The claim is not made that the volume-moisture condition just described bears a direct relation to the many factors involved in concrete making. However, its actual use in this connection has indicated its efficiency as a working tool. We can, I believe, ill afford to cast it aside without a full and careful trial to prove or disprove its value. It is entirely possible that physical factors other than cohesion and adhesion enter into this peculiar volume-moisture condition. In so far as the speaker has a knowledge, its existence has not been previously discovered. However, independent and more recent investigations made by Mr. Young have shown corroborative and unquestionable evidence of its existence.

Since the moisture content in a sand has the rather remarkable effect of increasing its volume by holding the sand particles somewhat rigidly in positions different from those they would readily assume when dry, it seems reasonable to aim to control this "bulking" effect, so far as is possible, in test mixes for concrete.

There is no evidence that the "bulking" effect of the moisture in sands has been given consideration either in written specifications or in field operations incident to mortar and concrete-making. Its consideration will show the fallacy of the commonly used volumetric method in so far as resulting strengths are affected by the moisture contained in the sand aggregate, and will inevitably lead to the opinion that the adoption of methods and appliances whereby the aggregates will be measured by weight rather than by loose volume, will result in a greater uniformity and reliability of the mortars and concretes produced. Important practical considerations render it advisable to continue the present practice of using in concrete mixes a volume of mortar equal to approximately one-half of the gross volume of the stone aggregate.

Proposed Tidal Power Development at Hopewell

Dams and Power-House at Confluence of Petitcodiac and Memramcook Rivers—Initial Installation of 90,000 H.P. Would Cost Approximately $122 per H.P.—Paper Read at Engineering Institute's Fifth Professional Meeting, September 11th, at St. John, N.B.

By W. RUPERT TURNBULL
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FIRST, and in a brief manner, we should review the tidal developments and proposals of the past, so that you will be led, as I have been, to think that the first large tidal development in the world will probably be carried out at Hopewell, N.B., the little village that lies closest to the tidal estuaries, the Petitcodiac and Memramcook, where nature has founded two great natural reservoirs with the exception of the dams that must be built to complete them.

Old charters show that tidal power was used in England, for grinding corn, as early as the 11th century, and tidal mills have been in operation for the same purpose, from that time to the present day. The following extracts are taken from an excellent article by W. C. Horsnaill, that appeared in "The Engineer," London, Eng.:—

"No records exist showing how the earliest tide wheels were arranged, but particulars are available of several mills which were erected in the eighteenth and nineteenth centuries. In the earlier historic mills no attempts were made to produce a fall, the power being obtained from the flow of the water into and out of the pound. To develop power in this way, a wheel similar to the paddlewheels of steamships was used, but with a reversed action; that is to say, the flow of water drove the wheel. This arrangement entailed the raising and lowering of the wheel to suit the rise and fall of the tide, as only the bottom floats could be immersed if the best results were to be obtained.

Layout of Old Mills

"A corn mill at one time existed at East Greenwich which was driven by tidal power in the way we have described. The pound has an area of about 4 acres and the wheel measured 11 ft. in diameter by 26 ft. long. The power was transmitted by a bevel gear at either end of the water-wheel shaft, the pinions being free to slide up and down two square vertical spindles. The water-wheel and bevel gears were mounted upon a frame which was caused to rise and fall to suit the tides, and the power was transmitted by either bevel wheel according to which way the water-wheel was running, the other bevel pinion being thrown out of gear. By these means the machinery in the mill was always driven in one direction, in spite of the reversal of the water-wheel at each turn of the tide.

"The movable frame, with the water-wheel and gear, weighed some 20 tons and the bottom of it was extended to form a kind of shutter, which filled up the opening underneath the wheel race, all the water flowing into or out of the pound being thus compelled to pass through the wheel.

"Another type of wheel was devised to overcome the drawback of having to move up and down with the tide. This wheel was fitted with hinged floats, which arranged themselves across the stream at the bottom of the periphery, while they travelled through the water edgeways during the remainder of each revolution. With floats of this type the wheel was fixed, and the tide gradually rose over it until in some cases complete immersion took place.

This Design Soon Discarded

"An arrangement of the sluices was also adopted to compel the water to pass through the wheel in the same direction, whether flowing in or out of the pound, thus doing away with the need for reversing gear between the water-wheel and the machinery to be driven.

"These wheels must have been very inefficient, as the loss of power caused by the drag of the upper portion when covered was serious, and the design was soon discarded.

"Following these earlier mills came the more recent examples, many of which are still in existence, while a few of them may be seen in operation. The older mills aimed at using the current of water caused by tidal action, and advantage was taken of the flow in either direction. The more modern tide wheel is arranged to operate with a considerable fall, and only develops power when the water is flowing out of the pound.

"The undershot wheel with straight radial floats is usually adopted, and the mill is started at half ebb or a little later, work being continued for about five hours, or until the water rises under the wheel and chokes the tail race. These arrangements give only five hours of working during each tide."

Listing the tidal mills that actually exist: There is a mill at Woodbridge of 10 to 12 h.p. and one at Walton-on-the-Naze of 85 h.p. These are both small powers, working on a low range of tide, and with only a single, small, natural reservoir that allows of only a partial use of the tidal power for a comparatively short period of time, but Mr. Horsnaill shows that if modern turbines were installed at the plant at Walton-on-the-Naze, and the power used to develop electricity instead of grinding corn, it would show up as a commercial development somewhat better than gas power in spite of a heavy outlay for storage batteries, which would be necessary at a plant situated as is Walton.