

**TIME TEST OF A GREAT IRRIGATING SYSTEM.**

BY H. A. CRAFTS.

The Turlock and Modesto irrigating systems, covering some quarter of a million acres of land in Stanislaus County, California, are among the most costly and extensive in the country.

They were built and maintained under the Wright irrigation law, and cover two adjoining districts. The Turlock system cost \$3,500,000, and has been in operation six years. The Modesto system cost \$1,350,000, and is now in its second year of operation.

The two districts joined in the construction of the great diverting dam at La Grange. This dam cost \$550,000, and is said to be the highest overflow dam in the world. It is 127 feet high at its highest point, and has an average height of 97 feet.

It is 301 feet long upon its crest. At its base it is 94 feet thick, and at its crest 13 feet thick. Yet long as it is, the Tuolumne River, in which it is situated, has been known to flow over it to a depth of 16 feet.

The dam was built by excavating for a foundation, and then building up a solid rubble masonry wall of rock, each rock weighing from one to eight tons. It contains 40,000 cubic yards of this class of masonry,

erses the rough and broken country composing the foothills of the Sierra Nevadas before reaching the San Joaquin Valley, where the distribution of water begins; and in this combined distance of 44 miles they present some as difficult problems in irrigation engineering as may be seen anywhere in the country.

The more difficult work was encountered on the Turlock canal, which embraces not less than four rock tunnels and four principal flumes. The tunnels represent an aggregate length of 2,500 feet.

The rock encountered in the first tunnel was of such a hard and flinty nature that three shifts of men working with the best Burleigh drills were enabled to advance the work but 18 inches each twenty-four hours.

But that the more vulnerable parts of the mountain division of the system have not stood the test of time in an entirely satisfactory manner, is evidenced by the fact that this season not less than \$75,000 is being expended in making changes and repairs.

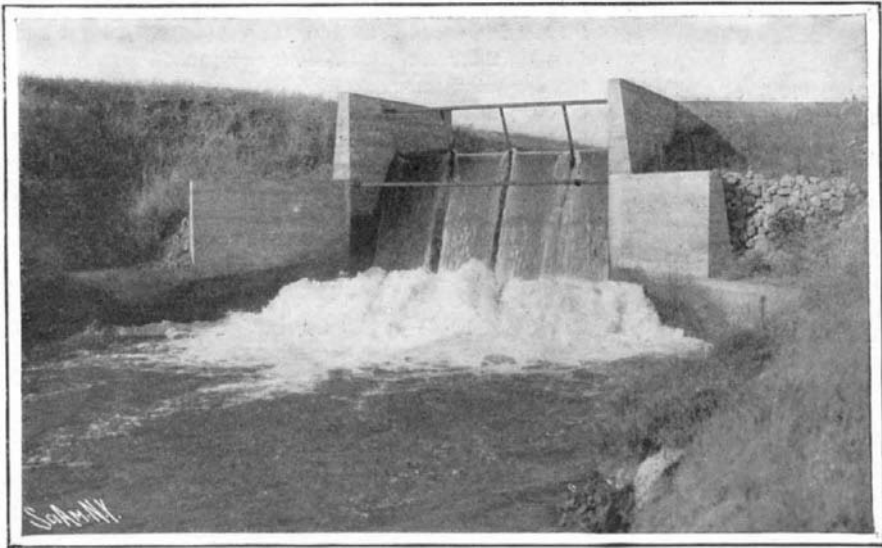
As has already been stated, the Turlock canal has seen six years of use, and the principal weaknesses evinced are in the flumes. The largest of these flumes is at Snake Ravine, and is 1,540 feet in length and

to a large percentage of the crops under the system.

The part going out was immediately replaced with fluming of the same character, and the old part is being replaced with new this season; while the flumes across Morgan Ravine and Peaslee Ravine will be taken out, and their places supplied with triple, inverted siphons of steel pipe, 6 feet in diameter. These changes will involve a cost of about \$45,000.

**Calcium Steel.**

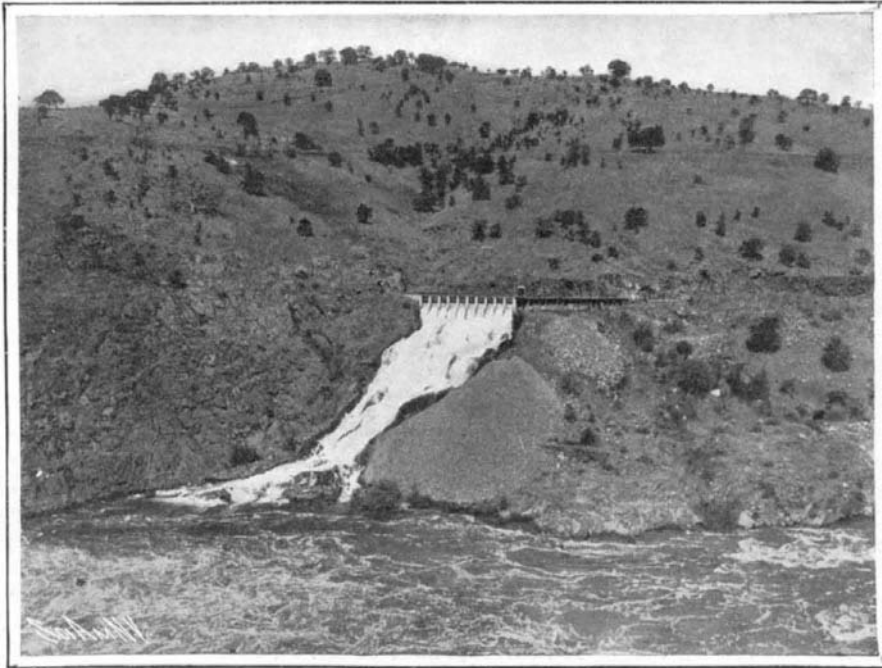
A novel material, likely to assume a high importance for the ceramical industries in case the statements made in regard to its properties are borne out even partially, is called "calcium steel." This product is obtained from feldspar sand and a lime flux and is a compact, homogeneous, and plastic mass of great hardness, resisting oxidation and not affected by the influence of the atmosphere or of acids; it also is a poor conductor of heat and electricity. Its specific weight is 3.2, and its crushing strength about 2,500 kilogrammes per square centimeter. "Calcium steel" can be worked like a metal, and can be filed, bored, chiseled, polished, enameled, painted on, or otherwise decorated like glass and porcelain. For the



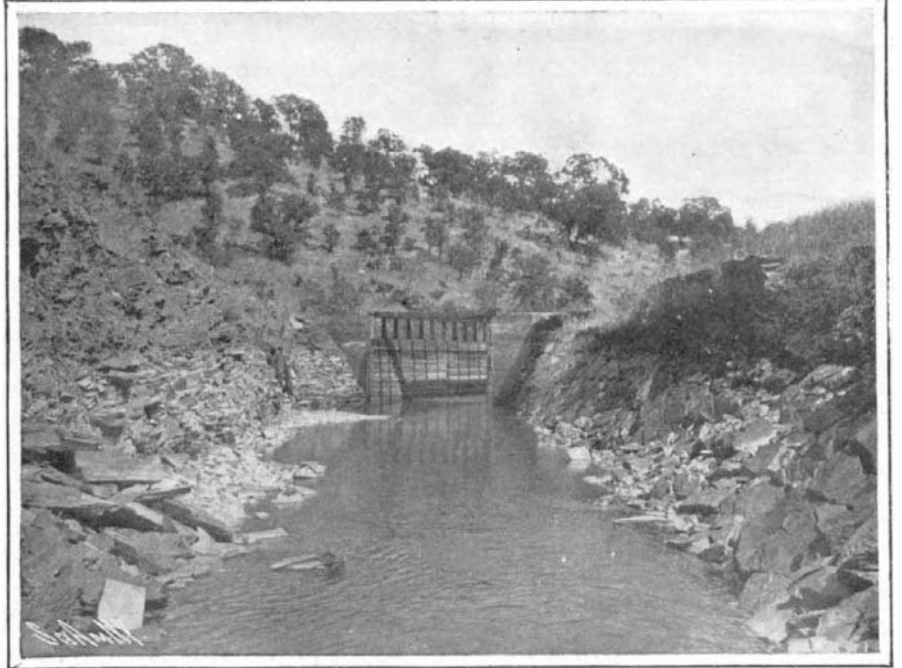
Fifteen-Foot Concrete Drop on the Modesto Canal.



Flood Tide at the Great La Grange Dam. Eight Feet of Water Going Over Dam.



Wash and Regulating Gates of Turlock Canal.



A Flume on Turlock Canal Joining a Rock Cut.

**TIME TEST OF A GREAT IRRIGATING SYSTEM.**

which was laid in 30,000 barrels of cement. The masonry was faced on both sides of the dam, and had a core of concrete laid in the center to prevent possible seepage.

The ground plan of the dam forms an inverted arch, the crown lying upstream. The upstream side of the dam is vertical, while the lower face has three slopes, varying from one-fourth to one.

The dam was finished in 1893, and within three months after its completion it had 16 feet of water flowing over its crest. It has been put to an equally severe test many times since, but has stood the strain without showing a flaw or a weakness.

The Turlock canal is taken out on the south side of the river, 60 feet above the dam, and starts with a solid rock tunnel 600 feet long and 12 by 15 feet in the open. The Modesto canal is taken out of the north side of the river, just at the dam, and through an open rock cut.

The carrying capacity of the Turlock canal is 1,500 cubic feet per second, and of the Modesto canal 640 cubic feet per second.

For a distance of 22 miles each of these canals trav-

13-3 feet in width. It was built on mud-sills, and the floor sills and posts are badly decayed.

This flume is not to be repaired, but is to be abandoned altogether, and the canal carried around an adjoining bluff on a bench, with an outer retaining wall of masonry. Around this bench the bottom and sides of the proposed canal will be excavated to the depth of about 18 inches, and filled with good puddle, and then the inner half of the retaining wall will be built up of the same class of material. The cost of this piece of work will be about \$25,000.

There are three flumes on high trestles on this upper portion of the main canal. The upper flume, which spans Morgan Ravine, is 300 feet long, and the bottom of the flume is 60 feet above the bed of the ravine. The second is that crossing what is known as Delaney Creek, and is 514 feet long and 61 feet above the bed of the creek.

The third is that crossing Peaslee Ravine, and is 350 feet long and 64 feet above the bed of the ravine. Some 200 feet of the Delaney Creek flume collapsed during the season of 1904, just in the busiest part of the irrigating season, and resulted in heavy damage

manufacture of articles from this product two processes are available. After mixing the two components, viz., feldspar sand and lime, in the proper ratio and in a finely-powdered condition, the mass can either be molded cold and compressed like bricks and the articles thus obtained heated up to the temperature required for the combining of the components, or else the mass may be simply melted together and poured out like metal in molds after having become liquid. The cast articles would have to be carefully annealed and cooled slowly.

Calcium steel is of a white color but can be colored by the addition of metal oxides or the like. Its extremely favorable physical properties make it an excellent material for water conduits, gas pipes, and other underground piping.

Gas producers, gas engines, and centrifugal pumps will be used at two of the pumping stations of the New Orleans drainage works to handle the dry-weather flow. The storm water will be pumped by the electrical apparatus already installed, which will be worked intermittently as occasion requires.