

at the outflow of the Great Lakes, so as to control the discharge of those lakes and also to rectify the river through the swamp district. With a view to ascertaining on a practical basis just what can be done and what it would cost, an experimental dredge fleet has been built, consisting of three machines, each adapted to a different class of work. These machines are now in service, and upon the result of their work future developments will depend.

The first machine is a grab dredge to deal with the vegetation and soft mud. This vessel is a light draft river steamer of the stern wheel type having a boom at the forward end with the necessary machinery for operating the grab. A boat of this type can readily move from place to place on the river for experimental purposes, and is well adapted to clearing away the obstruction of the sudd and thus maintaining navigation.

The second type of dredge is a dipper dredge, intended primarily for embankment purposes. One of the principal requirements in the rectification of the swamp country is the construction of embankments to enclose the river and prevent its overflowing, while at the same time the section of the waterway is increased by excavation. In many cases cut-offs will be made in the river to shorten the distance, and the dipper dredge is well adapted to this class of work.

The third type of dredge is a hydraulic machine. It is designed for taking wide cuts, deepening the bed of the river, and discharging the excavated material upon the banks, or over the embankment that may be made by the dipper dredge. In some places the three separate operations of the three dredges will proceed in sequence—one preparing the way for the other until the final result is obtained. They are, however, so constructed that each of them can work alone and complete its own section of the river.

*Difficulties to be surmounted.*—The difficulties to be surmounted in the conduct of a work of this kind are very great. The locality is one which is not only remote from the base of supplies, but it is entirely destitute of any resources whatsoever, and the climate makes it very hard for even the natives to work continuously, while Europeans must have frequent leave.

Added to this the question of fuel supply is a serious one. The fuel used is Welsh coal, and by the time it has reached its destination it has become very valuable. This coal is carried by ship through the Suez Canal and unloaded at Port Soudan on the Red Sea; from here it is carried to Khartoum, a distance of over 400 miles, where it is taken up the river about 800 miles by a towboat and barges. A special system of barges and towboat has been provided, by which a fleet of barges can be taken up at one time by being pushed ahead of the towboat, on the plan well known on