

THE PANAMA CANAL.

Connected with an undertaking of such vast proportions as the Panama Canal, there is an amount of work expended on preliminaries before the real task is touched, the magnitude of which it is difficult to form any just conception of. It was necessary to make complete and accurate topographical surveys of the country for a considerable distance on each side of the route, and though much assistance was derived from the surveys of the engineers of the Panama Railroad, still the labor was by no means insignificant. The geological surveys that had been made previous to the past few years did not give that practical information which this project required, and were, consequently, of little or no use. The isthmus is covered by almost impenetrable forests, so that the nature of the soil can only be ascertained in isolated cases. If a few rocks were now and then visible, it was hard to say whether they were outcroppings or detached blocks, and, therefore, the nature of the underlying mass could not be judged from an examination of them. Borings upon the line of the canal, at frequent intervals, became necessary. The disastrous effect of the climate upon foreigners is well known. The comfort and health of the staff and men have been closely attended to, and a good share of the preliminary work was expended in the construction of buildings, barracks, offices, hospitals, etc.

The line of the canal is divided into sections, at each of which the work is being pushed forward in both directions. The American Dredging and Contracting Company has a contract for that portion lying between Colon and Gatun, a distance of nine kilometers. Work upon the other terminus between La Boca and Rio Grande is being done by the Franco American Trading Company. The greater part of the remainder of the work is being done by the canal company, only a small portion of it being under contract. Work is progressing at the following points,* the height of each of which above the level of the oceans is given: Dos Hermanas, 20 feet; Vamos-Vamos, 25; Buhio Soldado (between this and the next point the land rises to a height of 165 feet); Buena Vista, 56; Frijole, 44; Tabernilla, 53; Barbacoas, 46; San Pablo, 104; Mamei, 79; Gorgona, 66; Matachin, 75 to 168; Bas Obispo, 100 to 236; Emperador, 228; Culebra, 333; Paraiso, 145; Pedro Miguel, 20; Miraflores, 36. The total amount of material to be dealt with is:

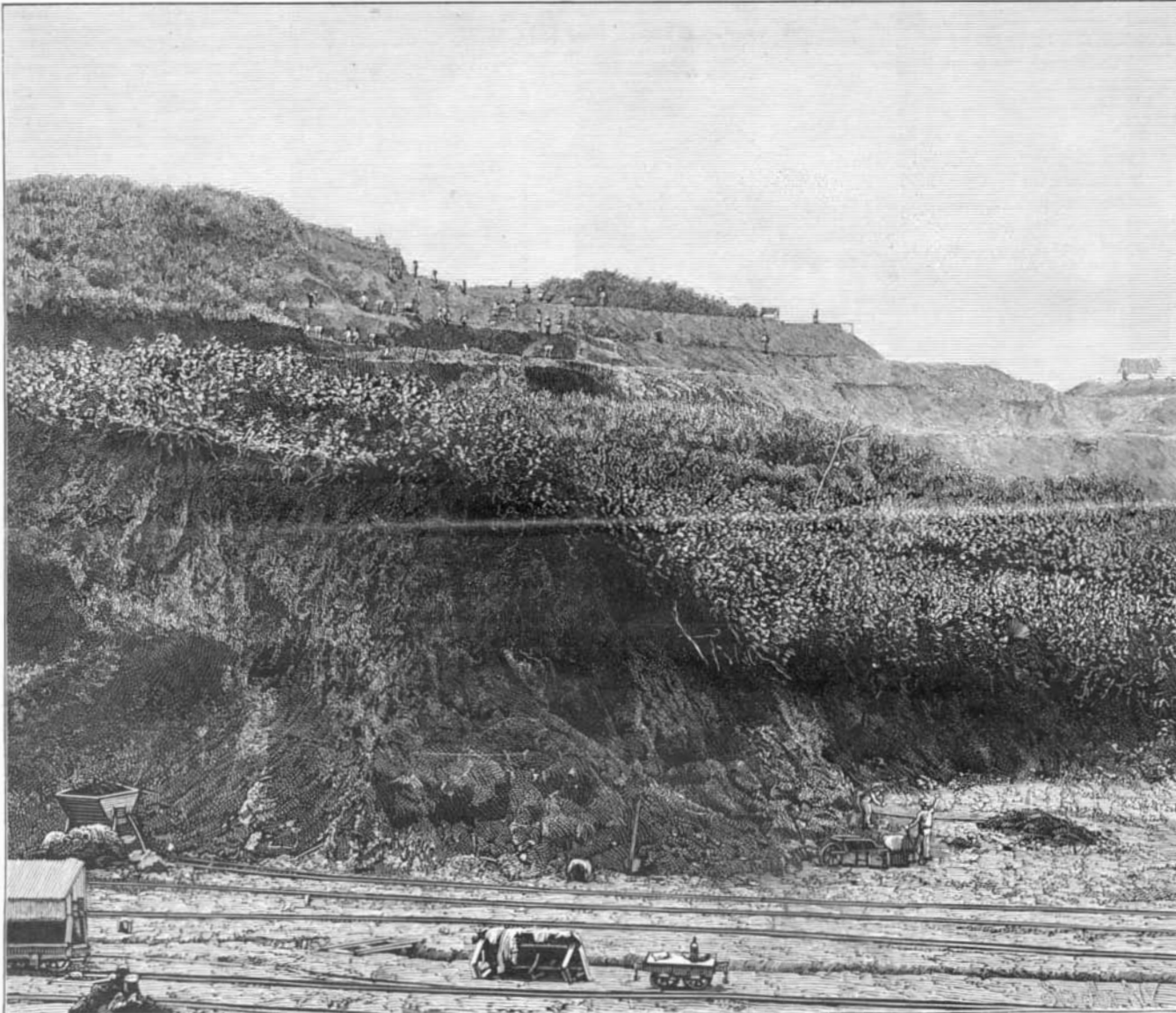
	Cubic meters.
Dredging.....	26,913,000
Rock, hard and soft.....	37,632,000
Earthwork.....	41,295,000
The amount of material removed up to March 1 last was:	
Dredging.....	452,000
Rock, hard and soft.....	752,000
Earthwork.....	2,967,000

The severe climate has prevented the employment of as many men as could be worked advantageously, and has forced the company to substitute black for white labor. Although the sanitary regulations are enforced as rigorously as possible, it is not in the power of any company to make a negro—such as are found upon the isthmus—obey rules which he will not understand, and which interfere with his present comfort. The natural result of his disobedience is that he is soon placed on the sick list, and sent to the hospital. During the dry season of the past year there were about 12,000 men employed on the excavations, but during the wet months, when operations in many parts of the line are suspended, only from 6,000 to 8,000 men are at work.

Machinery and supplies are delivered at Aspinwall, and distributed along the line of the canal by the railroad, which is also used to remove the excavated material. The proper disposal of this material makes one of the large items of ex-

pense, since it must not only be taken away from the canal, but must be so placed that the heavy rains will not wash it back after the completion of the work.

The manner of carrying on the work and the appliances used will be readily understood from our engravings. The "discharger" is used in connection with a marine dredge having a capacity of 6,500 cubic yards per day, and a scow, which are now working in the bay at Aspinwall. Through a hole in the center of the hull of the dredge extends a powerful frame carrying an endless chain to which iron buckets are attached. The excavated material is dumped into a chute leading over the side of the dredge, and whose outer end can be raised and lowered. The scow is towed alongside, and secured so as to receive the material falling from the chute; after having been loaded it is taken to the discharger—a name which well explains its duties. This is built upon the catamaran plan, and consists of two long hulls, secured together by overhead frames, and between which the loaded scow is placed. The material is elevated by buckets upon an endless chain carried upon a frame, the lower end of which can be raised and lowered by a chain passing through a block in the upper part of the cross frame. The material is emptied into a long iron tube, three feet in diameter, and supported by guys from a mast, as clearly shown in the engraving. Water is pumped into the tube in order to assist the discharge.



LOWER OBISPO—VIEW SHOWING THE MANNER OF EXCAVATING THE PANAMA CANAL.

For work of this kind, where it is impossible to ascertain the exact nature of the material to be excavated, and where obstructions in the form of boulders, stumps, etc., are being constantly and unexpectedly encountered, it is doubtful if this method of digging be as rapid and economical as that which uses the ordinary dipper and grapple. An obstacle of unusual size lying in the path of the buckets will obstruct operations, and there is no way of raising it. Besides, such obstacles, if raised, are apt to choke the delivery tube.

We show views of two excavators, one of American and the other of French make. The first was photographed as at work at Culebra, the other working at Emperador. Both are built entirely of iron, but they differ in plan. Each is mounted on a truck running upon a track, and each dumps into cars run upon a track alongside. In the American excavator the lower end of the boom is swiveled, and the upper end is connected to the top of the mast. Chains lead from the drum up the sides of the boom to the top, where they pass over sheaves, from which they are taken around sheaves on the yoke of the dipper, and then secured to the end of the boom. A wide sweep is given to the dipper, and all the movements of which the machine is capable are easily and rapidly effected by the engineer.

The French excavator somewhat resembles, in plan, the dredge just described. An endless chain provided with buckets passes over pulleys, one set of which is journaled in the upper part of a frame, and is driven by gearing connecting with the engine; the other set is journaled in the lower end of the frame, which has a vertical and horizontal movement. The lower end of the pulley frame is sup-

ported, and also raised and lowered, by chains passing from a drum over sheaves in the upper end of a frame hinged to the side of the platform. The excavated material is dumped into a chute, upon the opposite side of the platform, which discharges it into the car.

The method of working where the cut is deep is clearly shown in our view of Lower Obispo. The slopes are divided into terraces, upon each of which a track for the dirt cars is laid. The laborers upon each step work toward the hill, the track being moved inward as required. From this engraving a good idea may be obtained of the great magnitude of the work, and some conception may be formed of the task before the engineers, and of the amount of work that will have to be done before the cut at Culebra—some 825 feet across the top and 330 feet deep—will have been completed.

Stopping a Cattle Stampede.

"One of the smartest things I ever saw in my travels," said a passenger from the West, to a newspaper reporter, "was a cowboy stopping a cattle stampede. A herd of about six or eight hundred had got frightened at something, and broke away pell mell with their tails in the air and the bulls at the head of the procession. But Mr. Cowboy didn't get excited at all when he saw the herd was going for a straight bluff, where they would certainly tumble down into the canyon and be killed.

"You know that when a herd like that gets to going, they can't stop, no matter whether they rush to death or not. Those in the rear crowd those ahead, and away they go. I wouldn't have given a dollar a head for the herd; but the cowboy spurred up his mustang, made a little detour, came right in front of the herd, cut across their path at a right angle, and then galloped leisurely on to the edge of that bluff; halted, and looked around at that wild mass of beef coming right toward him. He was cool as a cucumber, though I expected to see him killed, and I was so excited I could not speak.

"Well, when the leader had got within about a quarter of a mile of him, I saw them try to slack up, though they could not do it very quick. But the whole herd seemed to want to stop, and when the cows and steers in the rear got about

where the cowboy had cut across their path, I was surprised to see them stop and commence to nibble at the grass. Then the whole herd stopped, wheeled, straggled back, and went to fighting for a chance to eat where the rear guard was.

"You see, that cowboy had opened a big bag of salt he had brought out from the ranch to give the cattle, galloped across the herd's course, and emptied the bag. Every critter sniffed that line of salt, and, of course, that broke up the stampede. But I tell you it was a queer sight to see that man out there on the edge of that bluff quietly rolling a cigarette, when it seemed as though he'd been lying under 200 tons of beef in about a minute and a half."

Ideas not Property until Patented.

The Philadelphia Times of May 24 states that "Charles A. Kortenhous' action against the American Watch Company, of Waltham, Mass., to recover royalties on an improvement in stem winding watches that he made, and which, he averred, the defendants have put to use, was nonsuited yesterday by Judge Mitchell. Kortenhous swore that he had submitted his invention to the company's inspection with the view of selling it. The company refused to purchase. Kortenhous discovered afterward, he swore, that the company had adopted the improvement. He had made the fatal mistake of not having his improvement patented. The court, in dismissing his action, ruled that there was no right of property in an idea as an idea, and that it could only be made property by letters patent."

* In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 367, we published a map of the Isthmus of Panama, showing the line of the canal as finally located.

SCIENTIFIC AMERICAN

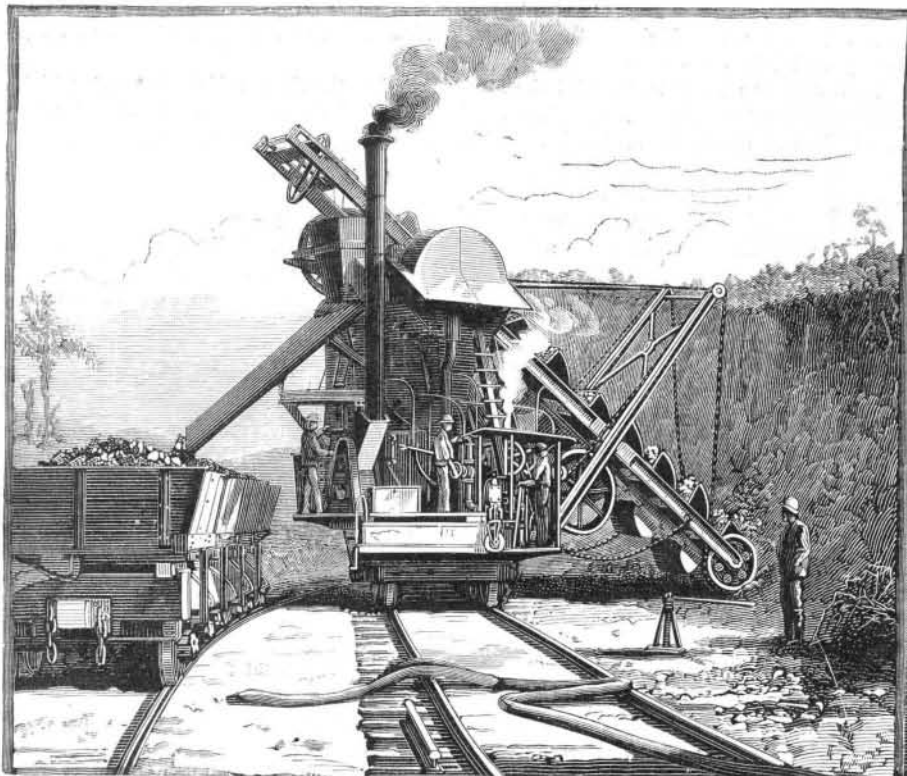
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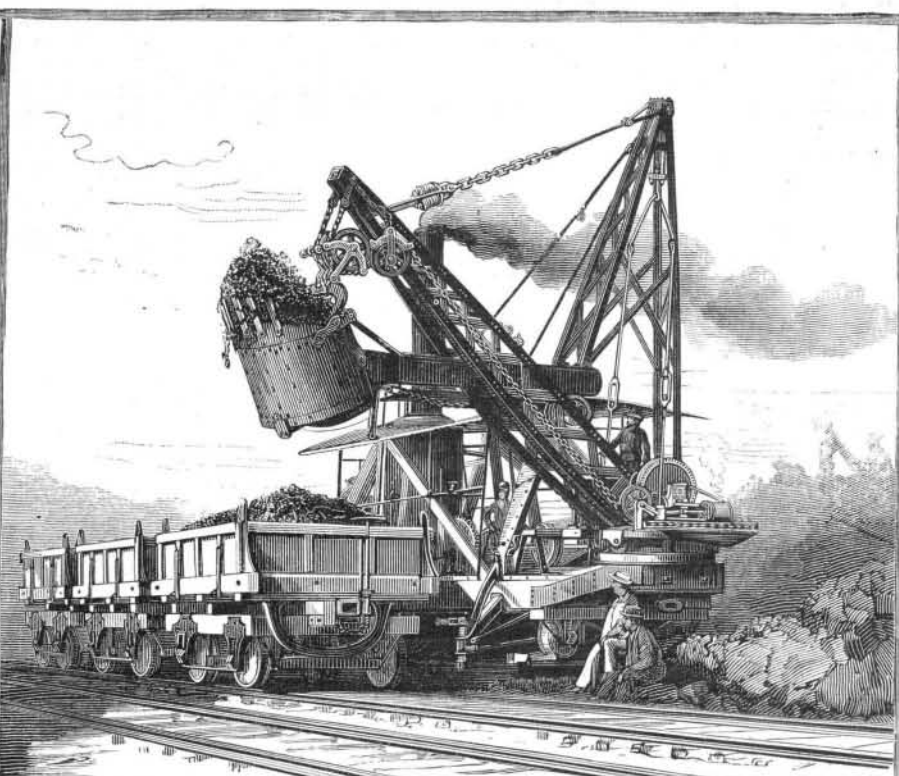
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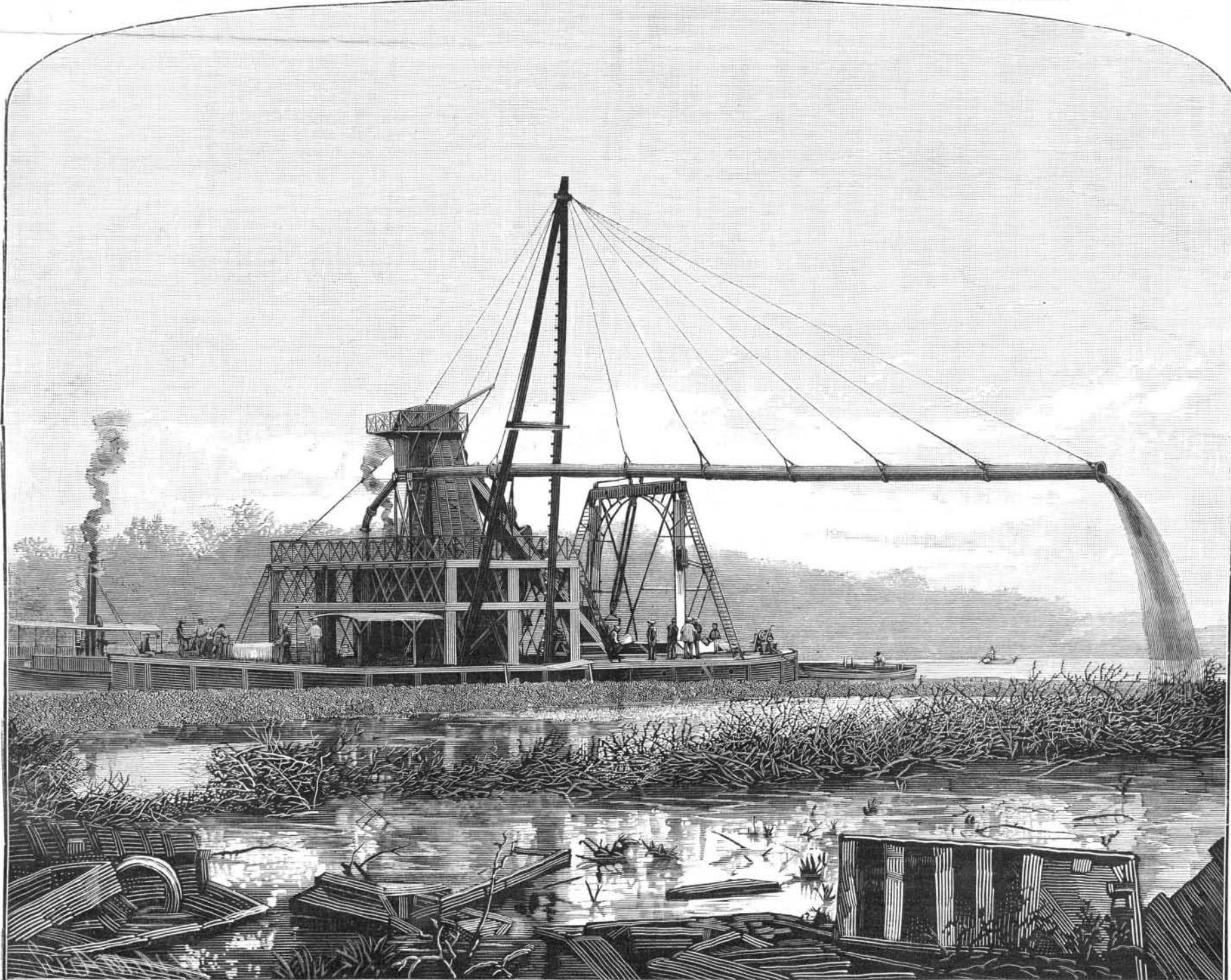
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FRENCH EXCAVATOR



AMERICAN EXCAVATOR



DISCHARGER AND EXCAVATORS NOW IN USE ON THE PANAMA CANAL.—[See page 406.]