

As many cuts across the sandbar are made as may be necessary to reduce it to a navigable depth. Generally two or three days work suffices to make a navigable channel 600 to 800 lineal feet across a bar.

The head-lines are worked from an independent steam winch on forward deck which also is arranged to raise and lower the suction pipe.

The centrifugal dredging pump is of Mr. Robinson's special design and is of small diameter for high speed and arranged with very wide passages through it in order to freely pass any solids which may enter the suction. It is arranged to run at an ordinary working speed of 300 revolutions per minute and is driven by a directly-connected triple expansion engine of the enclosed type with forced lubrication of Belliss & Morcom make. The automatic lubrication of this type of engine renders it specially suitable for this class of work in a hot climate where it is difficult to get skilled engineers to perform continuous inspection duty, while the speed of revolution renders possible the use of a small diameter pump of larger diameter. The pump has suction and discharge of 24 in. diameter and the engines are able to do the work satisfactorily at about 300 to 400 indicated horse power, although they are capable of working up to a higher power when required for pumping against higher heads or to a longer distance.

The boilers are of the locomotive type and present no special features except that they are fitted with extra large fire boxes and double doors for burning either coal or wood.

The propelling machinery is of the usual stern wheel compound condensing type. The paddle wheel is divided into two parts for the purpose of permitting the discharge pipe to pass out in the centre of the vessel. The discharge pipe is fitted with a swivel elbow at the stern so that the floating pipe can radiate from the dredge in any direction.

The discharge pipe used when dredging in the river is ordinarily about 400 ft. long and is carried on seven circular steel pontoons. A special arrangement of flexible joints at the stern of the dredge permits freedom of action of the discharge pipe both vertically and horizontally, and each length of pipe is fitted with a special form of metallic joint having springs which tend to maintain the pipes in a straight line but which will permit deflection under stress without breakage.

The discharge pipe terminates in a steel baffle plate which can be turned at any angle required so as to act as a rudder and thus steer the entire pipe-line to either one side of the dredge or the other as desired. The re-action of the issuing stream of water impinging against this rudder is sufficient to sustain the pipe-line at right angles to the dredge against the force of a moderate current. In this way the dredged material is discharged to one side or the other entirely clear of the channel.

All the operations of the dredge are under the direct control of one man from the operating platform on the upper deck. Here are arranged all the levers which control the various movements of the winch and also the pressure and vacuum gauges for the various purposes and signals to the engineer. The pilot house is also fitted with the usual steering apparatus, etc., for use when the vessel is navigating. Complete officers' and crews' quarters are fitted on the upper deck in a commodious manner suitable to the climate.

The suction inlet is of cast steel of special form and fitted with water jets to aid in loosening the sand. During the trials it was developed that the pump would suck up 1,100 cubic yards of sand per hour without the jets, and 1,300 with the jets.

Upon completion of the vessel at the yards of Messrs. Lobnitz & Company, Limited, Renfrew, complete steam trials

were carried out both for pumping and for navigation. A few hours continuous pumping test at full power was made in which the maximum horse power exceeded 700 and the discharge pressure on the pump exceeded 25 lbs. per square inch. A series of speed trials were made over the measured mile in the Gareloch which were eminently satisfactory and showed that the vessel had ample steaming and propelling power and handled easily, the speed obtained being 9 knots per hour. After completion of these tests the vessel was made ready for sea and the open sides closed in by temporary bulkheads. The vessel was then towed to her destination and arrived without mishap of any kind in June, 1909. Upon being finally re-fitted at destination a test under actual working conditions was made which showed that the vessel was capable of pumping sand at the rate of 1,200 cubic yards per hour and of making a cut across a sand bar of 500 lineal ft. in 70 minutes. It is found that in actual operation when a cut has been made across a sand bar at low water that the increased flow causes an erosion and consequently an enlargement of the cut thus opened and which therefore has a tendency to maintain itself in a navigable condition until the end of the low water season.

This method of dredging has not been in use on the river Niger for sufficient length of time to determine accurately the amount of benefit that can be derived from year to year, but it is believed that the channels thus formed will not be wholly obliterated during the high water and that they can be continuously maintained from year to year with a reasonable amount of dredging, and at comparatively small expense.

The vessel has shown its ability to move rapidly from place to place and to cut a navigable opening across a shallow or sand bar in a very short time.

A navigable depth of 5 feet at extreme low water will be ample for the present requirements on the river and as this dredge can make a channel 12 feet deep she can therefore begin work on the various sand bars at a higher stage of water sufficiently in advance of the extreme low water to keep control of the river well in hand.

The vessel was built by Messrs. Sobnitz & Company, Ltd., of Renfrew, from designs by A. W. Robinson, M. Inst. C.E., of Phillips Square, Montreal, Que., and the work on the Niger is under the direction of Mr. Coulton Elliott, Marine Superintendent.

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