July 11, 1933. E. L. BROOME 1,918,015

HYDRAULIC GATE

Filed Feb. 10, 1930 2 Sheets-Sheet 1

Fig. 1

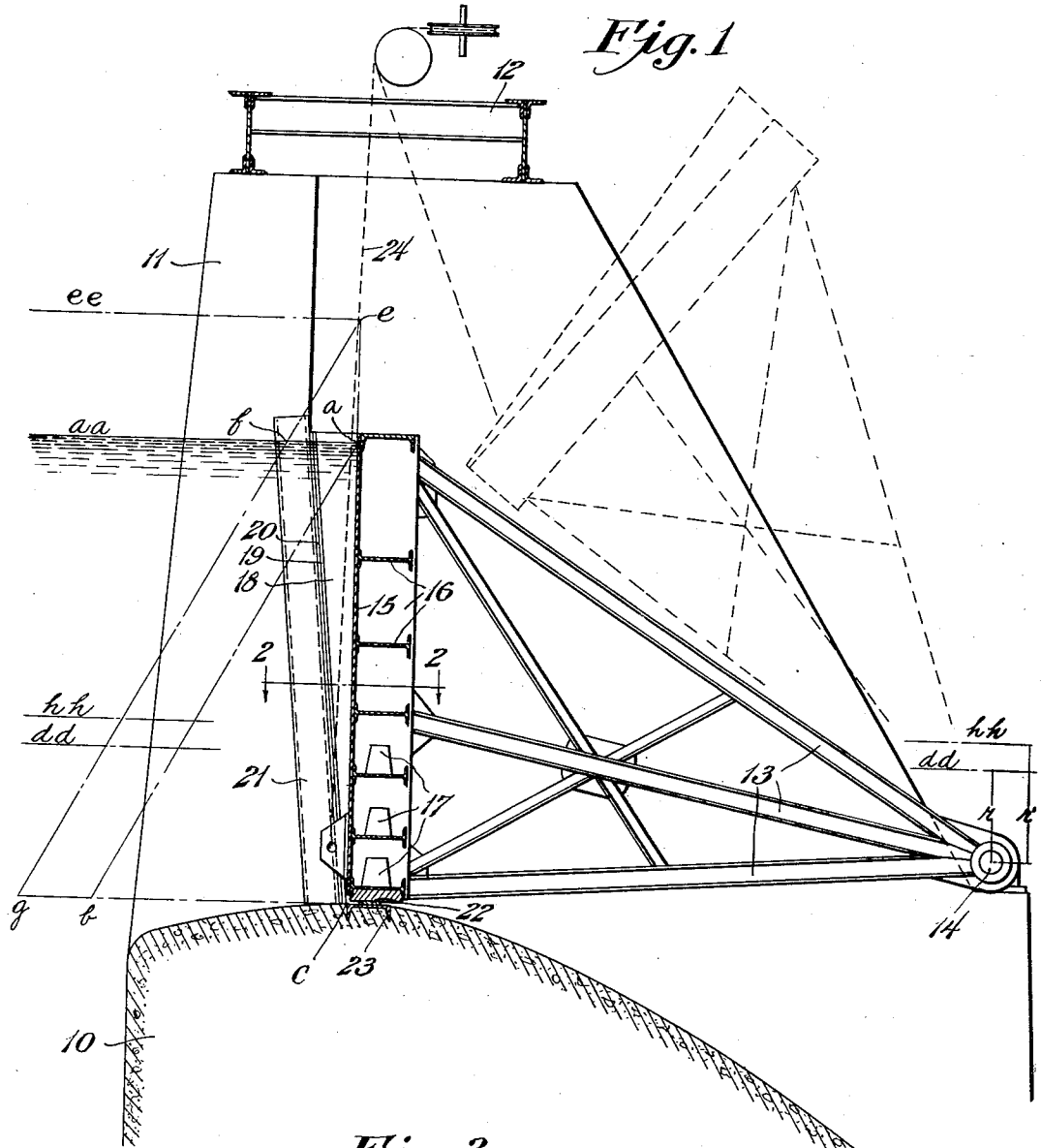
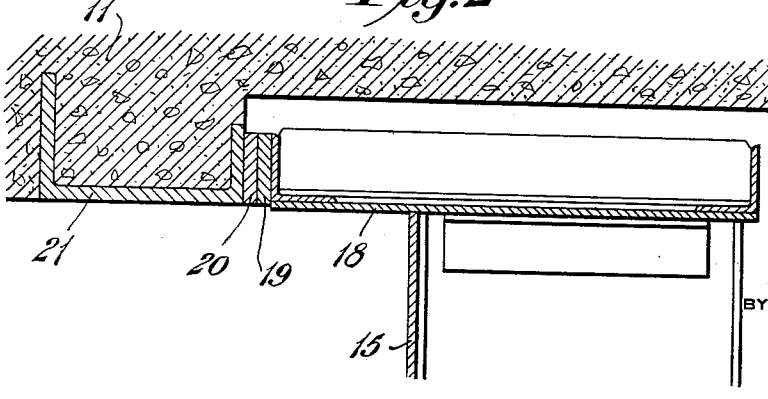


Fig. 2



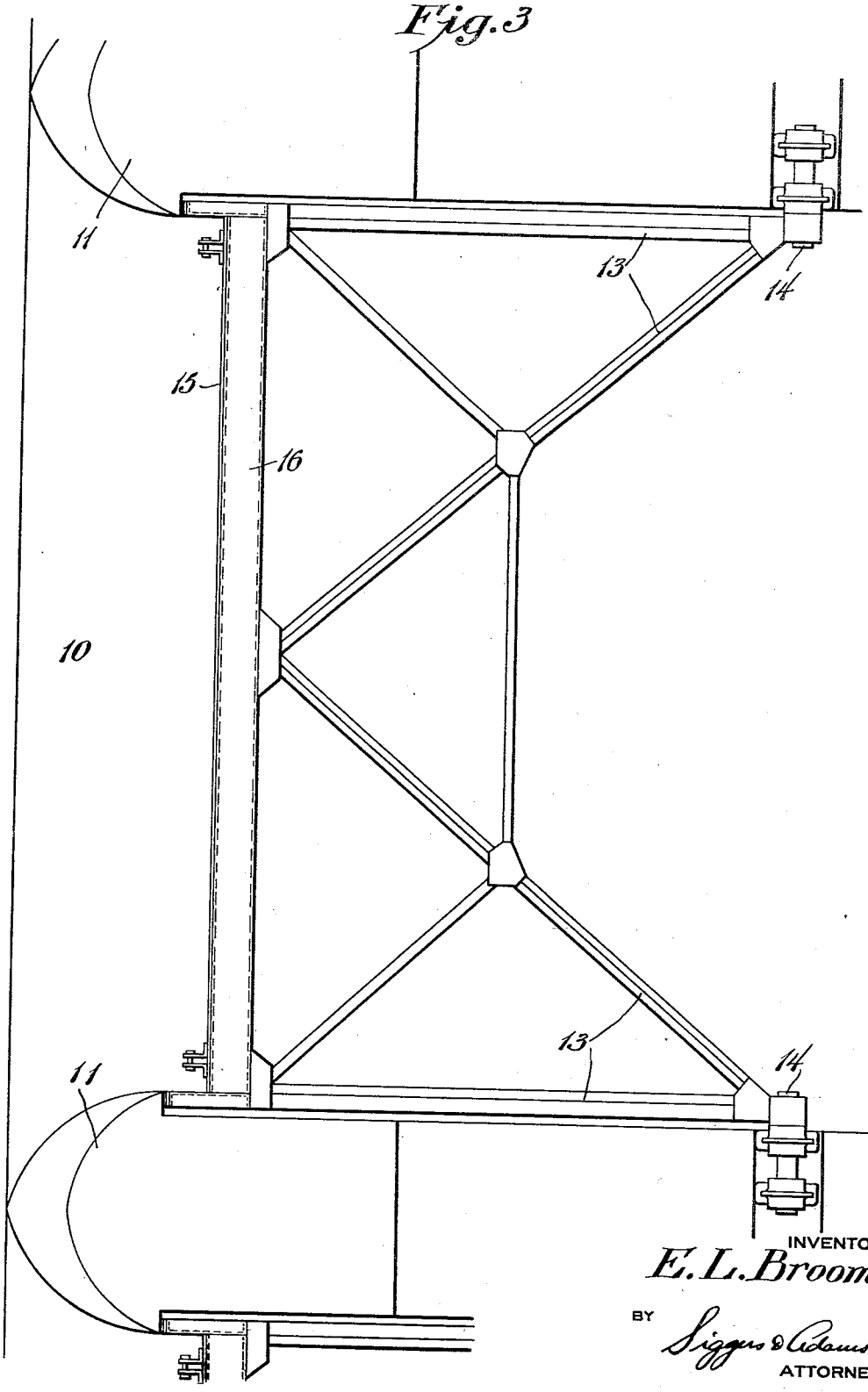
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Fig. 3



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UNITED STATES PATENT OFFICE

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HYDRAULIC GATE

Application filed February 10, 1930. Serial No. 427,346.

This invention relates to sluice gates to control the discharge of water through sluice-ways, flumes and the like such as are common in hydraulic power dams and the like, and among other objects, aims to provide an improved, relatively simple, efficient and inexpensive gate of the radial type constructed and arranged to operate automatically incident to predetermined variations in the water level or hydraulic head and having improved sealing means effectively to prevent leakage when the gate is closed.

In the drawings:

Fig. 1 is a vertical sectional view of a crest gate embodying the invention applied to the spillway of a dam;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1; and

Fig. 3 is a top plan view.

The ordinary radial gates, now in common use, present curved deck plates shaped like the segment of a cylinder supported by radial arms or frames pivoted on the down-stream side of the dam. Such gates are usually raised and lowered by mechanical means and generally have flexible sealing strips at their opposite ends which rub against smooth surfaces on the sides of the spillway. Experience has demonstrated that segmental gates of this type are not only expensive and difficult to build, but the seals are subjected to excessive wear and are not effective because the gates are often shifted laterally in their clearance spaces. This invention, therefore, aims to provide an improved gate installation which is so constructed and arranged as to overcome the foregoing drawbacks and is so mounted that it will open and close automatically.

Referring specifically to the drawings, the improved gate is there shown as being mounted in the spillway of an ordinary concrete or masonry dam 10 on the crest of which there may be any desired number of spillways, each gate in this example being pivotally mounted between vertical columns 11 on the dam which support a bridge 12 of ordinary design.

Herein, the gate is supported on radial or rearwardly converging arms or beams 13 pivoted to shafts 14 on the down-stream side of the dam, and a deck plate 15 presenting a flat surface is suitably reinforced by frame members 16 and secured to the free ends of the arms or beams. The arrangement of the deck plate, with respect to the axis of the gate, whether or not it has one or more flat faces, is such that when the hydraulic pressure against the deck plate exceeds a predetermined amount because of an increase in the hydraulic head the gate will automatically revolve about its pivots, thus permitting the discharge of water below its bottom edge until the water level is lowered and the hydraulic pressure is relieved or pressure due to the thrust of ice is reduced. According to this arrangement, the pivotal axis of the gate lies below a normal plane passing through the center of pressure of the deck plate when the water level is on the line *aa* as shown in Fig. 1. The weight of the gate is such that the weight moment about the pivotal axis exceeds by a predetermined amount the pressure moment tending to open the gate. The weight may be varied by utilizing weights 17 such as metal blocks on the deck frame or by adding counterweights (not shown) to increase the lifting tension on the mechanical hoisting members later to be described.

First, assuming that the water level is at *aa* or near the top of the gate in Fig. 1, the total pressure against the deck plate is graphically represented as being proportional to the area of the triangle *abc* and the total pressure may be considered as being applied in the plane *dd* passing through the center of gravity or area of the triangle. The pressure moment tending to open the gate is, therefore, the total hydraulic pressure multiplied by the distance *r* between the pivotal axis and the plane *dd*; while the slightly superior weight moment is the total weight of the gate multiplied by the horizontal distance between the pivotal axis and the center of gravity of the gate. Now, if the water rises, say to the line *ee*, the hydraulic pressure on the deck plate will then be proportional to the area of the trapezoid *afgc*, whose center of gravity is in the plane *hh* above the plane *dd* and a distance *r'* from the piv-

otal axis of the gate. The increased pressure moment will exceed the weight moment and the gate will open so that water will discharge thereunder until the hydraulic moment is again less than the weight moment.

To provide an effective watertight seal and eliminate friction between the ends of the gate and sides of the spillway or sluice, the opposite ends of the gate are shown as having fabricated end frames 18 presenting upwardly and forwardly inclined flat edges to which straight, flat sealing strips 19 are secured. These strips co-operate with complemental sealing strips 20 conveniently secured to the flange of a channel beam 21 which faces downstream. In all cases, the angle between the plane of the sealing strips and a plane passing through the pivotal axis of the gate and the lower edge of the deck plate must be at least ninety degrees to prevent the gate from binding. In this instance, the angle is greater than ninety degrees to avoid any rubbing contact. It will be further noted that the seals are so arranged that their watertight engagement is not affected by any slight lateral shifting of the gate.

In this example, the lower edge of the deck-supporting frame has a sealing plate 22 which seals against the web of a channel beam 23 having flanges imbedded in the concrete crest of the dam. Thus, the gate is tightly sealed both at the ends and the bottom by means of flat strips or plates. While metal strips may be used alone, obviously, flexible or elastic packing may be interposed between them to compensate for any slight irregularities in the contacting surfaces. While this type of seal is important in connection with the improved automatic gate, here shown, it is also applicable to ordinary radial gates now in common use.

In accordance with the usual practice, the gate is adapted to be opened intentionally by means of hoisting cables 24 connected to ordinary mechanical hoisting mechanism above the bridge 12.

While the preferred form of deck plate is shown as being flat, it is obvious that it may have several flat surfaces at angles to each other. Moreover, the deck may be inclined at an acute angle to the vertical either upstream or downstream.

Obviously, the present invention is not restricted to the particular embodiment thereof herein shown and described. Moreover, it is not indispensable that all the features of the invention be used conjointly, since they may be employed advantageously in various combinations and sub-combinations.

What is claimed is:

1. A hydraulic gate installation comprising, in combination, a substantially flat deck plate; flat sealing members projecting forwardly from the opposite ends of the gate; rearwardly converging arms supporting said deck plate and pivotally mounted to rotate about an axis remote from the down stream side of the deck plate and in a plane below the normal center of hydraulic pressure against the deck plate whereby the gate will automatically swing upwardly and open when the pressure against the deck plate exceeds the weight moment about the pivotal axis.

2. A hydraulic gate of the class described comprising, a substantially vertical deck plate mounted in a spillway flat sealing members on the down-stream side of the spillway and on the up-stream side of the gate; and supporting means for the deck plate pivotally mounted to rotate on an axis remote from the down-stream side thereof and in a plane below the center of hydraulic pressure of the deck plate so that the gate will swing upwardly and open automatically when the pressure against the deck plate exceeds a predetermined amount.

3. A hydraulic gate of the class described comprising a substantially vertical deck plate mounted in a spillway; supporting means for the deck plate pivotally mounted to rotate on an axis remote from the down-stream side thereof and in a plane below the center of hydraulic pressure of the deck plate so that the gate will swing upwardly about said axis and open automatically when the pressure against the deck plate exceeds a predetermined amount; and vertically inclined, coacting sealing means on the gate and the spillway structure so constructed and arranged that contact is broken as the gate is initially rotated so as to avoid frictional or rubbing contact.

4. In a hydraulic gate of the character described, a deck plate pivotally mounted to rotate about an axis remote from the down-stream side thereof and arranged to open and close automatically when the water level varies a predetermined amount; flat sealing members mounted on the upstream side of the gate at the opposite ends; and co-acting metal sealing members on the down-stream spillway structure, said gate being arranged to break the seals upon initial opening movement.

5. A hydraulic gate installation for sluiceways and the like comprising, in combination, a deck plate pivotally mounted to rotate about an axis remote from the down-stream side thereof, said axis being so located with respect to the normal center of hydraulic pressure that the gate is caused to open and close automatically with a predetermined variation in water level; a pair of backwardly inclined abutment members secured to opposite sides of the sluiceway presenting sealing surfaces perpendicular to the sluiceway walls, said members being at an angle greater than 90° to a line through

the pivotal axis of the gate and perpendicular to the deck plate; a pair of wedge-shaped members secured to the front surface of the deck plate at the ends thereof and coactable with said abutment members to form a water-tight seal; and strips of sealing material secured to the co-acting surfaces of said abutment members and said wedge members.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature.

ERNEST L. BROOME.