great quantity of air, as is evident in the *Water-blast* described by many authors.

There is another and very serious obstruction to the motion of an overshot or bucketed wheel. When it moves in back-water, it is not only resisted by the water when it moves more slowly than the wheel, which is very frequently the case, but it lifts a great deal in the rising buckets. In some particular states of back-water, the descending bucket fills itself completely with water; and, in other cases, it contains a very considerable quantity, and air of common density; while in some rarer cases it contains less water, with air in a condensed state. In the first case, the rising bucket must come up filled with water, which it cannot drop till its mouth get out of the water. In the second case, part of the water goes out before this; but the air rarefies, and therefore there is still some water dragged or lifted up by the wheel, by suction, as it is usually called. In the last case there is no such back load on the rising side of the wheel, but (which is as detrimental to its performance) the descending side is employed in condensing air; and although this air aids the ascent of the rising side, it does not aid it so much as it impedes the descending side, being (by the form of the bucket) nearer to the vertical line drawn through the axis.

All this may be completely prevented by a few holes made in the start of each bucket. Air being at least 800 times rarer than water, will escape through a hole almost 30 times faster with the same pressure. Very moderate holes will therefore suffice for this purpose: and the small quantity of water which these holes discharge during the descent of the buckets, produces a loss which is altogether insignificant. The water which runs out of one runs into another, so that there is only the loss of one bucket. We have seen a wheel of only 14 feet diameter working in nearly three feet of back-water. It laboured prodigiously, and