Getting a Line on Concrete Pipe

By S. R. Winters

WHEN 40 varieties of concrete pipe are being used for irrigation purposes, California alone supporting 150 concrete-pipe manufacturers, the demands for scientific information on the subject are not to be ignored. Strength, imperviousness to an incessant flow of water, and dependability are factors in an irrigation pipe system which insure the transformation of arid barrenness into flourishing areas of vegetation and people. The absence of these qualities may prove costly and retard man's progress in subduing an otherwise fertile territory.

Contractors, engineers, and irrigation managers are annually laying many hundred miles of artificial water routes, not without some trepidation, owing to the lack of specific information as to materials and methods entering into the manufacture of concrete pipe. Home-made equipment frequently isolated from the marts of trade, and a limited output are conditions which have heretofore kept standardization of the finished product in the background. Mounting prices of iron and steel, with a consequent enlarged use of concrete pipe in building irrigation routes, lend emphasis to the efforts of the Division of Irrigation of the U. S. Bureau of Public Roads in standardizing the methods of manufacture of the product.

Coöperating with the Department of Engineering of the State of California, the Federal government about twelve months ago established a field laboratory at Pasadena, Cal., where equipment has been devised and searching tests conducted. Progress in evolving equipment was slow, the machinery and methods being developed along original lines, and only recently were definite results available. The effects of quality of aggregates, grading materials for strength and imperviousness, quantity of mixing water, rock dust and improving water tightness, curing, amount of tamping, and comparison of strength of specimens tested dry and saturated were the angles of contact included in the experiments of the laboratory and yards of nearby factories.

The age-old method of testing the tensile strength of pipe was discarded by reasons of being cumbersome and costly, involving the disposal of huge volumes of waste water. Essentially, this antiquated method consists in the formation of a testing section composed

of a number of joints of pipe of the desired diameter, bulkheading each end, the latter being secured by means of a connecting tie rod and then applying water under pressure to the interior until rupture ensued. Substituting therefore, F. W. Stanley and E. C. Fortier of the field laboratory of the Bureau of Public Roads, developed a plan of determining the strength of each joint separately without the use of bulkheads, the joint subjected to the test being influenced by no force other than the water pressure within its shell.

The newly-devised method of testing the tensile strength of the pipe is accomplished by use of a cylinder of galvanized sheet iron corresponding to the length of the pipe joint having grooves at each end, in each of which is inserted a small rubber tube resembling the inner tube of an automobile tire. The cylinder is placed inside the joint of pipe subject to testing and the rubber tubes are filled with water until they press tightly against the inner periphery of the pipe. Water is forthwith admitted into the small annular space between the cylinder and the inside of the pipe. Thereby watertight connections are insured with the same pressure in the tubes as exerted against the concrete pipe. The equipment is portable and can be readily conveyed from one concrete-pipe-manufacturing yard to another where stock pipe can be tested. Likewise the usual

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Left: Canvas envelope in position, to protect men and work during bad weather. Center: Stack-building machine in position for the ninth fill on an 80-foot chimney. Right: Finished chimney, showing the flutings that add architectural charm

Concrete chimneys of character, and how they are built

The Architecture of the Concrete Chimney

By G. Orb

IN line with the popular idea that coniform chimneys possess the most pleasing lines, a stack-building machine recently brought out not only adopts this style of architecture but it further ornaments the monolith with a series of vertical and integral ribs which extend the entire height of the structure, dying out in the base of the ornamental top. These ribs are half round in cross section and add strength as well as beauty to the chimney.

The machine used in this class of construction is really a steel cage, carrying the entire construction equipment, and the underlying principle of which is the steel center-mast. This center-mast, with a set of radiating steel tees, makes possible unusual accuracy in every line and absolute uniformity in the taper as the diameter decreases. The overlapping of the wall-forming shells, which are framed in small angles, takes care of this decrease in diameter as the height is increased.

At no time is there any scaffolding in use, either on the inside or the outside of the chimney, as the workmen use the construction ladder which hangs from the machine. A rib-forming corrugation is stamped in each section of the outer forms; and these forms may be readily removed when it is desired to place reinforcing, thus giving easy access to the work at all times.

The working platforms are carried by the machine itself—the supports of these being elaborated into the steel cage. If the weather conditions are unfavorable, a canvas envelope may be let down over the entire cage and the work proceeds unhindered, with complete disregard for temperature and precipitation.

Due to the rigidity of the machine and the ruggedness of its manufacture it is possible to use the much desired quaky and efficient, though heavy, concrete mix—thus requiring a minimum of materials.

A recently built chimney 5 feet in diameter at the bottom, tapering to 4 feet at the top and 100 feet high, was completed in twenty-one days by four men. The ordinary rate of construction is about six feet per day. The accuracy of construction and ornamentation, as well as the very great reduction in the cost, which the new equipment makes possible, will no doubt do much toward popularizing this method of putting up the big stacks so necessary in modern industry.

The equipment employed in testing of concrete pipe, and a test carried to the failing point

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Getting a Line on Concrete Pipe

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type of the finished product can be compared with other joints of pipe made of specially prepared mixtures, the comparison reflecting the character of materials, proportions, water content and other ingredients.

Permeability tests are conducted upon the completion of the tensile-strength investigation, the same specimens being used. A concrete block, one side of which conforms to the inside surface of the specimen, constitutes the testing apparatus. It is held against the surface by two clamps. Water is furnished through a one-fourth-inch iron pipe running through the tester to the surface to be tested. Escape of water is barred by an inflated gasket seated in a groove around the edge of the tester. Fifty pounds of water pressure is applied for one-half hour. The quantity of sweat or seepage is noted at 5-minute intervals. Specimens are air-cured 29 hours and water-cured 3 weeks. Absorption tests are made on the same specimens. These are dried out in an electric oven to constant weight and then immersed in water. Weights are taken at one-half hour, 4 hours and 48 hours. The percentage of absorption is based on dry weight.

Definite results, although not comprehensive because of the incompleteness of the investigation, are available from the experiments. An outstanding conclusion is that proper grading of select material is the most essential factor in the manufacture of an excellent quality of concrete pipe. The porosity of a pipe is influenced largely by the grading of the material. Rock dust up to 10 per cent and clay free from organic matter up to 5 per cent have proven their efficacy in preventing seepage without decreasing the strength of the pipe.

Laboratory tests show that a substantially large variation in water content does not materially influence the strength of the pipe, conditional upon the mixture being heavily tamped. Under light tamping, pipe made of a so-termed "dry mixture" is much weaker and seeps freely. A first-rate quality of broken rock of uniform toughness insures the strongest pipe. This may be attributable to the difficulty of finding gravel free from soft or disintegrated particles in California. The breaking strength of concrete pipe under water pressures varies widely, the variation being due to the manner of testing. If a pipe is thoroughly saturated several days before the test is made a good quality of pipe will test as high as when dry, while a poor quality shows a decrease in strength of from 20 to 60 per cent.

That concrete expands and contracts when influenced by changes in temperature, is knowledge of general acceptance. However, the information that a concrete pipe expands when changed from a dry to a wet condition and contracts to a like extent when the conditions are reversed is not such common knowledge. A concrete pipe, when subjected to water pressure for some time, if permitted to dry, may contract as much as it would under a drop of temperature of 100 degrees Fahrenheit. Excessive internal stresses in concrete pipe, not infrequently resulting in ruptures, are created by having the lower part of a pipe line wet if not saturated and the upper part dry. Seepage through the shell of a pipe under water pressure will appear under low pressures nearly as rapidly as under high pressures. If water is going to percolate through a pipe, a pressure of 5 pounds to the square inch will indicate with reliable accuracy the quantity of water likely to pass through the shell.

Hardening Steel in Gas-Fired Furnaces

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of quenching is not quite so rapid, or as severe as water or brine, yet quick enough to give the proper hardness to most all work.

It is important to keep all quenching baths cool, and replenished from time to time with a fresh supply of the liquid. Where water is used it is best to keep up a fresh supply continuously. Oil baths are cooled either by a series of cold water pipes around the tank, an agitation of the oil by compressed air, or a circulation of the oil. The last-named method is perhaps the best as it not only causes a cooling of the oil but also a constant changing of the bath and takes the heated oil away from the metal after it gives up its heat to the oil.

Quenching should be done rapidly but uniformly. Tongs for holding the work should have as small grip as possible. Long pieces of steel, including drills and reamers should be quenched with their axis vertical. Where this is impossible such as in very long round rods, they should be made to roll into the quenching bath with their long axis horizontal, but they should enter the bath very quickly. Round cutting tools should be immersed with their axis horizontal. Small tools or pieces should be kept in motion when placed in the cooling bath.

Warping occurs frequently in hardening steel pieces and may be attributed to one of two causes—uneven heating or quenching too long. Some pieces should be left in only long enough to harden extreme edges. Again it is often necessary to immerse the piece at an angle in order to overcome this difficulty. Therefore, it will be necessary to give considerable thought to the shape and design of the tool, in order to obtain the best results.

The Heavens in November, 1920

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Jupiter is a morning star, rising at 1 A. M. in the middle of the month. Saturn is about seven degrees farther east, and rises half an hour later. The two planets are on the borders of Leo and Virgo, and afford a fine spectacle in the morning sky. Uranus is in Aquarius, observable in the evening, and Neptune is almost opposite in the sky, and visible before day-break.

The moon is in her last quarter at 3 A. M. on the 3rd, new at 11 A. M. on the 10th, in her first quarter at 3 P. M. on the 18th, and full at 9 P. M. on the 25th. She is nearest the earth on the 27th, and farthest off on the 15th. During the month she passes near Neptune on the 3rd, Jupiter on the 5th, Saturn on the 6th, Mercury on the 11th, Venus on the 13th, Mars on the 15th, Uranus on the 18th, and Neptune again on the 30th.

On the morning of the 10th there occurs a partial eclipse of the sun, which is visible throughout the northern and eastern portions of the United States, and as far west as Kansas. The eclipse begins about 9 A. M. eastern time and lasts more than two hours for observers in New England and the Middle States, about one-third of the sun's diameter being obscured on the northern side. The magnitude of the eclipse will be smaller, and the duration shorter for observers farther south and west, till it fades away to nothing in Alabama and Arkansas.

Do Moths Use "Wireless"?

It has for long been known that certain species of moths are able to communicate with one another even though separated by a considerable distance. This fact is to be noticed very plainly during the pairing season. A female of the Vapourer Moth (*Orayia*) may be enclosed in a wooden pill box. She will then attract males from all directions, and these will come from a distance of a mile or two.

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