that canal-locks built in place have been made of transversely-corrugated iron plates seated in a concrete bed, and this I do not claim.

I do not claim to be the first to construct a foundation-structure upon land and float the same to its place beneath the water, and then build a superstructure in the water thereon; nor do I claim to be the first to anchor and sustain a foundation such as above described in the stream above its final location, and then complete a superstructure thereon during or before the sinking of it to place. My method of construction permits the building operation to be completed on shore to such point that the structure can be floated to its place and sunk immediately, and that when sunk it will extend above the water. This method greatly cheapens the cost of construction, permits the parts to be adjusted accurately and united permanently and firmly, and enables the constructor to place the lock safely in position in rapid and turbulent streams, in which it could not otherwise be seated except at great cost.

Having thus described my invention, what I claim is—

1. The herein-described method of constructing river-locks without working below water, consisting in building upon land a floatable wooden structure embracing a bottom, main gates, flumes and flume-gates, side walls of a height greater than the depth of the water where the structure is to be located, and means, substantially such as described, for temporarily excluding the water, and then launching the structure and floating it over the position selected for it, and finally sinking it directly to its place.

2. A floatable lock constructed of timber, as described and shown, with cells to receive stone or ballast and with elevated walls and end gates, whereby it is adapted to float to its place when completed to a height greater than the depth of the water in which it is to be used, and loaded with the ballast.

3. A floatable dam or lock provided with thin vertical angle-irons or mud-sills extending transversely across the under side, as shown and described.

4. A floatable dam or lock having at its bottom transverse depending sharp-edged irons or ribs adapted to cut their own way into and take a firm hold in the bed of the stream.

5. The combination of a jointed or flexible dam or lock gate adapted to rise and fall beneath the water, a chamber or passage beneath the gate to admit water for elevating the same, a secondary gate connecting with said chamber and controlling the escape of water therefrom below the gate, and a float located above the dam and arranged to operate the second gate.

6. In combination with a jointed dam, B, and the water-passage thereunder, the pivoted gate *g'*, having pinion *i'*, and the float located above the dam and provided with the rack-bar acting upon the pinion.

7. In a hinged dam or water-gate, a water-tight hinge consisting of a series of eyebolts applied to the surfaces to be connected and a continuous rod, *d*, inserted through the eyebolts and seated against both of the surfaces, as described and shown, whereby the rod is caused to serve the double purpose of a hinge-pin and a packing.

8. The floatable lock provided with the internal gates, C D, and with the end gates, E, hinged thereto and arranged to turn down in the bed of the stream when not required for use.

9. The floatable lock consisting of the foundation and side walls, constructed of timber and provided with the water-channels, the two flexible gates, and the two end gates.

10. In a lock, the combination of the lower lock-gate, the upper jointed gate, and the end gate, E, located above the upper lock-gate, as shown.

11. The combination of a base or foundation, such as described and shown, and a floatable dam or lock constructed for application thereto.

12. In a base or foundation for dams and locks, the combination of the flooring, the timbers thereon, and the bolts having collars between the floor and the timbers, as shown.

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