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For the Week ending June 14, 1884.

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THE BROWN STONE QUARRIES OF CONNECTICUT.

Probably the most extensive quarries of red free stone or "brown stone" in the world are on the Connecticut River at Middletown and at Portland, on opposite sides of the river, fifteen miles below Hartford, the capital of the State. The Portland quarries on the east side of the river have been most extensively worked, and the place gives a local name to the stone as "Portland stone."

A recent article in the *Hartford Daily Times* gives an array of facts concerning these celebrated quarries, some of which are quoted in this article. It appears from undoubted historical evidence that these quarries were worked in 1645, 239 years ago, as there is an ordinance alluding to them at that time. The deposit of brown sandstone at Portland covers an area of 200 acres, and is practically inexhaustible. It lies in horizontal strata, usually with each stratum in the upper levels varying a trifle from the other in fineness of the sand. Occasionally there is found an intermixture of fine pebbles. Generally speaking, the deposit is not unlike that of silt upon a beach. In one of the three quarries now worked, several acres have been quarried to a depth of 200 feet below the surface. As an experiment, some years ago, to decide for business reasons the probable depth of the sandstone, a diamond drill was started downward from the 200 foot level. It was driven 312 feet, making 512 feet in all, and without reaching the bottom of the depositl A core that was taken out showed no material change in the character or quality of the rock.

"The sandstone" says Prof. Rice, of Middletown, "was deposited in a long, narrow estuary, extending from New Haven nearly to the northern boundary of Massachusetts. No fossils have been found except trunks of trees and tracks. The latter are probably not tracks of birds, but of reptiles and amphibia." The latter opinion, it will be noted, is directly contrary to the popular belief in the "bird tracks," for which the Portland quarries are widely known. The sandstone lies in horizontal strata, usually, and every few feet there is a well defined horizontal crack. On lifting a flat section of stone, the tracks are found on the surface of the stone beneath, with corresponding projections of the upper stone fitting into them. Professor Dana, in that model text book, "The Geological Story briefly Told," coincides with Professor Rice that the tracks are those of reptiles and amphibia. The late Edward Hitchcock, father of the present State Geologist of New Hampshire, and a famous writer on geological topics, was the first to assign to these fossil tracks in the Connecticut Valley sandstones their true significance in geology. His views were received with incredulity at first, but have since been adopted by the scientific world.

The stone is removed by blasting and by drilling and splitting. The blast is generally of powder in a single hole—from 25 to 60 pounds of powder in a nine inch hole 15 or 20 feet deep. The object of this is to shatter the rock, so that it may be easily broken into rubble for foundations. When large and regular blocks are required, a chiseled cut is made one or two inches wide and of varying depth, into which wedges are driven with sledges, and the block slides off at the interception of a horizontal seam. Flood, the California millionaire, has given the Middlesex Quarry Company an order for the stone for the grand mansion he is to erect in San Francisco. It calls for 40,000 cubic feet of best quality, such as is used for monuments. This will make twenty-five schooner loads. It is shipped to Newark, N. J., there dressed, boxed, and sent to New York, to be shipped for a four months' voyage around Cape Horn. The freight is $7 per ton, and Flood pays, therefore, $28,000 extra over the cost of putting up a similar building in New York. It is estimated that the bill for stone, when set in the walls of his residence, will amount to $200,000, but this is a small amount for the mere shell of the house, whose total cost will be nearly $2,000,000.

GAUGES FOR MECHANICAL WORK.

In a lecture delivered before the Franklin Institute a short time ago and recently published, Mr. George M. Bond spoke of the modern accuracy in the work of the machinist as compared with former crudity. James Watt, in a letter to a friend, claimed that he had attained remarkable accuracy in boring a cylinder of a steam engine and fitting its piston so closely that "the thickness of a half crown could not be introduced between them." Standard gauges are now made that show errors of one one-hundred-thousandth of an inch, and work is exacted to one fifty-thousandth of an inch. Such accurate work is not, however, generally necessary, except in the construction of gauges; but these standard gauges are the means provided for keeping within proper, useful, and practicable bounds in the production of thousands of pieces of the same size and shape in which oftentimes a certain amount of variation is allowed both *plus* and *minus*. A certain amount of looseness must be allowed, for instance, in the fit of journals and bearings, the amount to be determined according to the length and size of the journal; but this variation should be referred to some particular gauge as a standard.

This allowance of difference is necessary in the fittings of bearings and journals, as, if made with the extreme accuracy of gauge work, the surfaces would cohere and speedily destroy each other. This is seen in the construction of end measure pieces as gauges; where two are pressed together by their ends they will cohere even in a vacuum. In the perfect fit of plug and ring gauges where the plug is inserted in the ring, both being of hardened steel and both at the same temperature, it is necessary to keep the plug moving, or the easy sliding fit will change to a driving fit. In fact, there is no room for one to expand and not the other. A plug gauge of three-quarters of an inch diameter, but which is three-ten-thousandths of an inch smaller than the ring, is a loose fit which can be tested by feeling; and if the plug and ring are clean and of the same temperature, the plug will drop through the ring.

In order to make standard gauges within the limit of accuracy necessary for interchangeability, to fulfill the requirements of modern shop practice, line measure is the best standard for practical reference. This measurement is by means of engraved lines on a ruled steel bar, the tests being made by the microscope. For this purpose a hardened steel bar is used, the subdivisions being ruled or engraved by a diamond.

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A new catalogue of valuable papers contained in the SCIENTIFIC AMERICAN SUPPLEMENT is now ready, and will be supplied gratis to all readers who choose to send us their names.

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A SUGGESTED LATHE IMPROVEMENT.

The ordinary back-geared engine lathe of the machine shop is not a special tool, it being used generally for turning, boring, and screw cutting, and frequently for drilling and chucking. There are, however, special lathes, as boring lathes, pulley lathes, and others. It is proposed to add to the list of special tools for the machine shop a screw cutting lathe of a pattern somewhat different from the ordinary back-geared lathe. In constructing a special machine recently, on which the principal rotating spindle had to be reversed in motion instantly and frequently, the superintendent introduced a supplemental spindle carrying two step cones with their small ends contiguous. These turned freely on the spindle, and were belted to run in opposite directions. Between them was a sliding friction clutch that by a very slight movement of a lever could be made to engage with either cone, as desired. The arrangement suggested the possibility of an improvement in screw cutting lathes by constructing the lathe head in a similar manner, and dispensing with the overhead clutch, which requires so long a lever that the time used up in shipping interferes with accuracy of work.

The details are not completed as yet, but the superintendent, who is a skillful mechanic, is confident that much is to be gained in the way of positive and instantaneous reversing by having the clutch directly under the operator's hand.

A REMARKABLE STRAIGHT EDGE.

Some notice was made in the SCIENTIFIC AMERICAN of March 29, 1884, of a trio of remarkable straight edges made by the Pratt & Whitney Company, Hartford, Conn., which are each 12 feet long and wonderfully exact. These straight edges are castings of iron, forming a chord and a segment of a circle, the extreme radius in the center, from the chord or straight line to the highest point of the curve, being 20 inches, the depth gradually tapering on a curve. The width on the face is about 2½ inches, making a face 2½ inches by 12 feet. Between the chord and the curve the casting is a honeycomb of diagonal braces. Recently some remarkable tests have been made with these straight edges, one of them being a test of flexure. The straight edge was placed on a true and perfectly clean planer bed, with a slip of tissue paper under