

greater overturning moment than would be the case with a horizontally framed gate.

Let Fig. 4 represent the wall at the quoin; T , the thrust from a vertically framed gate, and T' the resultant of the thrust from a horizontally framed gate. If there is no water on the downstream side of the gate and if the water surface is level with the upper girder, it is evident that T will be one-third of T' . The lever arm of T above the sill is three times that of T' ; therefore, their overturning moments about the plane of the sill will be equal and there will be no choice between the two types as far as stability of the wall is concerned. About the base of the wall, which is always some distance, a , below the sill, a different result is obtained. With a vertically framed gate, the overturning moment about the base of the wall, if the sill foundation is self-supporting, will be,

$$M = T(h + a) = Th + Ta.$$

For a horizontally framed gate,

$$M = T' \left(\frac{h}{3} + a \right) = Th + 3Ta.$$

The second expression is evidently greater than the first and therefore the advantage, if any, so far as the amount

at Louisville, Ky., the top girder is 6 feet wide. The length of the gate is about 62 feet. The depth of the girders should not in any case be less than about one-tenth of the span; therefore, in this case, the use of vertical framing does not encroach on the wall nor is there any reason why it should do so in any other case. Taking everything into consideration, it may be said that if there is any choice between the two types as to the volume of masonry in the walls, the choice is in favor of the vertical framing.

The volume of masonry required in the sill will probably be greater for a vertically framed gate, because for this type the stability of the gate is entirely dependent on the stability of the sill. The difference in the amount of sill masonry will, however, not be as great as might at first sight appear. Since a horizontally framed gate is so designed as to take horizontal thrust, due to water pressure, throughout its entire height, each horizontal member taking its own share of the thrust, it is clear that the gate would be stable even if the sill were removed. Therefore, if the gate were perfectly fitted, a large amount of masonry would not be required in the sill. In practice, however, it may happen that the gate will come in contact with the sill before the two leaves are mitered throughout

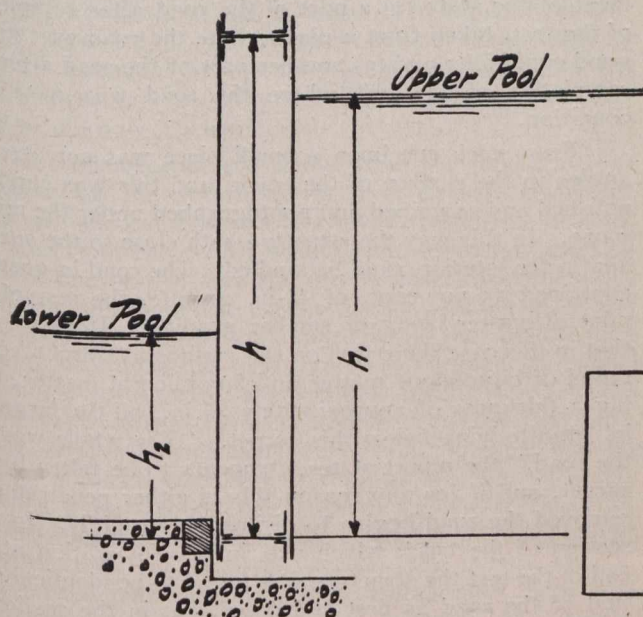


Fig. 3.

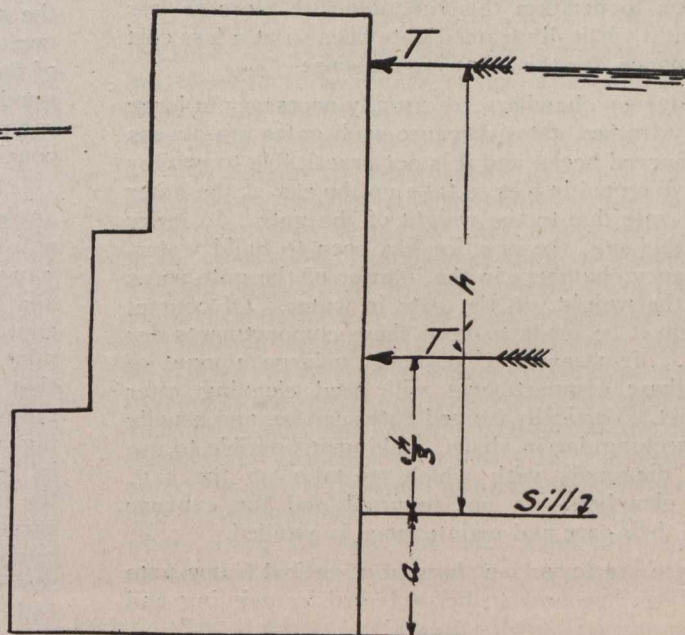


Fig. 4.

of masonry in the wall necessary to resist overturning is concerned, is with the vertically framed gate.

It has also been stated, with reference to the amount of masonry in the lock walls, that the top girder of a vertically framed gate is necessarily very deep on account of its heavy load and will require a deep recess in the wall, and therefore an added amount of masonry on the back of the wall in order not to decrease the top width and the available space for operating the gate. Even if a deeper recess were required, it is not clear why the masonry added to the back of the wall need be any greater in volume than that saved in the recess, but in reality the top girder of a vertically framed gate need not be any wider than the girders of a horizontal girder gate and usually encroaches on the wall much less than the arches of a horizontal arch gate. In the vertically framed upper gate recently designed for the new lock now being built

their entire height, in which case there will be a heavy pressure on the sill and sufficient masonry must be provided to resist it. For either type the masonry in the sill must be sufficient and so disposed as to stop effectively the flow of water from the upper to the lower pools and this consideration may result in as much masonry for one type as for the other.

Metal work is required in the walls and sills for both types of gates. For large horizontally framed gates there is required a metal hollow quoin in the walls, the metal being equal in length to the height of the gate. In vertically framed gates the thrust is concentrated at the top and is only one-third as great; therefore, the metal hollow quoin is very much smaller. On the other hand, more steel is required in the sills for a vertically framed gate on account of the heavier load. These items should about balance each other.