No. 735,387. PATENTED AUG. 4, 1903.

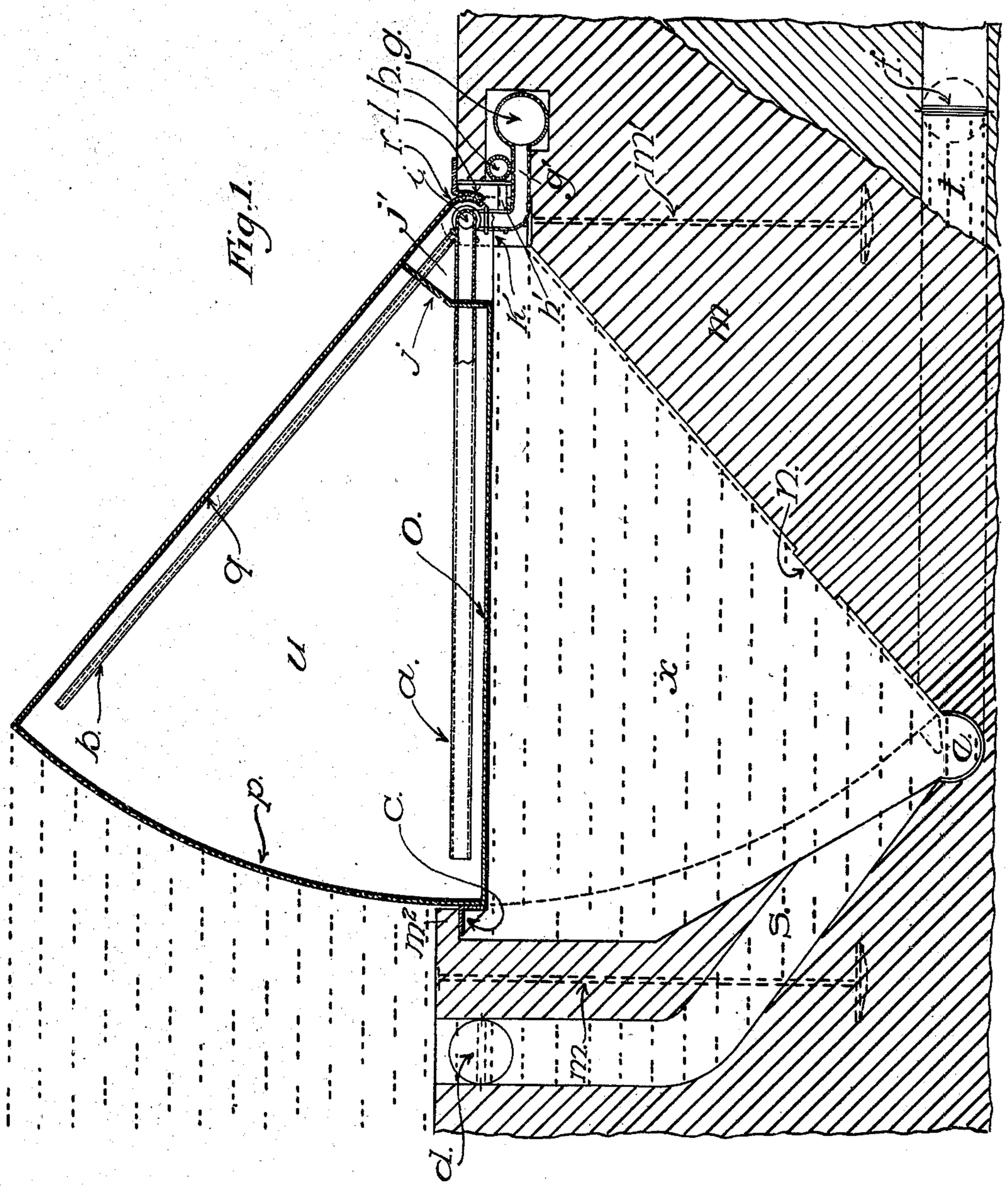
S. C. IRWIN & A. M. BOWMAN.

MOVABLE DAM.

APPLICATION FILED SEPT. 29, 1896.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:
G. J. Goldship
T. A. Connelly

INVENTORS
Samuel C. Irwin,
Arthur M. Bowman.
BY
Bakewell & Bakewell
ATTORNEYS.

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.

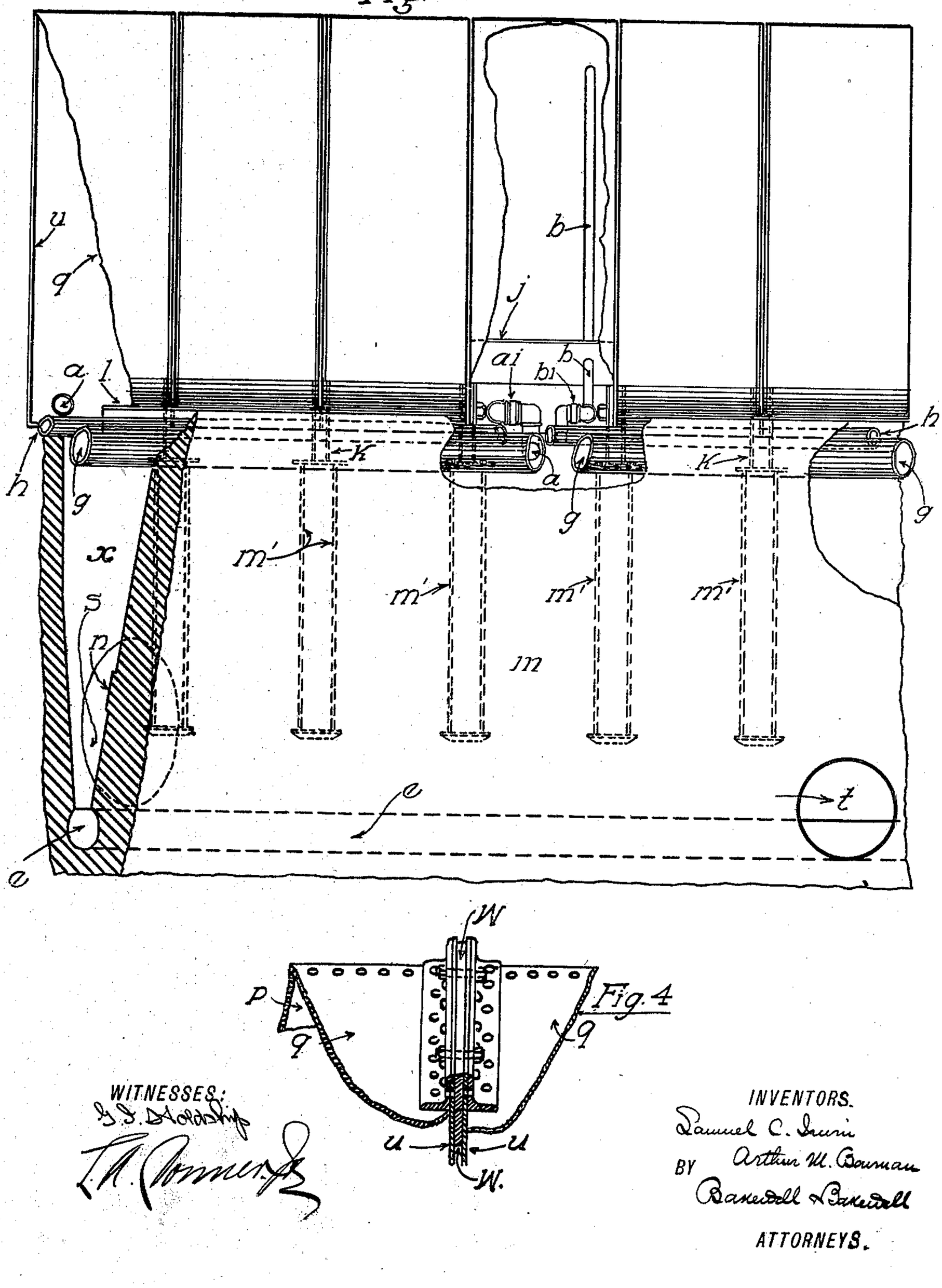

Fig. 4

WITNESSES:

J. J. Golding

T. A. Connelly

INVENTORS.

Samuel C. Irwin

Arthur M. Bowman

BY Bakewell & Bakewell

ATTORNEYS.

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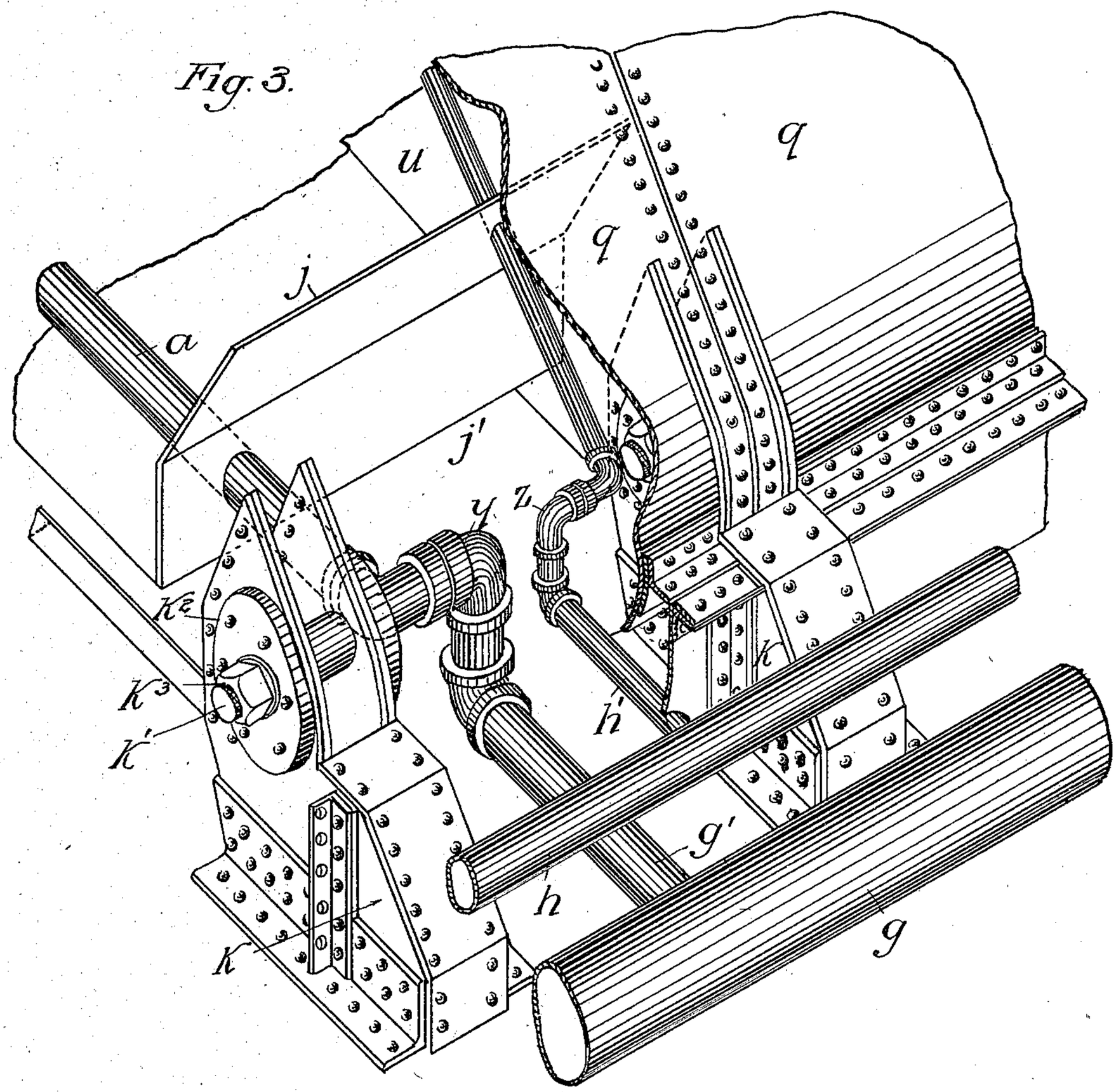
APPLICATION FILED SEPT. 29, 1896.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:
G. F. Goldship
F. A. Somers

INVENTORS.
Samuel C. Irwin
BY Arthur M. Bowman
Bakewell & Bakewell
ATTORNEYS.

No. 735,387. Patented August 4, 1903.

UNITED STATES PATENT OFFICE.

SAMUEL C. IRWIN AND ARTHUR M. BOWMAN, OF BELLEVUE, PENNSYLVANIA.

MOVABLE DAM.

SPECIFICATION forming part of Letters Patent No. 735,387, dated August 4, 1903.

Application filed September 29, 1896. Serial No. 607,360. (No model.)

To all whom it may concern:

Be it known that we, SAMUEL C. IRWIN and ARTHUR M. BOWMAN, of Bellevue, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Movable Dams, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical cross-section of one of the divisions of our improved dam. Fig. 2 is a longitudinal vertical view of a section of the dam, being partly in section. Fig. 3 is an enlarged detail showing the arrangement of the air and water pipes and their connection with the interior of the dam, and Fig. 4 is a detail of the connections between the dam-sections.

Like symbols of reference denote like parts in each.

Our dam is designed to be used for creating slack water in navigable streams, to be used in the place of lock-gates, sluice-gates, or bear-trap dams in sluices, chutes, or waterways of any description, and is capable of being raised more or less and lowered at pleasure.

There are various practical difficulties in the use of movable dams or vertically-movable lock-gates chiefly arising from the means necessarily employed for raising and lowering them, from the tendency to sagging when the gates are of any considerable length across stream, and from the difficulty of operating and controlling them when made in several sections or divisions. All of these obstacles to the practically successful operation of movable dams, besides other minor difficulties not mentioned, are obviated by the use of our invention, in which the sections are operated from the shore and are raised and lowered automatically.

Our improved dam consists, substantially, of a chamber or where the width of the stream renders it desirable of several chambers placed end to end across a stream or waterway. These chambers are (as that term implies) hollow and are substantially air and water tight, being supplied with means for the admission and exhaustion of air and water. They are made in the shape in cross-section substantially that of the sector of a circle, the radii of which form the top and bottom and the periphery the upper face of the dam, the sides or ends being closed by vertical triangular plates. Each such chamber or dam section is pivoted at each end at the central or meeting-point of the radii to shoes attached to a wall or crib in the lower pool extending across the stream, near to which point and just below the heel of the dam are located the air and water conduits. The axial point of the dam-sections is thus located at the upper edge of the wall just mentioned, which may be of stone, cribwork, or a concrete foundation, forming the lower wall of the pit, which extends under the dam and into which the dam descends when lowered. The dam sections or chambers when lowered are filled wholly or partially with water and are raised by first exhausting the water wholly or in part from the interior of the dam-sections and then admitting water from the upper pool into the pit under the dam, as hereinafter more fully described, it being an important feature of our invention that the operations of raising and lowering the dam-sections are performed automatically and from the shore, not requiring, as is the case with movable dams as ordinarily constructed, the raising of each section by power applied externally to the sections and to each section separately, which is always difficult and generally attended with more or less danger to the operators, and, further, that the dam-sections can be all raised simultaneously, the same power being applied at the same time to each.

Having thus given a general statement of the construction and operation of our movable dam, we will proceed to describe it in detail.

In the drawings, Fig. 1, a single sector or dam-section is shown composed of a radial top plate *q* and a radial bottom plate *o* and an arc-plate *p*, all of which may be made of sheets or plates of iron or steel of any desired thickness. These plates are supported internally by a framework of structural iron or steel joined together in the well-known mode of constructing framework of metal, which need not be here more particularly described, especially as our dam-sections may, if pre-

ferred, be constructed of timber and plank, although a structure of iron or steel is much preferable. The dam-section is closed by triangular vertical side plates *u*, one at each end, and also by a plate *j* near the heel of the dam, which incloses the chambers or sections at that point, leaving an open space *j'* near the heel of the dam for the joints or hinges of the dam-sections and for the swivel-jointed portions of the air and water pipes, as is clearly shown in perspective in Fig. 3. Between each pair of dam-sections is a shoe *k*, which is securely fastened to and held in place on the cribwork or lower foundation-wall *m* of the dam by anchor-bolts *m'*, as shown in Figs. 1 and 2. A center pin *k'* passes through the two arms of the shoe *k* and side plates *u* of the chamber at the open space near the heel of the dam, the plate *j* preventing the water which may find its way around the center pin from entering the dam-chamber. Both of the side plates are reinforced around the center pins *k'* by bearing-plates k^2 of suitable thickness to give proper bearing for the pins, as the side plates *u* would be too thin unless thus strengthened. These pins serve as journals for the dam-sections to turn upon, the box or bearing for the pins being supported by the bearing-plates, as just stated. The dam-sections are placed near to each other, so that their sides are as close together as the proper independent working of the sections will permit; but, if preferred, and where the prevention of waste of water by leakage from the upper pool is important packing *w* may be inserted between the outer edges of the top plates *q* of two adjoining sections. This packing may be of any suitable material, such as strips of wood, held in place between the sections by means of bolts inserted through the angle-iron or edge plate of the sections and which bolts may be removed when it is desired to renew the packing. If the packing-strips between two adjacent sections are fastened to both the sections, they will thus be removably connected together at their sides and will therefore necessarily rise and fall uniformly not only, but in case of any defect—as, for example, a stoppage of the circulation in the branch air or water pipe in any section—such section will be compelled to rise and fall with the adjoining sections. The dam-sections may be connected together, as above described, by means of removable bolts without the use of interposed packing.

Outside of the dam-sections and just below their turning-point are located the water-conduit *g* and the air-pipe *h*, which extend entirely across the stream, one end of the water-pipe being closed, while the other end is attached to a pump located on shore for exhausting the dam-sections of water. If it is desired to enable the dam to be operated from either side of the stream, each end of the pipe may be connected with a pump. The air-pipe is open at both ends, which are elevated sufficiently to prevent the entrance of water through it into the dam-sections. It is of course necessary to connect the air and water pipes with the interior of each dam-section. This we effect by means of branch pipes *g* from the water-conduit and *h'* from the air-pipe. These branch pipes *g* and *h'* tap the main air and water pipes in the usual way and extend thence into the open space *j'* before mentioned and thence enter the dam-sections, separable branch air and water pipes being connected with each dam-section. The air-pipe *b* should extend to the upper or highest corner of the chamber, and the water-pipe *a* should extend to the lower corner, as shown in Fig. 1. These pipes have each a swivel-joint on the axial line on which the dam-sections move, as shown at *y* and *z* in Fig. 3, so that the rising and falling of the dam-sections does not interfere with the free passage of air and water.

At the toe of the dam on each section is secured a bracket *c*, which projects from the circumference of the dam-sections, and when they are raised the bracket comes in contact with a projecting ledge m^2 on the upper crib or wall of the dam-foundation and prevents any further rise of the dam-sections, as shown in Fig. 1.

As before stated, the dam-sections are located above a suitably-shaped pit *x* in the bed of the stream and extending the whole length of the dam, formed by the cribwork or concrete foundation of the dam, and being suitably inclosed at both ends is preferably so constructed as just to receive the dam when lowered, leaving a space on the lower part for the admission of water under the lower side of the dam-sections, as shown in Fig. 1, a projection or projections *n* from the wall preventing the lower side of the dam from lying so close to the wall as to prevent the access of water. This pit *x* is connected with the upper and lower pools of the stream—with the upper pool by a conduit *s*, which is furnished with a valve *d* for admitting or shutting off the water of the upper pool into and from the pit *x*, and with the lower pool by the conduit *t*, also furnished with a valve *f*. The connection of these conduits *t* and *s* with the pit *x* is at its lowest point *e*, where there is a depression for the collection of silt and other matter. Similar conduits *t* and *s* should be placed at both ends of the dam, so as to be operated from the shore, and by opening the upper valve *d* at one end and the lower valve *f* at the other end the entire pit may be cleared of silt. When flushing out the pit *x*, the dam-sections should be empty of water—at least sufficiently so as to float them—so that when the inlet at one end and outlet valve or valves at the other end of the dam are both open the sections will not be so low down in the pit as in any way to obstruct the free passage of water and silt therefrom.

We have described our movable dam-sec-

tions as being hinged to the crib or foundation-wall at the lower level of the pool. This is, however, not necessary, as the dam could be operated in like manner if they were pivoted to the crib or foundation-wall at the upstream edge of the pit, the position of the pit *x* being reversed as well as that of the dam itself.

From the foregoing description of the construction of our movable dam the following statement of its operation will be readily understood: Supposing the dam-sections to be lowered into the pit *x* and the chambers of the dam-sections to be full or nearly full of water. In order to raise the dam, the water is drawn from the chamber of each dam-section through the water-main by means of a pump located on shore, air passing through the air-conduit to supply the place of the removed water. After a portion of the water has been removed the dam will begin to rise by flotation, and now the lower-level valve *f* being closed and the upper-level valve *d* opened more or less fully, according to the head of water in the upper level and the rapidity with which it is desired to raise the dam, the head of water in the stream above the dam causes a pressure to be exerted on the under side of the dam section or sections, which will assist their tendency to rise, so that the pump may be stopped and the dam section or sections will be raised until their full height is attained. If, however, only a partial elevation of the dam is desired, its upward movement may be arrested at any point that may be preferred by closing the upper valve and stopping the inflow of water into the pit *x*. In order to lower the dam-sections, all that is necessary is first to refill the chamber with water by opening the valve, admitting water through the pipe which connects the water-main *g* and the dam with the water in the upper pool, and to close the valve *d* and open the discharge-valve *f*, when the dam will sink more or less rapidly, according as the discharge of water from the pit *x* is regulated, until it reaches its normal depressed position in the pit *x*.

There are many advantages of our improved movable dam, some of which have been before referred to; but the chief merit, we think, is in the fact that the raising and lowering of the dam to a greater or less height and with greater or less rapidity, as may be desired, is entirely under the control of the operator in charge, and that these operations can be conducted with no danger to the operators, and that the dam-sections are all raised simultaneously and do not require that each piece or section should be operated upon separately and in detail.

We have described our movable dam as being constructed of several sections, but in case of a short dam it may as readily be made in a single section, the construction and operation being such as before described.

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

1. A movable dam consisting of a plurality of sections arranged end to end, and means for simultaneously displacing a fluid in said sections to raise or lower them together.

2. A movable dam consisting of one or more hollow sectional compartments hinged to a foundation, air and water pipes located adjacent to the hinging-point, branch pipes leading from the air and water pipes into the section or sections, and means for forcing water through the branch pipes into the sections and drawing it therefrom; substantially as described.

3. The combination of a movable dam consisting of one or more hollow chambers, furnished with suitable pipes for the admission and exhaustion of air and water into and from the interior of the section or sections, with a dam-foundation of cribwork or suitable material extending across the waterway to be closed by the dam, said dam-foundation having an inclosed pit to receive the dam when hinged to said crib or foundation, and suitable conduits or sluiceways for the admission of water under the hinged dam, and for the escape of water therefrom, and a pump or suitable device for exhausting the dam section or sections of water; substantially as described.

4. A dam composed of several sections pivoted independently of each other, in combination with means for detachably connecting said sections; substantially as described.

5. A dam consisting of one or more hinged hollow water-tight compartments, a crib or foundation having a pit to receive the same, a valved passage leading from the upper pool into the lower portion of the pit, and a valved passage leading from said portion to the lower pool; substantially as described.

6. A dam consisting of a plurality of hollow water-tight compartments, independently pivoted to a crib or foundation, a water-main extending adjacent to their pivotal points and having branches leading through their axes into the compartments, and means for drawing the water from the compartments; substantially as described.

7. A dam consisting of a plurality of hollow water-tight compartments, hinged independently of each other to a foundation, a water-main and an air-main extending adjacent to their pivotal points, branches leading from said air and water mains into each of the compartments, and means for drawing the water from the compartments through the main; substantially as described.

8. A dam consisting of a plurality of hollow water-tight sections, pivoted independently of each other to a foundation, water and air pipes leading into the sections, means for exhausting the water from the sections through the water-pipes, said foundation having a pit for the sections, and means for admitting water into the lower end of the pit

and exhausting it therefrom; substantially as described.

9. A movable dam consisting of one or more hollow compartments hinged to a foundation, air and water pipes leading into the section or sections, and means for forcing water into the sections and drawing it therefrom to depress or raise the sections.

In testimony whereof we have hereunto set our hands.

SAMUEL C. IRWIN.
ARTHUR M. BOWMAN.

Witnesses:
G. I. HOLDSHIP,
H. M. CORWIN.