



THE SHADOOF.

being enlarged for the purpose of irrigating the sugar-cane growing districts, which are now being extensively cultivated.

In the Delta and other parts of Lower Egypt, two crops a year are generally obtained; here the water is raised by steam power to a great extent, where the inundation of the Nile, does not save the trouble and expense.

Further north, and at low Nile, where the banks of the river are so high as to render mechanical irrigation necessary, the fertile land, from Thebes, or a short distance above in to Khartoom, is tended by the majority of the population, which, except in towns, follows the pursuit of agriculture, the hardest and most constant labour consisting, not in the tillage of the ground, but in the raising of water in sufficient quantity to irrigate it.

The two native methods most generally employed for this purpose are the Zakieh and the Shadoof.

The first-named machine, which is worked by two oxen, is shown in the sketch on page 76, and with it the greater portion of the land in Upper Egypt and Nubia is irrigated. In constructing a Zakieh a hole about 20 ft. square is dug in the bank of the river, to form a kind of well, over the top of which the trunks of palm-trees are laid, forming a kind of platform; the outer bearing of a shaft carrying a wheel and buckets is formed in a palm trunk supported at the ends, as shown in the plan.

The bucket wheel carries the rope to which the buckets or earthen pots are attached, and which is of sufficient length to

reach below the water level of the river. Two timber or mud piers support another palm trunk, which forms the upper bearing for the vertical shaft, on which is fastened a large horizontal toothed wheel of the rudest construction. Gearing into this is a crown wheel of similar workmanship, fastened on the same shaft that carries the wheel and buckets. A long spar is lashed to the vertical shaft, and to the end of it two oxen are yoked, a board being provided for a driver who, seated on it, urges the animals upon their monotonous revolutions. Like most other things Egyptian, the Zakieh is of an uncertain antiquity, and must have been handed down through almost countless generations exactly as it exists to-day.

It has probably never been improved upon, because had it ever existed in a much more imperfect shape, it would not have raised water at all. These structures are made entirely of wood, and generally being out of order, produce more noise than work. As, too, they are worked incessantly when irrigation is required, and are often quite thickly clustered together, it may readily be imagined that the natural silence of the river is considerably broken. At least 20 per cent. of the water is wasted before it is discharged from the pots into the channel that carries it to the land, and nearly all the power of the animals is absorbed in overcoming the friction of the apparatus.

On the other hand five-year old Arabs, male or female, generally fill the post of drivers, and as the oxen cost but little to keep, the Zakiehs hold their own, being apparently suited to the means and ideas of the small cultivators or capitalists. The duty of one of these machines in perfect order is, not to speak too accurately, a few gallons raised twenty feet high per minute, but it is needless to add that few come up to this standard. The main channel into which the water from the Zakiehs is emptied, is never placed far from the bank. As a rule the land falls slightly from the side, so that the distribution of the water is effected by gravity. When the width of land exceeds from a quarter to half a mile from the bank of the Nile, wells are sunk, perhaps to the depth of 20 feet through the soil, and the water filtering through from the river is raised as already described. This secondary system of irrigation occurs, how-

ever, for the most part far higher up the river, between the fourth and fifth cataracts, and where the strip of cultivated land extends for more than three-quarters of a mile before it joins the sandy plains on the western side.

The second native mechanical appliance employed on the banks of the Nile in raising water for irrigation, is the Shadoof, shown in the sketch. This apparatus is always worked by hand, and consists of two timber uprights, about 5 ft. high, and 3 ft. apart, connected by a crossbar at the top, to which is suspended a light bar about 12 ft. long, hung at about one-third of its length; the shorter part, having attached to the end a balance-weight made of Nile mud, while near the other end is fastened a rope or rod, to the bottom of which a leathern bucket, upon a circular frame, is hung. The height of lift averages about 6 ft., and the man in attendance can make about thirty lifts a minute; the water raised is discharged into a channel, whence it is distributed over the land by conduits. When the Nile begins to fall, it is necessary at each Shadoof station to erect additional apparatus close to the new water level, so that at low Nile the water is raised to the required height by a succession of lifts—five or six Shadoofs often working at varying levels. The implement is sometimes formed with two buckets, in which case two men are required to work it.