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“Dredging Operations on the Danube, between Pressburg
and Gönyö in Hungary.”

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THE navigation of the Danube in Hungary, more especially that portion of it between Pressburg and Gönyö, is greatly impeded by the constantly-changing formation of shingle banks, which, although during the season when the water is high are sufficiently covered to allow the passage of laden vessels, in summer and autumn, when the water is usually low, are at times partially exposed, or only covered to a depth of 3 to 3½ feet. A correction of the river in this portion of its course has not yet been attempted, and it is thus suffered to spread itself over a great width, studded with numerous islands. As a consequence the navigable channel of one year deviates considerably from that of the previous one. The average current on those parts of the river where the shallows occur is 4½ to 5 miles per hour. It has hitherto been customary to dredge the shallow parts which form for the time being the hindrance to the passage of laden barges, but the channels being narrow, the presence of the dredger necessarily becomes a hindrance to free navigation. It has also been customary to discharge a portion of the cargo of a laden barge on arriving at such points, thereby reducing the draft from 5 or 5½ feet (which is the maximum) to 3 or 3½ feet. In addition to the expense of reloading, the large number of barges thus rendered necessary for the traffic is inconvenient, and considerable delays ensue. These difficulties and hindrances caused the Danube Steam Navigation Company to try a system of deepening the river (Plate 17) which, so far as may be judged from the short time it has been at work, appears to be successful. It may be stated that the bars or banks formed in the bed of the river consist almost entirely of rolling shingle, varying in size, and rounded by the action of the water. These stones, brought down by the Inn and other tributaries from the mountains and worn quite smooth, are formed by the sand of the river into compact masses, having sufficient adherence on their surface to hold very firmly together, but which, if once loosened, would be carried away by the current, and de-

posited in deeper water at some point lower down the river. The loosening of the upper surface of such shingle-beds is effected by the implement shown in Plate 17. This "rake" is of a triangular form, and is suspended from the bows of a steamer, being hung, however, somewhat in advance of the same. The chain by which the rake is suspended passes over a pulley inserted in the end of a strong beam of timber A, and serves to lower or raise the whole by a steam crane placed on the forward deck. The shingle banks forming the obstructions described are seldom more than 100 to 200 yards in length, and the steamer beginning at the upper end, ploughs through them, running astern, and dragging the rake by chains attached to suitable towing bits at the bows. After passing over the shingle and reaching deeper water the rake is raised by the steam winch, and the engines are reversed, the steamer ascending the stream to the head of the bank, and taking up a position to make a fresh descent, for which purpose the rake is lowered and the process repeated. This plan, the success of which in a great measure depends upon the power of the stream to disperse and carry away the loosened shingle, is said to have been tried many years ago, when, however, a very light rake was towed from the stern of the steamer, which ran down the stream dragging the rake after her. The great difficulty, however, encountered then in steering rendered its application uncertain, and it was not continued. This difficulty has been entirely overcome by dragging the rake from the bows, the steamer running astern, and thus leaving the action of the rudder undisturbed. In five days during November 1879 the rake passed three hundred and fifty-five times over a shingle bank, the depth upon which was increased from 5 feet 6 inches to 9 feet. The current in this part being sluggish, the rake had to pass oftener. The barges employed by the Danube Company are mostly 180 feet long by 21 feet beam, and carry 250 tons on a draft of 5 feet; they are built of iron, and on account of the strong currents encountered have usually rather fine water-lines. No difficulty has hitherto been experienced from the loosened shingle being deposited lower down the stream, and as by the means described a sufficient depth of water can be gained in a short time, the system, although a rough and ready one, possesses considerable advantages. The frame of the rake is of wrought iron, and weighs complete $3\frac{1}{2}$ tons, measuring on each of its three sides 18 feet. It is provided with thirty-four teeth of chilled cast iron, projecting 12 inches from the underside; these teeth bite by the weight, and pull on the chains to rather more than half their depth. The engines of the steamer employed indi-

cate, when working full power, 440-H.P. An experiment, in which the steamer was made fast by hawsers, showed that the engines when dragging the rake would be capable of exerting a pull equal to $4\frac{3}{4}$ tons. The engines are oscillating, with cylinders $41\frac{1}{4}$ inches in diameter and 3 feet stroke; the pressure of steam is 30 lbs. It may be added that this steamer was selected for carrying the rake on account of her light draft of water, only 2 feet 6 inches. When the water is high and there are no hindrances to be overcome, the apparatus is dismounted until again required.

The communication is accompanied by a tracing, from which Plate 17 has been engraved.

DREDGING ON THE DANUBE.

PLATE . 17

BETWEEN PRESSBURG AND GÖNYÖ.

Scale $\frac{1}{8}$ Inch = 1 Foot

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