canals. A test was made recently in Los Angeles, California, to determine the comparative efficiency of this mortar against hand-placed mortar. A ditch was dug in a gumbo formation four feet deep, with a bottom width of six feet and with side slopes of one to one. Seventeen feet of this ditch was covered to a thickness of one inch with one of these machines in one hour, three men being engaged in its operation. Practically the same amount of material was used as was required by five men to cover the same amount one and one-half inches thick by hand,



Rock Cut Gunite-Sealed, Spuyten Duyvil Cut, N.Y. Central Ry.

but it took those five men two hours and forty minutes to cover this same space. The costs, therefore, were about 40 per cent. less for the machine-placed mortar.

This ditch was then allowed to stand for one week, when test holes were dug behind the walls to a depth of about one foot below the bottom. These holes were then filled with a puddle of clay and water. When this puddle reached a height of $3\frac{1}{2}$ feet above the bottom, the mortar that had been placed by hand broke up entirely. The machine-placed mortar, however, withstood the entire head of five feet with no effect other than a raising of the bottom about $\frac{3}{2}$ inch. This development should mean a great benefit in the economical reduction of the great losses to which our western irrigated regions are being subjected, due to loss of water in delivery.

On account of its imperviousness, ease of application and great strength, this machine-placed mortar has met with great success in the construction of new buildings. The walls of the machine shop of the Seaboard Air Line at Portsmouth, Va., are indicative of the character of such work. This building was originally designed to be covered with galvanized iron over the steel frame, but after investigation the engineers decided to change to this machineplaced mortar, with great satisfaction, since a wall has been produced which is fireproof, dampproof, weatherproof and permanent, at a cost not greatly exceeding the cost of a galvanized iron building, which would naturally be of a more or less temporary character. One of the latest uses of this machine in this connection is the work that is now under construction in the erection of two sheds for thawing coal cars at Port Reading, N.J., for the B. & O. and P. & R. Railroads. These great coal-delivering railroads have been subjected to great inconvenience and expense in the past due to the danger of spontaneous combustion in the cars that are thawed with the old steam point

method. To obviate this, these sheds are now being erected so that the cars may be subjected to a uniform heat of about 300° , delivered by pumping hot air through ducts in the walls to overhead sheds or tunnels and out through radiators in the floor. Naturally, to maintain this heat it is necessary to provide well-insulated walls, which has led to an unique design by the engineers and contractors who are responsible for the work.

Six-inch channels are used as columns and are spaced about six feet apart, connected with tie rods. Another wall, about 1½ inches thick, reinforced with wire mesh attached to the flanges of the channels, is built up of gunite, or machine-placed mortar, by shooting from the inside against movable wooden panels. A middle wall about one-half inch thick is then built up along the line of the tie rods by hanging tar-paper and light reinforcing mesh and covering same with machine-placed mortar. An inner wall similar to the outer is then built by shooting mortar against a surface of reinforced tar-paper attached directly to the channels over which the reinforcing mesh is hung. This is providing a wall with two insulating chambers and with very strong panels of six-foot space.

The writer cannot close this article without referring to the wide use that has been made of this method of placing mortar in the construction of hundreds of buildings. The buildings of the model Hospital for the Insane at Whitby, Ont., are erected almost entirely with this machine-placed mortar at low cost and with great satisfaction. Also, the numerous buildings that were constructed in such extraordinarily quick time at Camp Borden. Of special interest are the hundreds of buildings that have been erected in the vicinity of Los Angeles, California. The contractors there have developed some very ingenious methods and have successfully competed in price with hand-placed mortars. A comparative examination of the two methods has convinced the writer of the very great advantage to be gained by the use of the machine-placed



Repairing Reservoir, Nashville, Tenn. Waterproofing Old Masonry Wall.

mortar, for almost without exception the buildings that have been covered with hand-placed mortar show very badly cracked and porous surfaces, whereas those built by the machine method are almost universally without cracks or flaws.

This work is generally done by attaching a fairly heavy tar-paper directly to the studs. Then, over the

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