SCIENTIFIC AMERICAN

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THE NEW CROTON DAM.

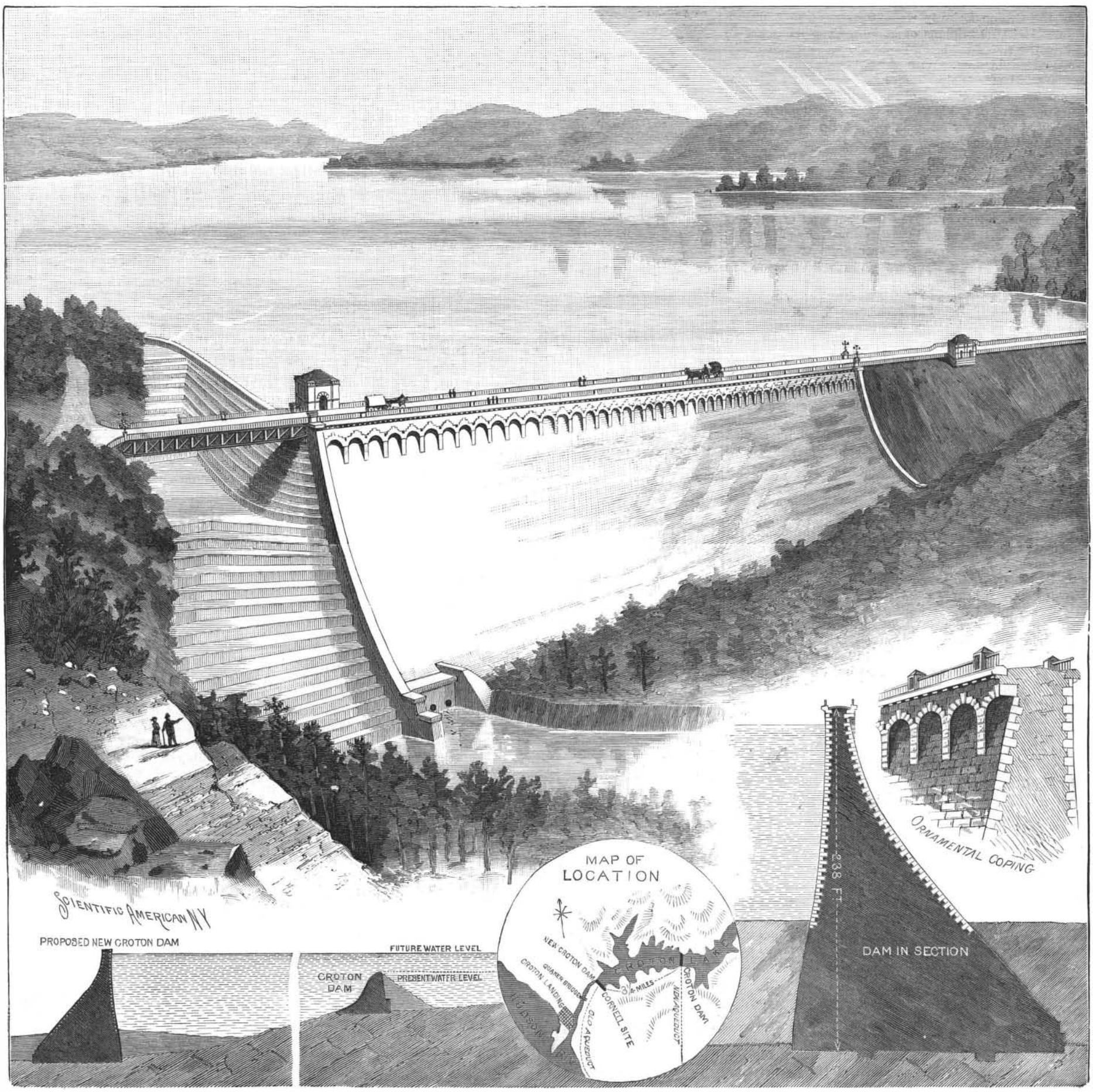
For some years it has been apparent that an increased reservoir capacity for the water supply of the city of New York was soon to be a necessity. To provide this the Quaker Bridge dam was proposed some years ago. This gigantic structure seemed almost in advance of the needs of the case, and the engineer of the aqueduct commission, M. A. Fteley, proposed as a substitute a high dam as close to the present Croton dam as possible, and immediately below it. Eventually a compromise site was chosen—what is known as the Cornell site—about half way between the present Croton dam and Quaker Bridge. Contractors' estimates for the construction of the dam will soon be before the authorities, and full plans have been prepared illustrating the details of its formation.

The dam is a combined masonry and earthwork structure. As shown in our cut, the portion on the extreme right is of earthwork. A section of this part shows an earthwork embankment rising 120 feet above the original ground level. Its apex is 30 feet wide, providing a 20 foot roadway. The slope of the sides is 2 horizontal to 1 vertical. This slope is made virtually flatter on the outside of the dam by a number of gutters, which run along the face to catch the drainage. This side is sodded.

The lower portion of the inner face is paved, 12 inches of broken stone acting as a basis for 18 inch thick paving blocks. For a considerable space above and below the water level, 18 inches of broken stone underlying 2 feet paving blocks is specified.

The earthwork is to be laid in 6 inch layers, each layer watered and rolled with grooved rollers. In a sample section the elevation of the crest above the original ground level is given at 120 feet. The excavation for the base of the dam is carried down 125 feet below this point. This excavation, starting with a width of about 280 feet at the ground level, by slopes and steps is reduced to a trench 25 feet wide under the center of the dam. From this trench a core rises. This is to be built of rubble masonry, 18 feet thick at the base and rising to a height 4 feet above the water level. The core is battered to a width of crest of 6 feet. It rests upon the bed rock.

The masonry section which adjoins this portion corresponds with it in level of crest. An 18 foot roadway runs across it. The dam is of rubble masonry, going in some cases 80 feet below the surface. Along the



THE NEW CROTON DAM AND LAKE, FOR THE FUTURE WATER SUPPLY OF NEW YORK CITY.

bottom of its excavation two trenches, 10 feet wide and 6 feet deep, are carried, into which the masonry descends, thus giving the great structure a definite resistance to horizontal thrust. The breadth of the masonry in some parts of the base is 185 feet. It is faced with cut stone. Its inner face slopes a little; the outer face, while varying in degree, has a general slope of 2 vertical to 1½ horizontal.

The dam proper is to be 1,200 feet long. Next to it comes the spillway, 1,000 feet long, over which the overflow takes place. This portion is built in a series of steps, and its level of crest determines the height of water in the dam. This crest is 24 feet below that of the dam proper, thus giving a margin of safety beyond any catastrophe.

In general construction the spillway is a masonry dam faced on the inner side with cut stone. The outer wall sloping outward is broken into a series of steps about 4 feet width and 5 feet rise. It is based upon the bed rock in exactly the manner described for the dam proper. It curves around as shown, and presents quite a striking appearance. Its peculiar shape enables a bridge to be carried over the gap to give passage to the highway.

The dam along its outer edge has a cornice of arches, an idea of whose appearance may be derived from the cut.

The work to be done by the dam is the formation of a larger reservoir than the present and the impounding of a quantity of the water which now at many times goes to waste, pouring over the crest of the present Croton dam. It will increase the storage capacity of the Croton Lake in round numbers from 2,000 millions to 30,000 millions of gallons. The main intake into the new aqueduct will be at the new gate house near the old dam. With the old aqueduct a connection will be made almost on a line with the new dam. Whether the section of old aqueduct intercepted will be preserved or not is still an open question. It may be used to deliver water back to the new gate house and thence into the new aqueduct.

The present Croton dam, and far back of it, Muscoot dam, will be submerged. The latter dam will cut off all water above it from the reservoir. Such water it is intended to use only in emergencies. The object of Muscoot dam is to preserve a uniform level of water as far as possible, in order to satisfy the desire of the residents of the region which surrounds its reservoir. Below the Muscoot dam 24,000 millions of gallons is the capacity of the new reservoir.

The watershed of the region feeding the new dam is 376·3 square miles. The estimated cost of the dam proper, as per engineer's report of October 8, 1890, is $3,650,000, to which must be added for roads, bridges, railroads, etc., $1,075,000, and for Muscoot dam $300,000. Six and one-half years are allowed for its construction. The dam, estimated to cost $400,000 less than Quaker Bridge dam, has only 4,000 gallons less storage. Its extreme height above the river bed is 159 feet, its extreme depth below the same is 80 feet, giving a total of 239 feet maximum height.

Estivation.

A rarer and even more curious phenomenon than hibernation, or winter sleep, is the estivation, or torpidity during the dry season, of certain animals. As one of the mammals which is most sensitive to heat and dryness, M. L. Cuonot mentions the tanrec, of Madagascar, an insect-eating creature resembling the hedgehog. It is very active during the rainy season, but lies torpid in a shallow burrow for nearly six months in the dry period. The most remarkable summer sleepers, however, are found in the group of dipnoids, intermediate between the batrachians and fishes, and comprising at present but three animals—the *Lepidosiren paradoxa* of the affluents of the Amazon, the *Protopterus annectens* of Gambia and Senegal, and the *Ceratodus Forsteri* of Australia. Their anatomical structure resembles that of the fishes, and a bronchial apparatus allows them to breathe in the water, while a pulmonary apparatus enables them to absorb the oxygen of the air. A careful study of the protopterus shows that during the entire dry season, lasting about nine months, it remains buried in the dried-up mud at a depth of five feet, and is surrounded by a sort of cocoon, which incloses it hermetically. Air penetrates through a narrow channel to the animal, which in this state breathes, not only through a lung into which the swinning bladder is transformed, but through its wide membraneous tail. On the return of the rainy season, the dried mucus covering the animal dissolves, and the creature straightens out from its doubled-up position, and swims in the water for three months.—*Mediterranean Naturalist.*

THE tide tables for the Atlantic coast of the United States, together with 206 stations on the Atlantic coast of British America, for the year 1893, published by the U. S. Coast and Geodetic Survey, are now ready for issue, and copies can be obtained at the agencies of the Survey in this city, or by addressing the office at Washington. Price twenty-five cents.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 862.

For the Week Ending July 9, 1892.

Price 10 cents. For sale by all newsdealers.

THE NICARAGUA CANAL.

The assertion is sometimes made that the Nicaragua Canal will not benefit us in regard to the increase of the number of our ships, and this assertion is based on the fact that France failed to add a single ship to her carrying fleet by the completion of the Suez Canal, built by French engineering, French enterprise and French capital. This fact is brought forward as a lesson in history which we must bear in mind when we are asked to consider the Nicaragua Canal question as an element in the development of our commerce.

At the present day the Suez Canal is chiefly devoted to the carrying trade of England, and England owns a fighting interest in the stock.

We hold in regard to the Nicaragua Canal that the United States will, no matter who builds it, take the same position that England could not fail to attain in the use of the Suez Canal. England possesses an immense, flourishing and steadily increasing commerce in the East, while the commercial possessions of France there are comparatively small.

Like England in the East, we have extensive possessions in the West on our Pacific shore, California, Oregon, Washington and Alaska, all very flourishing, while their productiveness is steadily increasing. It must, without fail, stimulate our shipbuilding trade when by a shorter and safer transit the mutual commerce will receive a most powerful impulse. All the European ocean-faring nations are even more interested in the Nicaragua Canal than in the Suez Canal, because by passing it they will avoid the stormy ocean of the extreme southerly coast of South America, the sailing round which is a great deal worse than sailing around the Cape of Good Hope.

There ought to be no doubt that our government will assist the enterprise. It is in duty bound to do so. Even in the view of national defense we must have a shorter waterway for more rapid and safer navigation between our extensive eastern Atlantic and western Pacific shore, and so dispense with the delay and danger of a long, roundabout way of sailing around the whole South American continent over the two grand oceans of our globe.

OF INTEREST TO ELECTRICIANS.

By years of exposure to atmospheric temperature, hardened steel loses hardness.

Steel magnets lose their permanent magnetism at the boiling point of almond oil.

Steel not only loses its magnetism, but becomes non-magnetic when heated to an orange color.

Silvanus Thompson says that the sudden slamming on of the armature of a permanent magnet is liable to deteriorate the magnetism; and that the sudden detaching of the armature is of advantage to the magnet.

In the storage battery the plates intended for the positive are pasted with red lead and dilute sulphuric acid (acid 1 part, water 9), and those to be used for negatives with litharge and dilute sulphuric acid.

The positive plates of a storage battery when fully charged should look like wet slate, nearly black; when partly charged they are dark red, chocolate or plum color. The negative plates are always much lighter than the positives and have a pale slate color.

Too quick a discharge buckles the plates and a very sudden discharge draws the paste out of them. When fulled charged plates which have been removed from the electrolyte are to be replaced, the liquid put in should have the same specific gravity as it was before.

According to Silvanus Thompson, a simple tangent galvanometer may be made to read as an ampere meter when constructed as follows: "Take a piece of insulated copper wire of a gauge not less than No. 10 B. W. G., or say than three millimeters in diameter, and of this wire wind five turns only, so as to have a mean radius for New York, Cleveland and Chicago of 6·72 inches; for Philadelphia, 6·37 inches; Washington, 6·18 inches; San Francisco, 4·85 inches; New Orleans, 4·42 inches; then such a coil when traversed by one ampere deflects the needle exactly 45°, that is, to the angle whose natural tangent = 1, and the natural tangents of the deflections will therefore read amperes directly. The radius has to be inversely proportional to the intensity of the horizontal component of the earth's magnetic force at the place where the ampere meter is to be used. It may be further noted that a current of one ampere strength will cause the deposition in one hour of 1·174 grammes or 18·116 grains of copper in an electrolytic cell. It will in one hour deposit 4·024 grammes or 60·52 grains of silver in a silver cell.

THE exposition is deriving quite a revenue from the visitors whose curiosity prompts them to see the grounds and the wonderful buildings now approaching completion. An admission of twenty-five cents is charged, and on single days the number of visitors has exceeded 14,000. With cooler and more pleasant weather, it is believed, the visitors will be much more numerous. Without exception all are enthusiastic in their admiration and wonder at the magnificent spectacle.